

Rules on chemicals in the life-cycle of articles

– a legal analysis

REPORT 3/14



The Swedish Chemicals Agency is supervisory authority under the Ministry of the Environment. We work in Sweden, the EU and internationally to develop legislation and other initiatives to promote good health and improved environment. We monitor compliance of applicable rules on chemical products and substances in articles and we carry out inspections. We review and authorise pesticides before they can be used. Our environmental quality objective is A non-toxic environment.

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Foreword

It is often noted that there is a need for improved coordination between legislation on waste, products and chemicals. The different regulatory frameworks deal for example with different environmental and health aspects, without or with a life-cycle perspective, and there may be gaps or overlapping between the rules. To be able to do this there is a need first for an analysis of the instruments that exist today and how they deal with environmental and health aspects, for instance of hazardous substances in a life-cycle perspective. The Swedish Chemicals Agency and the Swedish Environmental Protection Agency wrote in the government assignment “Better EU rules for a non-toxic environment” (KemI Report 1/12) that the agencies intended to conduct such an analysis with regard to hazardous substances. Per Bergman, former senior legal adviser at the Swedish Chemicals Agency, has carried out such an analysis on behalf of the Swedish Chemicals Agency, and the outcome is presented in this report. Per Bergman has been particularly engaged in EU legislation since the early 1990s. He has been coordinator of European affairs at the Swedish Ministry of the Environment and Swedish negotiator in environmental matters in Brussels. He has experience from developing legislation on waste, articles and chemical products. Per Bergman was responsible for developing Swedish positions in the negotiations on REACH. Between 2002 and 2012, Per Bergman was senior legal adviser at the Swedish Chemicals Agency. The author has been supported by a reference group consisting of experts from the Swedish Chemicals Agency and the Swedish Environmental Protection Agency.

The report identifies a number of areas in the legislation to which attention needs to be paid and which need to be improved in order to increase the opportunities for resource-efficient and, as far as possible, non-toxic recycling, in accordance with the Government's environmental objectives. An important issue needing continued development is how newly manufactured and recycled materials can be managed in a comparable way with regard to hazardous substances.

The views expressed in this report are those of the author, and do not necessarily reflect the opinion of the Swedish Chemicals Agency or the Swedish Environmental Protection Agency.

Contents

| | |
|---|-----------|
| Summary | 6 |
| Sammanfattning | 13 |
| 1. The assignment – limitations and points of departure..... | 19 |
| 2. Point of departure: Basic concepts | 20 |
| 3. Point of departure: Environmental objectives, life-cycles and environmental action programmes | 22 |
| 3.1. The Swedish environmental objectives and the EU's environmental action programme | 23 |
| 3.1.1. Non-toxic environment | 23 |
| 3.1.2. Phase-out of substances of very high concern | 24 |
| 3.1.3. Non-toxic and resource-efficient cycles with the objective of comparability | 24 |
| 3.1.4. Information on chemicals in articles | 26 |
| 3.1.5. The EU's environmental objectives and a new environmental action programme | 26 |
| 4. Overview – what types of regulatory frameworks are there? | 27 |
| 4.1. National rules, conventions and EU rules | 27 |
| 4.2. Different types of rules on chemicals | 29 |
| 4.3. The role of the rules in material cycles | 30 |
| 5. Examination of the rules | 32 |
| 5.1. REACH and CLP | 32 |
| 5.2. Application of REACH and CLP to articles and waste | 33 |
| 5.2.1. Registration in REACH and classification in CLP | 34 |
| 5.2.2. The information requirements in REACH and CLP | 38 |
| 5.2.3. Evaluation..... | 40 |
| 5.2.4. Authorisation | 41 |
| 5.2.5. Restrictions..... | 42 |
| 5.2.6. The concept of substance in REACH | 43 |
| 5.3. Rules on persistent organic pollutants (POPs) | 46 |
| 5.4. Rules on waste..... | 47 |
| 5.4.1. The Waste Framework Directive..... | 47 |
| 5.4.2. The definition of waste | 49 |
| 5.4.3. Hazardous waste | 51 |
| 5.4.4. Waste shipments and the Basel Convention | 53 |
| 5.4.5. The EoW criteria | 54 |
| 5.5. When does waste become a product, and how is this product treated? | 58 |
| 5.6. Rules on articles..... | 63 |
| 5.6.1. Rules on articles and health risks | 64 |
| 5.6.2. Directives on waste streams | 64 |
| 5.6.3. Ecodesign..... | 66 |
| 5.6.4. Biocidal products..... | 67 |

| | | |
|-----------|---|-----------|
| 5.6.5. | Food packaging..... | 67 |
| 5.6.6. | Conclusions on the product rules..... | 68 |
| 6. | Information requirements, prioritisation lists, standards and other soft instruments..... | 70 |
| 6.1. | What are soft instruments? | 70 |
| 6.2. | Information requirements | 71 |
| 6.2.1. | What rules exist? | 71 |
| 6.2.2. | Development needs | 72 |
| 6.3. | Prioritisation lists, ecolabelling and procurement criteria | 73 |
| 6.4. | Environmental taxes and charges..... | 74 |
| 7. | Analysis and conclusions..... | 74 |
| 7.1. | Chemicals and waste – two worlds..... | 74 |
| 7.2. | Shortcomings and gaps in the regulatory framework | 76 |
| 7.3. | How to assess risks associated with recycled materials? | 81 |
| 7.4. | How should the legislation be developed?..... | 82 |
| 7.5. | Are the environmental objectives met, and what is to be achieved with a new environmental action programme? | 84 |
| 7.5.1. | Are the environmental objectives achieved? | 84 |
| 7.5.2. | The seventh environmental programme of action – a new opportunity? | 85 |
| | Annex: The example of plastics | 86 |

Summary

The assignment

The assignment has been to conduct a legal analysis of how the legislation is formulated and should be developed to contribute to non-toxic material cycles. The report includes an analysis of the rules applied today in chemical, product and waste legislation, primarily in the EU, which have a significant bearing on how hazardous substances are managed in a life-cycle perspective. An analysis of how the legislation can be developed to contribute to non-toxic material cycles is also included. Some proposals are made for changes and improvements.

Because of the focus on life-cycles of articles, emissions of hazardous substances from industrial processes of various kinds are not considered. Nor does the report deal with chemicals that are specially regulated with regard to health and environmental aspects, such as pesticides and medicinal products.

Points of departure

The report begins with an account of the points of departure for the analysis. Important terms and fundamental concepts are discussed. A comparison is made in the report between the applicable rules and the overarching objectives of chemicals policy. These are expressed in the Swedish system of environmental objectives as specifications and milestone targets linked to the overarching environmental quality objective A Non-Toxic Environment. Three objectives can be regarded as being of particular importance for an analysis of chemicals regulation relating to articles in the material cycle:

- Use of substances of very high concern is to be phased out as far as possible.
- Material cycles are to be non-toxic and resource-efficient, which means that strict and comparable requirements should apply with regard to the content of hazardous substances in newly produced and recycled materials.
- Information about substances in articles hazardous to health and the environment is to be made available to everyone concerned by 2020.

Another important point of departure is the processes for developing and improving the rules that may be relevant in the area. It is of particular interest that the EU has adopted a new environmental action programme for the coming decade, which includes developing a Union strategy for a non-toxic environment by 2018. The life-cycle perspective plays a prominent role in the action programme.

Different regulatory frameworks in the material cycle

Several different regulatory frameworks apply to the various stages of the life-cycle. The most important dividing line is between chemicals and articles on the one hand and waste on the other, as the rules on waste principally exclude application of the rules about chemicals and articles. Chemicals and articles are regulated through chemicals legislation (REACH and CLP) and rules on persistent organic pollutants (POPs). There are also specific product rules, which may relate to specialty chemicals (e.g. pesticides) or particular types of articles. The production of chemicals and articles is regulated by different rules focused on environmentally hazardous activity, principally the EU's Industrial Emissions Directive. Another regulatory system is the rules on waste, which consist of the EU Waste Framework

Directive with a number of supplementary EU rules. However, waste management is largely governed by the national rules under the Swedish Environmental Code.

These rules are supplemented by “softer” instruments such as environmental taxes and charges and rules on ecolabelling.

REACH and CLP

The basic legislation on chemical products (REACH and CLP) treats chemical substances recovered from waste in principle in the same way as new substances. There is, however, a far-reaching derogation from the registration requirement in REACH for recycled substances that have already been registered. This derogation is, in some cases, difficult to defend from the point of view of health and the environment. On the other hand, a recycler who places a substance on the market is always responsible for identifying any hazardous properties, assessing the need for risk management measures and informing users through safety data sheets and labelling. The recycler must therefore be aware of the properties of the recovered material, including what impurities it contains.

The risk assessment of a substance to be made under the rules on chemicals covers the entire life-cycle, including the use and waste phases. Users and waste operators do not, however, have right of access to the safety data sheets for the substance. This is particularly remarkable as the application of the derogation from the registration requirement in REACH for recycled substances is dependent on the recycler having access to safety data sheets.

REACH also contains rules on authorisation of substances of very high concern as well as restrictions and bans relating to the use of certain hazardous substances. These rules may cover use in articles and sometimes concern waste management. Authorisation has not yet reached the stage at which final decisions on permits have been taken. The authorisation process has, however, been commenced for one substance where the recycling industry has applied for authorisation for recycled materials (PVC plastic containing the substance of very high concern DEHP).

It is not easy to identify what is to be regarded as an individual substance under the rules on chemicals. The composition of chemical substances can vary widely. Substances regarded as identical may vary greatly with regard to the content of impurities, which may have hazardous properties. It is therefore not unproblematic to say that recovered materials are the “same substances” as the virgin materials.

A recovered material that is still regarded as waste may, in some cases, be converted directly into an article, which means that the rules on chemicals will never become applicable.

Persistent organic pollutants (POPs)

The rules on POPs in international chemicals conventions prohibit certain substances of very high concern. The bans have been introduced in a special EU Regulation. The rules on POPs regulate waste management and in principle prohibit recycling of materials containing POPs. In the case of brominated flame retardants, however, less stringent requirements apply to recycled materials than to the virgin materials.

The Waste Framework Directive

The EU's Waste Framework Directive contains fundamental rules and specifies a waste hierarchy of prioritised measures, where the first priority (prevention of waste) may entail measures that lead to a reduction of the level of hazardous substances in materials and products. The Directive contains objectives with levels to be achieved with regard to the recycling of certain materials. It defines when something becomes waste or ceases to be waste. As the rules on chemicals are not applicable to waste, the Directive regulates when rules on waste or rules on chemicals become applicable. The Waste Framework Directive does not otherwise contain any rules with a special focus on the life-cycle of articles.

Hazardous waste and waste movements

Particularly strict requirements apply to the management of hazardous waste. The Waste Framework Directive contains fundamental criteria regarding what waste is to be regarded as hazardous. The criteria are based on the definitions of hazardous properties in chemicals legislation and consequently cover environmentally hazardous substances, but not the substances of particular environmental concern defined under REACH. There is a list of types of waste based on the criteria in the area of waste that is used to assess whether a particular type of waste has hazardous properties.

Rules on waste movements are contained in the Basel Convention and in a special EU Regulation. These rules state that exports of hazardous waste to non-OECD countries are completely prohibited. Waste movements are also strictly regulated in other respects, both within the EU and with regard to exports to countries outside the EU. Large volumes of waste are exported from the EU for recovery. Illegal exports of waste occur, for example, when hazardous waste is declared as non-hazardous waste or as second-hand articles.

When do recycled materials cease to be waste? - the EoW criteria

Material in waste that it is recovered ceases in principle to be waste when the criteria in the waste definition are no longer fulfilled. The rules contained in chemicals legislation then, in principle, become applicable. An important indication that the material is no longer to be regarded as waste is that a recycling process has been carried out in full. However, it is not always easy to establish precisely when this has happened. According to case law it is also necessary to be able to establish that other criteria regarding what constitutes waste are no longer met, for instance it has to be possible for the material to be used without harming human health and the environment.

To simplify implementation, a number of new features have been introduced into the rules on waste decided upon in 2008. By-products from industrial processes are in some cases not to be regarded as waste at all. In addition, there is an option to draw up criteria regarding when certain recovered materials are no longer to be regarded as waste (the EoW criteria). There is also a possibility of stipulating in national decisions when waste ceases to be waste.

EoW criteria have been adopted for two waste streams (certain scrap metal and glass cullet). It has been very difficult to reach agreement on criteria for other materials (for instance plastic and waste paper). Adopted and proposed criteria contain a requirement that the recycled material is not allowed to have hazardous properties under the rules on chemicals. Only the proposed criteria for plastics contain a reference to criteria for substances of very high

environmental concern in REACH, i.e. to the candidate list of environmentally hazardous substances, which is an evident shortcoming.

It is not mandatory for recyclers to apply EoW criteria when such criteria exist for a particular material. Although the criteria concern properties hazardous to health and the environment in recovered materials, they cannot fully replace the risk assessment and risk management done through chemicals legislation.

Rules on articles

In addition to rules on chemicals and on waste, there are rules focused on particular types of articles¹. These may be limited to health and safety aspects of the use of the articles (examples are the EU rules on toys and food packaging). There are also rules that deal with all stages in the life-cycle of articles, from design of the article to waste management and recovery. EU directives on waste streams contain such broader regulation of a number of types of articles (packaging and packaging waste, electrical and electronic products, end-of-life vehicles and batteries). As well as restrictions on the content of hazardous substances, the directives contain rules on collection/treatment of the waste, recycling requirements for materials, rules on producer responsibility and certain information requirements. There is also a new regulatory system in the EU for articles that have been treated with pesticides, for example bactericidal agents.

There is also an independent regulatory framework in the EU in the form of a framework directive on ecodesign, which has been focused on promoting energy efficiency in different types of energy-using articles. This directive could theoretically be used to regulate chemical aspects (i.e. content of hazardous substances) and waste aspects (e.g. requirements for particular design of articles to facilitate recovery). The directive has not been used to date to address such issues. For several reasons it is not likely that the directive will do so other than in individual cases, at least not with regard to the chemical aspects.

The directives on waste streams have been successful as a complement to and development of the regulatory framework regarding specific types of goods. They have led to a reduction of the content of hazardous substances, and have introduced producer responsibility and separate management of waste streams. It is not realistic to consider a type of regulation focused on types of materials (e.g. plastic) instead of on types of articles, even though such regulation would be more comprehensive. There are reasons to consider whether further types of articles ought to be covered by the type of regulation contained in the directives on waste streams, for example textiles and building products. The review of the directives recently carried out by the Commission has not been focused on assessing whether the rules on waste management in the directives are adequate to create the necessary basis for recovery of non-toxic materials. The regulatory review could be complemented to cover this aspect.

The rules on plastic materials in food packaging are an example of rules aimed at counteracting health risks through a complete check on the quality of both newly produced and recovered materials.

¹ There are also rules relating to health and environmental aspects of particular types of chemicals, such as medicinal products, foods and cosmetic products. Such rules are obviously important, but they are not dealt with in this report.

Soft instruments

Soft instruments may, for example, be requirements for information about hazardous substances passed to professional users, consumers and waste operators. Criteria for ecolabelling or green procurement can be of great significance as instruments in practice. Economic instruments such as environmental taxes and charges are, however, only applied to a limited extent in the area of chemicals. The candidate list in REACH, which identifies substances of very high concern, has been of great significance in limiting the presence of such substances and is a striking example of how effective soft instruments can be.

There are a large number of rules in various legislation laying down requirements for the provision of information on chemicals. The clearest shortcoming in a life-cycle perspective is that the information systems for chemical products do not cover information to those who recover materials from waste.

Analysis and conclusions

The report ends with a number of summarising conclusions concerning some statutory shortcomings and an assessment of how well the rules agree with the policy objectives in the area.

Chemicals and waste – two worlds

In the area covered by the report, there is a clear division between rules on waste and rules on chemicals. This division also relates to the authorities that apply the rules. There is a risk of a lack of lateral thinking and of conflicts arising between the different objectives applicable to the areas. The challenge for those who apply the rules on waste and the rules on chemicals is to try jointly to find ways of applying the principles of risk management in chemicals regulation also to recycled materials, but in a manner that takes account of the special circumstances that exist in the waste area.

Shortcomings and gaps in the regulatory framework

- Recovered substances are covered by the legislation on chemicals, but the far-reaching derogations for recycled substances from the obligation of registration in REACH cannot, in some cases, be justified.
- The development of EoW criteria for when waste ceases to be waste has been problematic, and the way in which hazardous substances are dealt with in the criteria can be discussed.
- The legislation on waste has not adopted the criteria for substances of very high environmental concern in REACH.
- Information requirements on substances of very high concern under REACH are inadequate and work poorly. Waste operators/recyclers need to receive better information on the chemicals contained in the articles that become waste.
- Development of individual producer responsibility ought to be able to contribute to non-toxicity, but does not appear to have worked in practice.

How to assess risks associated with recycled materials?

There is a lack of an adequate basis for assessing in this report whether the rules applicable today can in practice deal with the chemical aspects of recycled materials in a reasonable way. A better basis for decision-making is needed, which ought to include:

- a broader analysis of the quality of recycled types of materials aimed at assessing whether the materials, in practice, contain hazardous substances that can lead to problems,
- an analysis of how waste and chemicals legislation is applied in practice to recycled materials, with regard both to REACH/CLP and to the rules on waste with the EoW criteria,
- a focus on enforcement both in Sweden and at EU level, where guidance on enforcement is developed jointly by authorities in the areas of chemicals and waste.

How should the legislation be developed?

The fundamental rules in the area should be adequate to deal with the problems of chemicals in recycled materials. On the other hand, it is possible to develop regulations at a lower level, and in particular the guidance on REACH and CLP. The directives on waste streams are the most successful examples of legislation concerned with hazardous substances in material cycles. Additions to these rules should be considered with regard to some further types of articles. Producer responsibility for waste management, introduced among other things through these directives, ought to be reviewed and could be made more effective. A broader review of the rules on the right to environmental information is also justified.

Are Swedish environmental objectives met and what can be done in the EU's new environmental action programme?

Of the three Swedish environmental objectives identified as important in the area, one – phase-out of substances of very high concern – has gained broad acceptance as a principle in the EU and in part also internationally. This does not, however, mean that all these substances have disappeared from the life-cycle. A large amount of work on evaluating and testing individual substances remains to be done.

Non-toxic and resource-efficient material cycles are being discussed not only in Sweden but in the rest of the EU as well. The principle that new and recycled materials should be subject to comparable requirements applies under the legislation, but there are a number of exceptions in practical application. If such exceptions are deemed necessary, they should always be limited in time.

With regard to the objective of information on substances hazardous to health and the environment being made available to everyone concerned, a great deal remains to be done before the goal is met.

The new environmental action programme in the EU provides an opportunity to address a number of the issues discussed in this report.

A more in-depth analysis of how the rules are applied to plastic materials

Plastic waste represents an important and complex waste stream that is particularly problematic in recovery. A more in-depth analysis of how the rules are applied to plastic materials, in particular how the rules address any chemical risks with recycled plastic materials, is conducted in the report.

An extract from the Swedish Chemicals Agency Products Register made for this report shows that substances of very high concern for human health (CMR) are very common in plastics. Such substances remaining in plastic waste have to be managed if the material is to be recycled.

Sammanfattning

Uppdraget

Uppdraget har varit att göra en juridisk analys av hur lagstiftningen är utformad och bör utvecklas för att bidra till giftfria kretslopp. I rapporten ingår en analys av de regler som används i dag i kemikalie- produkt- och avfallslagstiftningen inom EU i första hand, och som har betydelse för hur farliga ämnen hanteras i ett kretsloppsperspektiv. Vidare ingår en analys av hur lagstiftningen kan utvecklas för att bidra till giftfria materialkretslopp. Vissa förslag lämnas till ändringar och förbättringar.

Inriktningen på kretsloppen för varor innebär att utsläpp av farliga ämnen från industriprocesser av olika slag inte behandlas. Rapporten behandlar inte heller kemikalier som är specialreglerade med hänsyn till hälso- och miljöaspekter, som bekämpningsmedel och läkemedel.

Utgångspunkter

Rapporten inleds med en redovisning av utgångspunkterna för den fortsatta framställningen. Viktiga termer och grundläggande begrepp redovisas. I rapporten görs en jämförelse mellan de gällande reglerna och de övergripande målsättningarna för kemikaliepolitiken. Dessa uttrycks i det svenska miljömålssystemet som preciseringar och etappmål kopplade till det övergripande miljökvalitetsmålet giftfri miljö. Tre målsättningar kan ses som särskilt viktiga för en analys av kemikaliereglerna för varor i kretsloppet:

- Användningen av särskilt farliga ämnen ska så långt möjligt upphöra.
- Kretsloppen ska vara giftfria och resurssnåla, vilket bland annat innebär att höga och likvärdiga krav bör gälla när det gäller innehållet av farliga ämnen i nyproducerade och återvunna material.
- Information om hälso- och miljöfarliga ämnen i varor ska vara tillgängliga för alla berörda senast år 2020.

En annan viktig utgångspunkt är de processer för utveckling och förbättring av regelverken som kan vara aktuella på området. Av särskilt intresse är att EU har beslutat om ett nytt miljöhandlingsprogram för det kommande decenniet, där det ingår att ta fram en unionsstrategi för giftfri miljö till år 2018. Livscykelperspektivet spelar en framträdande roll i handlingsprogrammet.

Olika regelverk i kretsloppet

Flera olika regelverk tillämpas för de olika stegen i kretsloppet. Den viktigaste gränsdragningen är mellan kemikalier och varor å ena sidan och avfall å andra sidan, eftersom avfallsregelverket i huvudsak utesluter tillämpningen av reglerna för kemikalier och varor. Kemikalier och varor regleras genom kemikalielagstiftningen (Reach och CLP) och regler om långlivade organiska föroreningar (POPs). Det finns också specifika produktregler, som kan avse specialkemikalier (t.ex. bekämpningsmedel) eller särskilda varuslag. Produktionen av kemikalier och varor styrs av ett annat regelverk med inriktning på miljöfarlig verksamhet, främst EU:s industriemissionsdirektiv. Ytterligare ett regelsystem är avfallsregelverket, som består av EU:s ramdirektiv för avfall med ett antal kompletterande EU-regler. Avfallshandlingen styrs dock i stora delar av det nationella regelverket under miljöbalken.

Dessa regler kompletteras av ”mjukare” styrmedel, som t.ex. miljöskatter- och avgifter samt miljömärkningsregler.

Reach och CLP

I den grundläggande lagstiftningen för kemiska produkter (Reach och CLP) behandlas kemiska ämnen som återvunnits från avfall på i princip på samma sätt som nya ämnen. Det finns dock ett långtgående undantag från kravet på registrering i Reach för återvunna ämnen som redan registrerats. Undantaget är delvis svårt att försvara från hälso- och miljösynpunkt. Däremot är en återvinnare som släpper ut ett ämne på marknaden alltid ansvarig för att identifiera eventuella farliga egenskaper, bedöma behovet av riskhanteringsåtgärder och informera användare genom säkerhetsdatablad och märkning. Återvinnaren måste därför känna till egenskaperna hos det återvunna materialet, bland annat vilka föroreningar det innehåller.

Den riskbedömning av ett ämne som ska göras enligt kemikaliereglerna omfattar hela livscykel, inklusive användnings- och avfallsfasen. Användare och avfallshanterare har dock inte rätt att få del av säkerhetsdatabladet för ämnet. Detta är särskilt anmärkningsvärt, eftersom tillämpningen av undantaget från registreringskravet i Reach för återvunna ämnen förutsätter att återvinnaren har tillgång till säkerhetsdatablad.

Reach innehåller också regler om tillståndsprövning av särskilt farliga ämnen och om begränsningar och förbud mot användningen av vissa farliga ämnen. Dessa regler kan omfatta användningen i varor och ibland gå in på avfallshanteringen. Tillståndsprövningen har ännu inte kommit så långt att slutliga beslut om tillstånd har fattats. För ett ämne har dock ett ärende påbörjats där återvinningsindustrin har ansökt om tillstånd för återvunna material (PVC-plast som innehåller det särskilt farliga ämnet DEHP).

Vad som ska betraktas som ett ämne enligt kemikaliereglerna är inte lätt att avgöra. Sammansättningen av kemiska ämnen kan variera kraftigt, bland annat kan ämnen som betraktas som identiska ha stora variationer när det gäller innehållet av föroreningar, som kan ha farliga egenskaper. Att säga att återvunna material är ”samma ämnen” som de jungfruliga materialen är därför inte oproblemiskt.

Ett återvunnet material som fortfarande betraktas som avfall kan i vissa fall omvandlas till en vara direkt, vilket innebär att reglerna om kemikalier aldrig kommer att bli tillämpliga.

Långlivade organiska föroreningar (POPs)

De internationella POPs-reglerna i kemikaliekonventioner förbjuder vissa särskilt farliga ämnen. Förbuden har införts i en särskild EU-förordning. POPs-reglerna styr avfallshanteringen och innebär att återvinning av material med POPs i princip är förbjuden. För bromerade flamskyddsmedel gäller dock lindrigare krav inom EU för återvunna material än för de jungfruliga materialen.

Avfallsdirektivet

EU:s avfallsdirektiv innehåller grundläggande regler och anger en avfallshierarki med prioriterade åtgärder, där den första prioriteringen (förebyggande av avfall) kan innefatta åtgärder som innebär en minskning av halten av skadliga ämnen i material och produkter. Direktivet innehåller målsättningar med nivåer som ska uppnås när det gäller återvinning av vissa material. Det definierar när något blir till avfall resp. upphör att vara avfall. Eftersom kemikaliereglerna inte tillämpas på avfall blir direktivet styrande för när avfallsregler resp.

kemikaliereregler blir tillämpliga. Avfallsdirektivet innehåller i övrigt inte några regler med särskild inriktning på kretsloppet för varor.

Farligt avfall och avfallstransporter

För farligt avfall gäller särskilt stränga krav för hanteringen. Avfallsdirektivet innehåller grundläggande kriterier för vilket avfall som ska betraktas som farligt. Kriterierna utgår från kemikalielagstiftningens definitioner av farliga egenskaper och omfattar därmed miljöfarliga ämnen, men inte sådana särskilt miljöfarliga ämnen som definieras enligt Reach. För tillämpningen av kriterierna på avfallsområdet finns en lista över avfallstyper, som används för att bedöma om ett visst avfallsslag har farliga egenskaper.

Regler om avfallstransporter finns i Baselkonventionen och i en särskild EU-förordning. Reglerna innebär att export av farligt avfall till icke OECD-länder är helt förbjuden. Även i övrigt är avfallstransporter strängt reglerade, både inom EU och vid export till länder utanför EU. Stora mängder avfall exporteras från EU för återvinning. Illegal export av avfall förekommer, t.ex. genom att farligt avfall deklarerar som icke farligt avfall eller som begagnade varor.

När upphör återvunna material att vara avfall? – EoW-kriterierna

Material i avfall som återvinns upphör i princip att vara avfall när kriterierna enligt avfallsdefinitionen inte längre är uppfyllda. Reglerna i kemikalielagstiftningen blir då i princip tillämpliga. En viktig indikation på att materialet inte längre ska ses som avfall är att ett återvinningsförfarande har genomförts fullständigt. Exakt när detta har skett är dock inte alltid lätt att konstatera. Enligt praxis måste man dessutom kunna konstatera att övriga kriterier för vad som utgör avfall inte längre är uppfyllda, bland annat ska materialet kunna användas utan att skada människors hälsa och miljön.

För att förenkla tillämpningen har man infört ett antal nyheter i de avfallsregler som beslutades år 2008. Biprodukter från industriprocesser ska i vissa fall inte alls ses som avfall. Vidare finns en möjlighet att sätta upp kriterier för när vissa återvunna material inte längre ska ses som avfall (EoW-kriterier). Det finns också en möjlighet att i nationella beslut fastslå när avfall upphör att vara avfall.

EoW-kriterier har antagits för två avfallsströmmar (visst metallskrot och krossglas). Det har varit mycket svårt att nå enighet om kriterier för andra material (bland annat plast och returpapper). Antagna och föreslagna kriterier innehåller ett krav på att det återvunna materialet inte får ha farliga egenskaper enligt kemikaliereglerna. Endast de föreslagna plastkriterierna innehåller en hänvisning till kriterier för särskilt miljöfarliga ämnen i Reach, dvs. till miljöfarliga kandidatlistämnen, vilket framstår som en brist.

Det är inte obligatoriskt för återvinnare att tillämpa EoW-kriterier när sådana finns för ett visst material. Även om kriterierna berör hälso- och miljöfarliga egenskaper hos återvunna material, kan de inte ersätta den riskbedömning och riskhantering som görs genom kemikalielagstiftningen.

Regler om varor

Utöver regler om kemikalier och om avfall finns det regler som inriktas på särskilda varuslag¹. Dessa kan vara begränsade till att gälla hälsa och säkerhet vid användningen av varorna (exempel är EU-reglerna om leksaker och livsmedelsförpackningar). Det finns också regler som behandlar alla stegen i kretsloppet för varor, från utformningen av varan till avfallshandling och återvinning. EU:s direktiv om avfallsströmmar innehåller en sådan bredare reglering av ett antal varutyper (förpackningar och förpackningsavfall, elektriska och elektroniska produkter, uttjänta fordon samt batterier). Utöver begränsningar av innehållet av farliga ämnen innehåller direktiven regler om insamling/behandling av avfallet, återvinningskrav för material, regler om producentansvar samt vissa informationskrav. Det finns också ett nytt regelsystem inom EU för varor som har behandlats med bekämpningsmedel, t.ex. bakteriedödande medel.

Det finns vidare ett självständigt regelverk inom EU i form av ett ramdirektiv om ekodesign, som varit inriktat på att främja energieffektivitet hos olika typer av energianvändande varor. Detta direktiv skulle teoretiskt kunna användas för att reglera kemikalieaspekter (dvs. innehåll av farliga ämnen) och avfallsaspekter (t.ex. krav på viss design av varor för att underlätta återvinning). Direktivet har hittills inte använts för att hantera sådana frågor. Det är av flera skäl inte heller sannolikt att direktivet kommer att göra detta annat än i enstaka fall, åtminstone inte vad gäller kemikalieaspekterna.

Direktiven om avfallsströmmar har varit framgångsrika som en komplettering och utveckling av regelverket när det gäller specifika varuslag. De har medfört en begränsning av innehållet av farliga ämnen, introducerat producentansvar och en separerad hantering av avfallsströmmar. Det är inte realistiskt att tänka sig en typ av reglering som inriktas på materialslagen (t.ex. plast) i stället för på varuslagen, även om sådan reglering skulle vara mera heltäckande. Det finns skäl att överväga om ytterligare varuslag borde omfattas av den typ av reglering som finns i direktiven om avfallsströmmar, t.ex. textilier och byggprodukter. Den översyn av direktiven som nyligen genomförts av kommissionen har inte varit inriktad på att bedöma om hanteringsreglerna för avfallet i direktiven är tillräckliga för att skapa förutsättningar för materialåtervinning av giftfria material. Översynen skulle kunna kompletteras i den delen.

Reglerna om plastmaterial i livsmedelsförpackningar är ett exempel på regelverk som syftar till motverka hälsorisker genom en fullständig kontroll av kvaliteten hos både nyproducerade och återvunna material.

Mjuka styrmedel

Mjuka styrmedel kan t.ex. vara krav på att information om farliga ämnen som lämnas till yrkesanvändare, konsumenter och avfallshanterare. Kriterier för miljömärkning eller grön upphandling kan i praktiken ha stor betydelse som styrmedel. Ekonomiska styrmedel som miljöskatter och miljöavgifter tillämpas dock bara i liten utsträckning på kemikalieområdet. Den kandidatförteckning i Reach som identifierar särskilt farliga ämnen har fått en stor betydelse för att begränsa förekomsten av sådana ämnen och är ett slående exempel på hur effektiva mjuka styrmedel kan vara.

¹ Det finns också regler som behandlar hälso- och miljöaspekter på särskilda typer av kemikalier, som t.ex. läkemedel, livsmedel och kosmetiska produkter. Sådana regler är givetvis viktiga, men de behandlas inte i denna rapport.

Det finns ett stort antal regler i olika lagstiftningar som ställer krav på informationslämnande om kemikalier. Den tydligaste bristen i ett kretsloppsperspektiv är att informationssystemen för kemiska produkter inte omfattar information till de som återvinner material från avfall.

Analys och slutsatser

Rapporten avslutas med ett antal sammanfattande slutsatser om några lagtekniska brister och en bedömning av hur reglerna stämmer med de politiska målsättningarna på området.

Kemikalier och avfall – två världar

Det finns en tydlig uppdelning på området mellan avfallsregler och kemikaliereregler. Uppdelningen gäller även de tillämpande myndigheterna. Det finns en risk för stuprörstänkande och att man hamnar i konflikter mellan de olika målsättningar som gäller för områdena. Utmaningen för de som sysslar med avfallsregler och kemikaliereregler är att tillsammans försöka hitta vägar för att tillämpa kemikaliereglernas principer för riskhantering även på återvunna material, men på ett sätt som tar hänsyn till avfallsområdets särskilda förutsättningar.

Brister och luckor i regelverket

- Återvunna ämnen omfattas av kemikalielagstiftningen, men de långtgående undantag för återvunna ämnen som finns från registreringskyldigheten i Reach går delvis inte att motivera.
- Utvecklingen av EoW-kriterier för när avfall upphör att vara avfall har varit problematisk, och hanteringen av farliga ämnen i kriterierna kan diskuteras.
- Avfallslagstiftningen har inte anammat de kriterier för särskilt miljöfarliga ämnen som finns i Reach.
- Informationskrav om särskilt farliga ämnen i varor enligt Reach är otillräckliga och fungerar dåligt. Avfallshanterare/återvinnare behöver få bättre information om de kemikalier som ingår i de varor som blir avfall.
- En utveckling av individuellt producentansvar borde kunna bidra till giftfrihet, men synes inte ha fungerat i praktiken.

Hur bedöma risker med återvunna material?

Det saknas ett tillräckligt underlag för att bedöma om de regler som gäller i dag i praktiken kan hantera kemikalieaspekterna på återvunna material på ett rimligt sätt. Ett bättre sådant beslutsunderlag behövs, som borde innefatta:

- en bredare analys av kvaliteten hos återvunna materialtyper som syftar till att bedöma om materialen i praktiken innehåller farliga ämnen som kan leda till problem,
- en analys av hur avfalls- och kemikalielagstiftningen i praktiken tillämpas för återvunna material, både vad gäller Reach/CLP och avfallsreglerna med EoW-kriterierna,
- en satsning på tillsyn både i Sverige och på EU-nivå, där tillsynsvägledning tas fram gemensamt av myndigheter på kemikalie- och avfallsområdet.

Hur bör lagstiftningen utvecklas?

De grundläggande reglerna på området bör vara tillräckliga för att hantera problematiken med kemikalier i återvunna material. Däremot finns det en möjlighet att utveckla föreskrifter på

lägre nivå och särskilt vägledningen för Reach och CLP. Direktiven om avfallsströmmar är de mest framgångsrika exemplen på lagstiftning som hanterar farliga ämnen i kretsloppen. En komplettering av dessa regler bör övervägas när det gäller ytterligare några varuslag. Producentansvaret för avfallshanteringen, som bland annat införs genom dessa direktiv, borde ses över och skulle kunna göras effektivare. En bredare översyn av reglerna om rätt till miljöinformation är också motiverad.

Uppfylls svenska miljömål och vad kan göras i EU:s nya miljöhandlingsprogram?

Av de tre svenska miljömålsättningar som identifierats som viktiga på området har en – utfasning av särskilt farliga ämnen – fått bred acceptans som princip inom EU och delvis även internationellt. Detta innebär dock inte att alla dessa ämnen har försvunnit ur kretsloppet. Mycket arbete med utvärdering och prövning av enskilda ämnen återstår.

Giftfria och resurssnåla kretslopp diskuteras inte bara i Sverige utan också inom EU. Principen att behandla nya och återvunna material likvärdigt gäller i princip enligt lagstiftningen, men det finns ett antal undantag i den praktiska tillämpningen. Om sådana undantag bedöms som nödvändiga bör de alltid tidsbegränsas.

När det gäller målsättningen att information om hälso- och miljöfarliga ämnen ska vara tillgänglig för alla berörda återstår mycket att göra innan målet är uppfyllt.

Det nya miljöhandlingsprogrammet i EU ger en möjlighet att ta upp ett antal av de frågeställningar som diskuteras i denna rapport.

En fördjupad analys av regelverken tillämpas på plastmaterial

Plastavfall utgör en viktig och komplex avfallsström som är särskilt problematisk vid återvinning. I rapporten görs en djupare analys av hur reglerna tillämpas på plastmaterial. Ett utdrag ur Kemikalieinspektionens produktregister som gjorts för denna rapport visar att ämnen med särskilt hälsofarliga egenskaper (CMR) fortfarande är mycket vanliga i plast. Kvarvarande sådana ämnen i plastavfall måste kunna hanteras om materialet ska återvinnas.

1. The assignment – limitations and points of departure

The assignment entails conducting a legal analysis of how the legislation is formulated and should be developed to contribute to making material cycles more resource-efficient and non-toxic. An analysis is to be made of the rules that are applied today in legislation on chemicals, products and waste, primarily in the EU and that are of significance to how hazardous substances are managed in a life-cycle perspective. An analysis is additionally to be made of how the legislation can be enhanced to contribute to non-toxic material cycles, and proposals are to be made for changes and improvements.

The report has been produced on behalf of the Swedish Chemicals Agency (KemI). During this work, the issues have been discussed in a reference group with KemI and the Swedish Environmental Protection Agency, which are the two government agencies most immediately responsible for the legislation considered in the report. The Swedish Environmental Protection Agency has stated that it considers the report to be extremely valuable. The Agency will in future assess the possibility of developing some of its topics on the basis of the Agency's responsibility for waste management and resource efficiency. The most important of these is *comparability* of original and recycled material with respect to hazardous substances. I discuss some issues relating to the objective of comparability in section 3.1.3.

The report is principally limited to a review of EU rules, with some consideration of global regulations, for example in the Basel Convention. Swedish national waste policy is consequently for the most part omitted (this has recently been considered by the Waste Inquiry in SOU 2012:56). The focus on non-toxic material cycles is a strong limitation, particularly with regard to application of rules on waste. Measures to implement the waste hierarchy that do not relate to hazardous substances must in principle be omitted, as must aspects relating to resource efficiency and energy efficiency. At the same time, it cannot be entirely disregarded that in application of the rules in the area of waste different, sometimes contradictory, interests sometimes have to be weighed up. It is of particular significance for this assignment that the objective of attaining a high level of recycling of materials from waste may to some extent conflict with the objective of bringing about non-toxic life-cycles, if the recycling takes place in a way that leads to toxic substances in the waste entering the cycles through the recycled materials.

Non-toxicity means that the material cycles as far as possible (or as far as necessary) are free of substances hazardous to health and the environment, as these are defined in the chemicals legislation. These can enter cycles through the production of articles in the EU or imports of articles from countries outside the EU. The hazardous substances may have been added deliberately (for example flame retardants) but may also be impurities not needed for the function of the product, for example impurities from raw-material extraction, residues left over from the production phase or impurities in recycled materials remaining after recycling.

On the other hand the assignment does not include addressing pollution in connection with the production of articles (emissions from industry, for example dioxin) or emissions from recovery processes, even though such pollutants can obviously also be hazardous substances). Rules on environmental quality, principally water quality, are not addressed in detail. Nor do I discuss substances that are hazardous due to their physico-chemical properties, for example flammable or explosive substances. Such properties are obviously important when assessing the risks associated with a product, but they are not toxins.

The report begins, in accordance with the assignment, with a description of the background and an overview of what the legislation looks like in this area (Chapter 6). This is followed by an analysis of the most important regulatory frameworks (Chapters 5-6) and an analysis of how the regulatory frameworks can be enhanced (Chapter 7). To be able to assess the needs for development and change with regard to the legislation, it is necessary to start out from and analyse the objectives that actually exist for chemicals policy, in order then to be able to assess to what extent the rules contribute to these overarching objectives being met. I therefore begin by attempting to summarise the Swedish objectives in this area (Chapter 3).

Plastic waste represents an important and complex waste stream that is particularly problematic in recovery. In the annex I have attempted to conduct a more in-depth analysis of how the rules are applied to plastic materials, in particular how the rules address any chemical risks with recycled plastic materials.

The report is focused on legislation, i.e. binding rules. This includes bans or restrictions concerning chemical products, articles and waste in life-cycles but also softer instruments, for example rules on information systems and environmental taxes or charges. The chemicals legislation in a broad sense is very extensive. There is special regulation of a number of types of chemicals (e.g. pesticides, medicinal products and cosmetics). The report does not examine these specialty chemicals, except with regard to biocidal products, which are mentioned separately in the assignment. However, the management of specialty chemicals can obviously highlight significant life-cycle-related problems, for example waste management of expired pesticides or the need to limit levels of endocrine-disrupting medicinal products in wastewater. For an overview of all chemicals legislation at EU level, see Swedish Chemicals Agency Report No 1/12. Better EU rules for a non-toxic environment.

2. Point of departure: Basic concepts

Basic terms can have different meanings in the different regulations applicable to the stages in the life-cycle. The most important ones are described briefly in this section.

When an attempt is made to obtain an overview of what rules apply to the different stages in the life-cycle, a number of fundamental concepts are encountered that may be of decisive significance to the scope of the different regulatory frameworks. The same term may, however, have a differing meaning depending on the legislation in which it occurs. It is therefore necessary first of all to describe these concepts.

Chemical, material, article or product?

When *chemicals* are mentioned in this report, *substances* or *mixtures* of chemical substances are meant. In Chapter 14 of the Swedish Environmental Code these are termed *chemical products*. All kinds of objects or materials obviously consist of chemicals in some sense. However, a distinction must be made in application of the rules of chemicals between chemicals and *articles*. An article is “an object which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition” (Chapter 14 Section 2(3) of the Swedish Environmental Code, cf. Article 3(3) of REACH). For example, a plastic granular material used as a raw material in the manufacturing industry is a chemical. If this is shaped into an object made of plastic, the object in general is an article, and the rules on chemicals are no longer applicable. The distinction is thus very important for chemicals legislation, as completely different rules in

this legislation apply to chemicals and to articles. Certain articles are to be regarded rather as packaging of a chemical, for example an ink cartridge for a printer. In some cases the chemical is not regarded as part of the article/packaging but as a separate chemical product, to which the rules on chemicals apply².

In other regulatory frameworks the word *product* is often used with the same meaning as *article*, but products can sometimes be chemical, for example cosmetic products. In the context of waste, terms such as products or objects are often used, but also *materials*. Materials that have been recycled and are no longer waste can normally be seen as chemical products in the sense of chemicals legislation, i.e. they do not have such a special shape, surface or design that to a greater extent than their chemical composition determines their function.

Chemical substances and mixtures

The distinction between chemical substance and chemical mixture is also important for the application of REACH. Mixtures (previously known as preparations) consist of substances that do not react chemically with each other. The content of a can of paint, for example, is a mixture of different substances: pigment, solvent, preservative etc. The fundamental provisions of REACH are focused on the chemical substances. Chemical substances are not the same as elements, but are substances in the form in which they are produced and sold on the market, including any impurities from the manufacturing process. The concept of substance is difficult to apply in practice but important for the issues addressed in this report. It is therefore discussed in a separate section 5.2.6 below.

Waste

The term *waste* is defined in the waste legislation as a “substance or object which the holder discards or intends or is required to discard” (see also section 5.4.2). The concept “substance” in this definition does not mean the same as in chemicals legislation but has a broader and more indefinite significance. Waste is not regarded as a chemical or article according to REACH (Article 2(2)), which has the important consequence that requirements for registration etc. under REACH do not apply to waste.

Important concepts in waste legislation are *recovery* and *disposal*. Recovery means that material in the waste is utilised in some way for the original purpose or for other purposes. *Recycling* is a narrower concept which means that material in the waste is processed and acquires new use. Disposal means that the content of the waste is not utilised but that the waste for example is incinerated, landfilled or finally disposed of some other way. If incineration takes place with utilisation of the energy, for example for district heating or electricity production, however, this is regarded as a form of recovery.

Hazardous substances and substances of very high concern

The term *hazardous substances* refers to substances that, according to the criteria in EU rules (CLP), can be characterised as hazardous. The hazard may relate to health hazard, environmental hazard or hazard due to physico-chemical properties (flammability etc.). *Substances of very high concern* are a smaller group of substances that have been defined in

² Cf. European Chemicals Agency (ECHA) Guidance on requirements for substances in articles, version 2, April 2011, section 2.4.

different ways in different contexts, for example in the Swedish environmental objectives³. The term has also been introduced in REACH as a point of departure for the rules on authorisation. In REACH (Article 57) the term substances of very high concern is used to mean those that have CMR properties (carcinogenic substances and substances that are mutagenic or toxic to reproduction) or is environmentally hazardous PBT substances (persistent, bioaccumulative and toxic) or vPvB substances (very persistent and very bioaccumulative). These definitions of what are substances of very high concern are based on the EU rules on classification and labelling (CLP) with regard to health hazard. Special criteria for environmentally hazardous substances of very high concern are stated in REACH (Annex XIII). These thus complement the criteria for environmental hazard contained in CLP. According to REACH, substances can be regarded as being of very high concern following a decision in the individual case, even if they do not entirely fulfil the criteria for these hazardous properties (there is one such example). Endocrine-disrupting substances are separately mentioned in REACH. Such substances often have the hazardous properties mentioned (CMR, PBT etc.), but discussion is under way on developing separate definitions and criteria for endocrine disruptors.

Similar definitions of substances of very high concern have been introduced into the new rules on pesticides (see KemI Report No 1/12). The term is somewhat broader under the Swedish system of environmental objectives than under the EU rules (see next section).

Chemicals sold on a market are often *mixtures* consisting of several substances. Some of these substances may have hazardous properties, others not. Any toxicity of the mixture is determined in general through what is known as a conventional method, based on which hazardous properties are present in the mixture and in what quantities. The hazardous properties of the mixture can then be calculated. The methodology for this is described in CLP (see below). It is also possible to test the mixture directly to see whether it has hazardous properties.

3. Point of departure: Environmental objectives, life-cycles and environmental action programmes

The point of departure for the assignment is to analyse how the legislation – primarily that of the EU – should be developed to contribute to non-toxic material cycles, i.e. cycles that as far as possible are free of toxic substances. Detoxification of cycles is needed among other things for it to become possible to recycle materials safely in the future. If any conclusions are to be drawn from an analysis of the legislation of the type included in the remit, however, there is a need for more closely specified points of departure regarding what the legislation ultimately is intended to achieve. Answers are needed to a number of questions, for example these:

- What is meant by hazardous substances: are all substances that have a hazardous property of some kind meant, or should certain hazardous properties be prioritised for phasing-out from material cycles?
- Can certain hazardous chemicals nevertheless be accepted in cycles in cases where there are no alternatives, and if so on what terms?

³ The Swedish rules on chemicals confusingly also contain the term "particularly hazardous chemical products", which is defined in a completely different way. The term relates to chemicals that are acutely toxic and are covered by restrictions on sale. Cf. Ordinance (2008:245) on chemical products and biotechnical organisms and the Swedish Chemicals Agency's regulations.

- Should the same requirements for non-toxicity apply to new and to recovered materials that are added to the life-cycles?
- Is the legislation to be formulated as binding rules in the form of bans or restrictions or in the form of softer instruments, such as information requirements or economic instruments?

Environmental objectives and strategies of the environmental action programme type provide some generally formulated answers to such questions.

3.1. The Swedish environmental objectives and the EU's environmental action programme

Swedish chemicals policy has three fundamental objectives in the form of specifications or milestone targets, which are particularly important in order to achieve non-toxic material cycles:

- Use of substances of very high concern is as far as possible to cease.
- Material cycles are to be non-toxic and resource-efficient, which means that strict and comparable requirements should apply with regard to the content of hazardous substances in newly produced and recycled materials.
- Information about substances hazardous to health and the environment in articles is to be available to everyone concerned by 2020.

In its 6th environmental action programme, the EU has established an objective for safe use of chemicals by 2020. An objective included in the new 7th environmental action programme is for recovered waste to be used as a significant and reliable raw-material asset for the Union through the development of non-toxic material cycles for materials. A Union strategy for a non-toxic environment is to be devised by 2018 which among other things is to lead to “the minimisation of exposure to chemicals in products, including, inter alia, imported products, with a view to promoting non-toxic material cycles and reducing indoor exposure to harmful substances.”

A fundamental aim of this report is to assess whether the legislation in the area is formulated in such a way that it contributes to these Swedish objectives being met. Another aim is to identify possible improvements and additions to the legislation and to consider how the objectives in this area in the EU's new environmental action programme can be met.

3.1.1. Non-toxic environment

The Swedish system of environmental objectives has developed the general objectives applicable to chemicals policy and has therefore been of great significance to the work on chemicals, particularly with regard to how Sweden acts within the EU and in other international contexts. According to the restructuring of the system carried out recently⁴, the system consists of a generally formulated *generational goal* for the whole environmental area, 16 *environmental quality objectives* (which include A Non-Toxic Environment) with a number of specifications and a number of *milestone targets*, which indicate measures required

⁴See Govt Bill 2009/10:155, report 2009/10:MJU25, Parliamentary Communication 2009/10:377.

to attain the environmental quality objectives.⁵ The specifications for the environmental quality objective of A Non-Toxic Environment include:

- the use of substances of very high concern has as far as possible ceased,
- information on substances hazardous to the environment and health in materials, chemical products and articles is available.

Milestone targets currently applicable have been established through two government decisions.⁶ Of the seven milestone targets adopted under A Non-Toxic Environment, three are of particular interest for this report:

- Phase-out of substances of very high concern
- The target of non-toxic and resource-efficient material cycles
- Information on chemicals in articles

3.1.2. Phase-out of substances of very high concern

According to the specification of the environmental quality objective, use of substances of very high concern is as far as possible to cease. Substances of very high concern are the same substances as those that can become the object of authorisation under REACH. Substances that are highly allergenic and the heavy metals mercury, cadmium and lead are also indicated as substances of very high concern⁷. The latter substances would probably in part, but not entirely, fall within the definition of substances of very high concern contained in REACH.

According to the milestone target relating to substances of very high concern, endocrine disruptors and highly allergenic substances are to be regarded as substances of very high concern in relevant regulatory frameworks by 2015. The substances are to be subject to testing and decisions on phase-out in all areas of use by 2018.

There are thus reasons for addressing in this report the issue of whether substances of very high concern are managed in a uniform manner in the various regulatory frameworks in the life-cycle of a product and whether adequate measures are taken to attain the objective of removing such substances from the life-cycle.

3.1.3. Non-toxic and resource-efficient material cycles with the objective of comparability

Another issue is whether the same requirements for non-toxicity should be set for recycled materials as for the materials originally added to the life-cycles (referred to below as virgin materials, newly produced materials or raw materials). Experience shows that there may be problems in ensuring that recycled materials are pure and free of hazardous substances. Recycled materials may contain impurities or such additives that are no longer used in newly produced materials and which may be difficult to get rid of in recovery. A number of examples of this are presented below.

⁵In addition to objectives for a non-toxic environment, there are objectives that have been established for the area of waste, but these apply to resource efficiency and do not deal with hazardous substances in the waste.

⁶See memorandum Ds 2012:23 for the first three milestone targets. The latter four were adopted through a government decision on 27 June 2013, ref. No M2013/1740/Ke.

⁷Ds 2012:23 p. 38 ff.

Accepting recycled materials that are of poorer quality than the virgin materials may, however, lead to the objective of non-toxic material cycles never being attained. The Government has therefore recently, in the context of the system of environmental objectives, proposed a milestone target of non-toxic and resource-efficient material cycles⁸. According to the goal, it is necessary to ensure *“the safe use of recycled material from a health and environmental perspective through, as far as possible, avoiding the recirculation of dangerous substances while at the same time aiming at resource-efficient material cycles”*. This is to be achieved through an action strategy within the EU, leading among other things to the regulatory framework for waste, chemicals and articles principally being supplemented and coordinated so that they guide towards the target.

The milestone target further states that *“the principle of high and comparable requirements on the content of hazardous substances in newly produced and recycled materials”* is to be established through a decision where appropriate. This target of comparability is a new feature and is significant for this report. There are reasons to try to analyse how such a target relates to existing legislation.

There is no detailed analysis of what the word “comparable” actually means in this context in either the government decision or the government report. The intention is likely to be that recycled materials need not necessarily be identical to newly produced materials with respect to content of hazardous substances. The idea appears to be that differences in properties can be accepted to some extent, but that the recycled materials must not be perceptibly worse than newly produced ones. The whole situation is, however, complicated by “resource-efficient material cycles” having to be aimed for at the same time. The decision (p. 24) states that: *“...the principle of high and comparable requirements for the content of hazardous substances in both recycled and newly produced materials is gradually converted into limit values for such substances in relevant regulations. There is a need in this process for continuous balancing of non-toxicity and resource efficiency.”*

The Government thus notes with this wording that there may be a conflict between strict requirements regarding hazardous substances and interest in recovering as much as possible of the waste. This becomes particularly topical when the EU legislation sets requirements for the Member States to meet specified targets for how much of the waste is to be recovered at different times. However, the Government decision does not address how this balancing is to proceed and what level of toxins is to be permitted in recovered products for it to be possible for the desired resource efficiency to be achieved.

The Government probably does not mean that it is to be accepted for recycled materials to have properties hazardous to health and the environment that pose risks when the materials enter cycles, even if this is not directly stated. This at least applies to risks that are not adequately controlled. But the matter is more complicated than that. Virgin materials may also consist of or contain substances with hazardous properties. Such substances may be needed for the functioning of the materials, or the substances in practice may also be difficult to remove from the materials. There are no general bans on hazardous substances in materials or articles, at least not if the risks are controlled so that it can be guaranteed that harmful exposure for humans and the environment does not occur during use. On the other hand there is a general objective, both in Sweden and in the EU, to remove the substances of very high concern from life-cycles, regardless of whether protective measures can be taken for

⁸ Annex point 2(3) to Government decision of 27.06.2013.

individual cases in use that counteract harmful exposure. This is particularly important with respect to the problems that may arise in waste management.

With this in mind, possible specifications of the objective of comparability can be discussed. The following four theoretical examples of possible specifications could be developed and combined in various ways.

- Hazardous substances in recycled materials must not be present at levels higher than those in virgin materials.
- Recycled materials must not have different hazardous properties than virgin materials.
- A general assessment of the risk scenario must be made for recycled materials. The recycled materials must not pose (new or) more serious risks than virgin materials.
- Substances of very high concern must not be added to cycles through recycled materials (at least not substances that are not present in the virgin materials).

In its consultation response to the proposals of the All-Party Committee on Environmental Objectives, the Swedish Environmental Protection Agency considered there to be a need to investigate a comparability objective more closely, particularly if the issue is to be pursued in international contexts. A task for this report should be to analyse how the issue is addressed in different regulatory frameworks at different stages of the life-cycle. It can be noted at the same time that the issue has also become topical at EU level through the 7th environmental action programme (see below). At least in conjunction with implementation of the programme, a comparability objective (in some sense) ought to be able to serve as a guiding principle.

3.1.4. Information on chemicals in articles

A third target of interest is the milestone target on information in hazardous substances in articles. According to this target, information about substances hazardous to health and the environment in articles is to be made available to everyone concerned by 2020. Information on substances hazardous to health and the environment contained in materials and articles is to be made available throughout the life cycle of the article through harmonised systems that cover prioritised article groups. This target is intended to contribute to facilitating recovery, so that hazardous substances are not dispersed again in the life-cycle.

There are a number of different information systems in the legislation that are applied at different stages of the life-cycle. The question of whether these are adequate or whether measures need to be taken to meet the information target is addressed below in section 6.2.2.

3.1.5. The EU's environmental objectives and a new environmental action programme

The EU is also working on overarching strategies and environmental action programmes. An important political initiative is the roadmap for a resource-efficient Europe⁹. The roadmap, as the name suggests, is focused on resource efficiency, which may relate to energy efficiency and efficient use of natural resources. The strategy has a clear focus on a life-cycle or material cycle perspective and also addresses the issue of non-toxic material cycles:

“Avoiding, wherever possible, the use of dangerous chemicals and promoting green chemistry can help protect key resources like soil and water, and make others, like materials, safer, easier and less

⁹ Commission Communication COM(2011) 371 final.

costly to recycle and reuse. The approach to chemicals management promoted by fully implementing REACH will help identify opportunities for substituting dangerous chemicals with safer and technologically and economically viable alternatives.” (Commission Communication point 3(1)(2).

In the EU's 6th environmental action programme from 2002 a generational goal is set for safe use of chemicals by 2020¹⁰. This programme is being replaced by a new 7th environmental action programme¹¹. The new programme naturally enough addresses the objectives for a life-cycle perspective in the roadmap for a resource-efficient Europe. The focus on a “green, competitive and resource-efficient” economy by 2020 in the waste area means full implementation of rules on waste so that

1. *“landfilling is limited to residual (i.e. non recyclable and non recoverable) waste, having regard to the postponements provided for in Article 5(2) of the Landfill Directive;*
2. *energy recovery is limited to non recyclable materials, having regard to Article 4(2) of the Waste Framework Directive;*
3. *recycled waste is used as a major, reliable source of raw material for the Union, through the development of non toxic material cycles;*
4. *hazardous waste is safely managed and its generation is reduced;*
5. *illegal waste shipments are eradicated, with the support of stringent monitoring; and*
6. *food waste is reduced”.*

There are also far-reaching targets for 2050, among other things for sustainable use of resources. In the area of chemicals a Union strategy for a non-toxic environment is to be devised by 2018, which is to lead to

“ (4) the minimisation of exposure to chemicals in products, including inter alia imported products, with a view to promoting non toxic material cycles and reducing indoor exposure to harmful substances;”.

The need to work towards non-toxic material cycles is emphasised at several places in the action programme. It is clear that the issues addressed in this report will be relevant in Europe over the next few years. It is too early to say how work on devising the Union strategy for a non-toxic environment will be done, but it is important to monitor this. A review of the goals in the Waste Directive will also be conducted in 2014.

4. Overview – what types of regulatory frameworks are there?

4.1. National rules, conventions and EU rules

This report is focused on a survey of the regulatory framework concerning chemical risks in a life-cycle perspective. The regulatory framework is principally at EU level. There are a few special rules in Sweden on chemicals in articles in the Ordinance (1998:944) on prohibitions etc. in certain cases in connection with the handling, import and export of chemical products, but it is otherwise the EU rules that regulate. On the waste side Sweden follows the EU rules, for example with regard to what waste is to be regarded as hazardous. The regulatory

¹⁰ Article 7 of Decision No 1600/2002 of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme. Cf. a study initiated by the Commission on the need for measures to meet the 2020 target, available at bookshop.europa.eu: ” Interpretation of the WSSD 2020 chemicals Goal and assessment of EU efforts to meet the WSSD commitment, 2013, European Commission”.

¹¹ Decision No 1386/2013EU of the European Parliament and of the Council.

framework for waste is otherwise mostly formulated at national level, but is governed by general principles in the EU rules. These principles are put into practice in requirements for the Member States to apply the priorities in the waste hierarchy and for certain levels of collection and levels of recovery to be achieved nationally for certain types of waste (see section 5.4).

The Swedish Environmental Code with subordinate rules (ordinances and agency regulations) are thus in this area the primarily legislation responsible for implementation of the EU rules at national level. The general rules of consideration in the Code (Chapter 2) may have an independent significance for interventions in individual cases. The Swedish rules contain provisions on producer responsibility and on who is responsible for waste management in general.

There are also a number of global conventions in the area of chemicals containing binding rules. The most important are

- The Stockholm Convention on Persistent Organic Pollutants (POPs),
- The Protocol on persistent organic pollutant and the Protocol on metals (Hg, Cd, Pb) to the Convention on Long-Range Transboundary Air Pollution (LRTAP).
- The Montreal Protocol on Substances that Deplete the Ozone Layer.
- The newly adopted convention limiting the handling of mercury (the Minamata Convention on Mercury).

These conventions limit or ban the handling of certain substances of very high concern, particularly those with a transboundary effect. Although the conventions are focused on the chemicals as such, they must also often address life-cycle problems. This may relate to waste aspects, for example how remaining stocks of banned substances are to be dealt with or to what extent recycling of materials containing the regulated substances is to be permitted.

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* both serve the fundamental purpose of preventing certain hazardous chemicals or hazardous waste being exported to third countries without the recipient countries having been afforded an opportunity to decide whether they are willing to accept the import. They are thus intended to prevent industrialised countries getting rid of their environmental problems by exporting them, for example to get rid of pesticides that are no longer allowed to be used in the exporting country or hazardous waste that is difficult or expensive to dispose of nationally.

The EU now regularly becomes a party to the environmental conventions, but the individual Member States also become parties. It is therefore becoming necessary for the EU to adopt a position on the extent to which the obligations in the conventions are to be fulfilled by the individual Member States or through legislation at EU level. With regard to the chemicals conventions and the Basel Convention, rules have been introduced at EU level that signify largely complete implementation of the obligations in the conventions. It is thus also the regulatory framework at EU level that is the determining factor with regard to global agreements.

SAICM (Strategic Approach to International Chemicals Management) is a global framework for cooperation in the area of chemicals under the auspices of the UN, which was adopted in

Dubai in 2006. An important area of work linked to the subject of this report is information systems on chemicals in articles (see section 6.2).

Against this background, this report will principally focus below on EU rules, but with some glances towards international conventions.

4.2. Different types of rules on chemicals

There are a number of EU rules that govern chemicals in one way or another. The rules may focus on the chemicals as such or on articles in which the chemicals are present. They may be focused on different stages in the life-cycles of chemicals and articles (e.g. chemicals production, production of articles, waste management). A more complete overview of the regulatory framework is presented in KemI Report No 1/12. This report is limited to rules of significance to the life-cycle of articles. On this basis, a number of groups of rules can be identified that are described in more detail below.

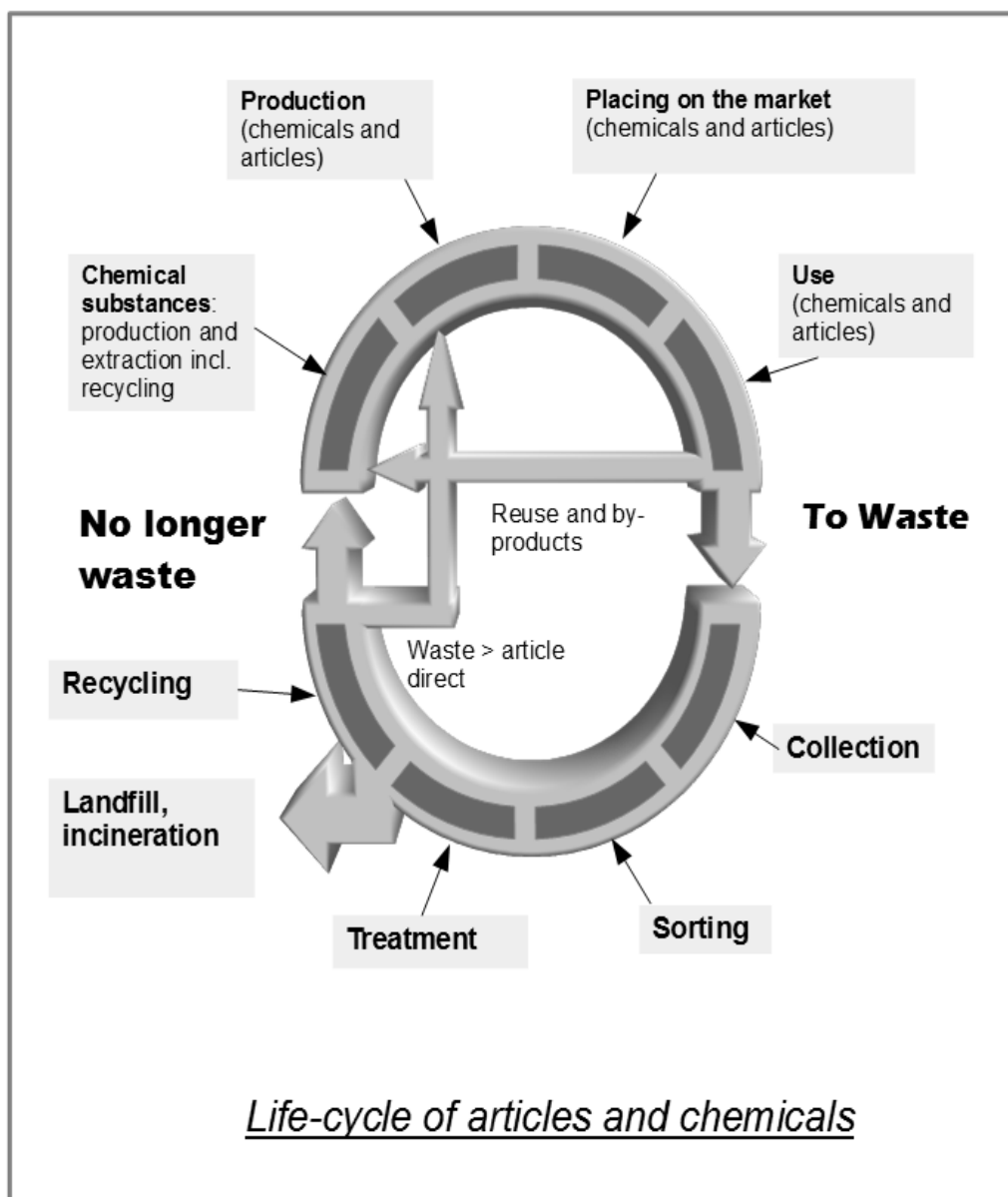
- **Rules on chemicals:** primarily focused on chemical products (REACH/CLP), in particular chemical substances, with limited application when they have been incorporated into an article
- **Specially regulated chemical products:** foods, cosmetics, pesticides, paints, detergents etc. Only biocidal products are discussed to some extent in the report.
- **Rules on articles/waste streams** that contain requirements for chemicals and/or producer responsibility (electronics, vehicles etc.). There are also product rules focused solely on health aspects in the use of articles (toys, product safety rules etc.). Food packaging is specially regulated. The Ecodesign Directive is a general regulatory framework that has not been applied to chemical aspects and has only regulated energy efficiency.
- **POPs rules**, which are based on conventions and supplement the regulations on chemicals and waste with regard to substances of very high concern.
- **Information systems:** Safety data sheets and labelling requirements for chemicals. Labelling of certain materials and products focused on waste management. Special quality labelling, for example ecolabelling and procurement criteria. The candidate list in REACH and similar lists.
- **Environmental taxes** and similar.
- **Waste rules:** the Waste Directive with the definition of waste, rules on hazardous waste and about waste movements.
- Other rules concerned with **environmental effects of activities** which form part of the life-cycle but are not dealt with here: the Industrial Emissions Directive with rules on environmentally hazardous activity, environmental quality of water, rules on landfills and waste incineration etc.

The latter rules on environmental effects in the form of emissions etc. are obviously of great significance when assessing the total environmental impact of material cycles. The rules cannot, however, be used to control the content of hazardous substances in an article and are instead focused on the processes, for example emissions of pollutants in connection with the manufacturing of articles and risks from waste management. The rules are therefore not addressed in this report.

4.3. The role of the rules in material cycles

The picture presented below is a simplified description of the life-cycle of chemicals in articles (the upper part of the picture) and in waste (lower part of the picture).

Different rules are applied for the different stages in the life-cycle. Many of these apply to more than one stage in the life-cycle. The dividing line between chemicals and articles on the one hand and waste on the other is what is most important for application of the rules, as illustrated in the picture. This dividing line is determined by waste legislation. Obviously not all stages in the life-cycle are always relevant. For example, collection of waste leading to an extremely pure and uniform fraction may enable several stages of waste management to be omitted.



To simplify, it can be said that chemicals are regulated in the following ways at the different stages of the life-cycle:

Input to the material cycle in the form of chemical substances

REACH and CLP ensure that hazardous properties are assessed and that information is provided to users.

Production of chemicals and articles

The Industrial Emissions Directive and the Swedish Environmental Code regulate environmentally hazardous activity. Environmental quality rules of various kinds (e.g. the Water Directive) govern activities.

Placing on the market of chemical products and articles

Restrictions and bans may apply to substances under REACH and the rules on POPs. Certain substances in articles are prohibited in rules on waste streams (e.g. electronics, cars) and in product safety rules (e.g. toys). Speciality chemicals often have to be authorised in order to be allowed to be sold. Ecolabelling and similar soft instruments may be of great significance, such as the candidate list in REACH.

Use of articles and chemical products

The end-use of articles or chemicals is generally not separately regulated. Users are obliged in certain cases to follow the terms of authorisations (e.g. pesticides). Users otherwise receive information (labelling) for chemical products under the chemicals regulations (CLP) and in some cases for articles under waste regulations.

Waste management

The Waste Directive regulates what is to be regarded as hazardous waste based on the content of hazardous substances. Restriction of waste movements and exports applies in particular to hazardous waste under international rules. Rules on waste streams contain requirements to separate certain waste or for treatment of the waste, for example to separate hazardous substances. Precautions to be taken in waste management are identified in registration under REACH.

Development of the rules is to a great extent leading from linear flows to material cycles

The picture above describes a life-cycle of chemicals in articles, which is a relatively new phenomenon in Europe and globally. The life-cycle of chemicals was previously best described as a linear flow from production and use to relatively unregulated final disposal, principally by landfilling. The trend is now changing rapidly towards circular flows, where the waste is viewed as a resource with a particular value. This development is also necessary, but there is a risk of it leading to hazardous substances being returned to the material cycles.

As knowledge of hazardous substances in chemicals and in end-of-life articles has increased, it has become increasingly clear that waste dumps are not suitable for the final disposal of waste. New EU directives have been issued on landfilling and incineration, but they have their limitations. A large proportion of the chemicals in end-of-life articles are organic, and it is not possible to landfill organic matter safely, even using modern technology. It is broken down

over the course of time, so that the landfill becomes unsealed and starts to leach. Landfilling is still the dominant method of treatment in around half the EU's Member States, and in large parts of the rest of the world, but the trend is towards reducing the proportion of waste landfilled. Although controlled waste incineration of organic matter is an alternative to landfilling, it is a method of treatment that requires it to be possible for the thermal energy in waste incineration to be utilised if it is to be economically advantageous. The method will therefore probably undergo limited development in many of the countries where our articles are produced in the future. Other forms of waste management such as biological treatment may pose problems in safely disposing of chemicals in end-of-life articles. It is therefore reasonable to assume that for many different sub-streams of waste and end-of-life articles an alternative in the future will be to return the resources to material cycles in some form, both in and outside Sweden. It will therefore become increasingly important to ensure that material cycles become toxin-free and resource-efficient. I shall return to this in Chapter 7 on analyses and conclusions.

5. Examination of the rules

5.1. REACH and CLP

The two EU regulations REACH¹² and CLP¹³ contain the basic rules for chemicals control at EU level (in Chapter 14 Section 3 of the Swedish Environmental Code the legal instruments are referred to as “the chemicals registration regulation” and “the chemicals classification regulation”). The principal components of REACH are summarised in the following way in Swedish Chemicals Agency Report No 1/12:

- Registration: Manufacturers and importers have to register substances handled in quantities of least 1 tonne per year. Data (test results) have to be reported in the registration, as well as a separate risk assessment for each use recommended by the registrant (chemical safety report) if the volume handled exceeds 10 tonnes. The chemical safety report contains exposure scenarios with more or less detailed conditions for the handling of hazardous substances that must be followed.
- Information requirements: requirements to be met by safety data sheets for professional users of chemicals, which supplement the labelling under the CLP Regulation and contain exposure scenarios. There is also a limited obligation to inform about substances of very high concern in articles.
- Downstream users who are not manufacturers or importers but who use a substance in their activity may, in certain cases, be obliged to produce their own chemical safety report.
- Evaluation of registrations must be done firstly to check that the registrations received are correct and secondly in the form of an in-depth substance evaluation of the substances on a priority list.

¹² Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC .

¹³ Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures amending and repealing Directive 67/548/EEC and 1999/45/EC, and Regulation (EC) No 1907/2006.

- Authorisation has to take place for substances that have particularly hazardous properties for the environment or human health. Such substances are placed on a candidate list and transferred successively to a list in Annex XIV with a timetable for authorisation.
- Restrictions are bans or other restrictions on particular substances and specified uses. Annex XVII contains restriction rules for 60 substances and a long list of chemicals of very high concern for health (CMR substances) that may only be sold for professional use.

CLP contains the rules on classification of chemicals with respect to hazardous properties and is based on a globally harmonised system (GHS). The classification is a point of departure for the labelling of chemical products and for the requirements set for packaging.

This legislation is focused on chemicals, not on articles. It applies in the production of articles, where chemicals are used as raw materials or in production, but not to the article in itself. It also applies to chemicals directly used for example in households (such as detergents). However, it is also of great direct or indirect significance in the later stages of the life-cycle, i.e. for articles and for waste management. I make an attempt below to present a detailed account of what significance REACH and CLP have for these stages in the life-cycle of articles.

5.2. Application of REACH and CLP to articles and waste

REACH and CLP are based on the legislation on chemicals that has existed in the EU since the 1960s and which was initially focused on direct health risks from the use of chemicals. The legislation was to ensure that substances that were, for example, very toxic were identified (classified) as such and that information on the hazardous properties and the need for protective measures was provided to the users. The information requirements were supplemented by bans or restrictions on use, which gradually came to apply to a large number of substances (now Annex XVII of REACH). CMR substances were generally banned for consumer use.

The rules on bans/restrictions developed in the chemicals legislation could also apply to the use of chemicals in articles and be aimed at counteracting problems in waste management. With regard to how chemicals are actually used and the consequences of use, it was not possible to limit application of the rules just to apply to the chemicals as such. The rules must be applied to some extent, also at later stages of the life-cycle. If the chemical was used in an article, bans etc. sometimes had to be applied to the article and not just to the chemical as such, partly to ensure that imported articles were covered.

The regulatory frameworks relating to chemicals have thus been focused from the start on substances and on avoiding health risks in the use of substances hazardous to health. The rules were also applied to mixtures of substances. They have been of significance to waste management by providing the basis for the classification of hazardous waste. The rules were gradually expanded to cover not only chemicals hazardous to health but also those hazardous to the environment. As knowledge of the long-term impact of certain chemicals on the environment and the risks of exposure to the articles has increased, the rules on chemicals have become increasingly significant for the later stage of the material cycle. However, most of the rules still only apply to the first stage in the life-cycle, that is to say the management of chemical products.

The following section contains an examination of the principal components of REACH (see above), focusing on the material cycle aspects.

5.2.1. Registration in REACH and classification in CLP

- Registration under REACH is fundamental to assessing hazardous properties and what protective measures are needed in handling. The requirements for registration in REACH apply to chemical substances. The assessment of exposure and risk which is to be done applies to the use of chemicals as such but also to use in mixtures and in articles. The need for measures in waste management has to be covered. The rules apply in that sense to the whole life-cycle, including the use and waste phases.
- Recovered chemical substances are in principle to be regarded as new chemicals which are to be registered. There are, however, many exceptions to this principle, and it is doubtful whether it has any effect. Even if registration takes place, the registration requirements are limited for chemicals handled in low quantities.
- Because of the derogations from the registration obligation for recovered substances the recycler does not need to develop a separate risk assessment (chemical safety report), even in cases where the recycled material is given a different use than that recommended in previous registration and when the exposure situation may be different.
- However, classification according to CLP always has to take place for recovered hazardous substances that can no longer be regarded as waste. Industry is responsible for identifying hazardous properties in recovered substances or mixtures that are marketed and making this assessment the basis for information to users, for example in safety data sheets.
- If waste is directly converted into an article, however, none of the requirements in REACH and CLP relating to chemical products are applicable.

Requirements for registration according to REACH apply to *chemical substances* (including substances in mixtures) that are imported into the EU and placed on the market (REACH Article 6). The requirements for registration, as mentioned above, do not apply to waste. The registration entails a requirement for knowledge to be developed on the inherent hazardous properties of substances, analysing human and environmental exposure in different uses and protective measures being identified. This primarily applies to chemicals handled in large volumes. The requirements are very limited with regard to chemicals handled in volumes of 1-10 tonnes per year per user or importer. No requirements apply to handling volumes of less than 1 tonne. With regard to application of the registration requirements in the later stages of the life-cycle (risks in the handling of articles and waste management), it is particularly important to note that assessment of the risk of exposure through a chemical safety report is thus not required for chemicals handled in volumes of less than 10 tonnes annually.

With regard to *articles* containing hazardous substances, these limited registration requirements (Article 7) do not apply to substances in the articles. Registration is never required if the substance concerned as such has been registered for the same use within the EU (Article 7(6)). It does not matter who has done the previous registration of the substance, as long as the registration relates to the same use. If there is no previous registration, registration of the chemical in the article is done in the following cases:

- Substances that are intended to be released from an article have to be registered if the total volume of the substance in the article handled exceeds 1 tonne per year (Article 7(1)).
- If substances of very high concern are contained in the article in quantities of more than 0.1% by weight, registration has to take place (Article 7(2)), with the same

restriction to 1 tonne per year. Registration may be omitted if the producer/importer can show that exposure to the substance cannot take place in use, including waste management.

- The chemicals authority may request registration if it is suspected that the substance is released and presents a risk to human health or the environment (Article 7(5)).

The registration requirements for articles are thus focused on articles imported into the EU. The requirements relate to such a type of use in an article of a particular chemical that does not occur in the EU, or where the chemical as such is not already covered by registration requirements. The requirements are also limited to chemicals that are intentionally released or such as are known to have properties of particularly high concern. It should be noted, however, that the term “article” does not include a chemical in an object that principally serves as packaging for the chemical (see also section 2). The derogations in Article 7 do not apply to such chemicals.

There are other important derogations from the registration requirements. The exemptions primarily apply to *polymers*, which need not be registered. Plastics, for example, thus do not have to be registered. On the other hand, the monomers of which the polymer is made up are registered (see also the annex). In addition, *intermediates* used in industrial processes do not have to be registered or are only registered in a very limited way. Intermediates do not remain in the final article and are therefore not of interest for the purposes of this report. Exemptions from registration requirements for a number of substances or types of substances are also contained in Annexes IV and V of REACH. Annex IV contains a number of substances limited to foods, for example sugars, and some elements. Annex V contains a number of exemptions for substances which for various reasons it is not considered necessary to register. These may be substances that are not themselves placed on the market and that arise in the use of a substance for which registration is mandatory. Other derogations apply to naturally occurring substances that are not chemically modified or that do not have hazardous properties.

Substances that are recovered from waste are treated as new substances and thus in principle have to be registered. The recycler who places the recycled material on the market is regarded as a manufacturer within the meaning of chemicals legislation. This obviously necessitates the material no longer being regarded as waste under waste legislation. The registration obligation is, however, very limited (Article 2(7)(d)¹⁴. The substance need not be registered if three conditions are met:

- The substance has been recovered in the EU.
- The same substance has previously been registered under REACH (it need not have been registered in the same supply chain or for the same use).
- The recycler has had access to information about the substance in the form of safety data sheets etc.

The recycler thus gains an economic advantage through the derogation compared with whoever manufactures or imports a new substance and avoids the cost of registration. This also means that the recycler does not even need to develop a separate risk assessment (chemical safety report), in cases where the recovered material gains a different use than that recommended in previous registration and when the exposure situation may be different. Although the exemption necessitates that a recovered substance is identical to one registered

¹⁴ Guidance from ECHA: Guidance for waste and recovered substances, version 2, May 2010.

previously, the definition of what is a substance is very open and vague (section 5.2.6), and the derogation in Article 2(7)(d) could therefore be applied to recovered substances containing for example impurities in the form of hazardous substances that are never present in virgin materials. This provision highlights several issues that are important for this report and are discussed in more detail in the annex regarding application to plastic materials.

The registration requirements in REACH as mentioned contain requirements for a chemical safety report, if the substance is handled in quantities of at least 10 tonnes per year (Article 14). This report has to contain an *exposure scenario covering the whole life-cycle* (Article 3(37)), i.e. also exposure to the chemical from articles during the use phase and exposure during the waste stage. The chemicals safety report has to identify the *safety measures required* for safe handling¹⁵.

The registration requirements in REACH registration require an extensive assessment of danger and risk for chemicals handled in large volumes, but there are thus many derogations from and restrictions in the requirements. It is important, however, to remember that the information requirements in the form of safety data sheets (see next section) are based upon whoever places a chemical on the market conducting an analysis based on already existing knowledge of hazardous properties and risks in the chemicals that are sold. The requirements set are quite extensive (Annex II of REACH), although they do not entail requirements to develop new test data or to make a complete risk assessment according to the registration rules in Annex I of REACH. They apply regardless of the volume in which the chemical is handled provided the substance (or mixture) has a hazardous property. As recyclers in general are exempt from the requirement to register substances, this obligation becomes all the more important. ECHA's guidance on recovered substances emphasises this and points out that a recycler must be aware whether the recovered material contains hazardous substances. How such knowledge has to be obtained is a fundamental problem to which neither chemicals nor waste legislation provides a clear answer.

Although registration according to REACH is not required, chemical substances or mixtures always have to be *classified according to CLP* by whoever imports the chemical or places it on the market (CLP Article 4). The classification of properties hazardous to human health and the environment takes place in accordance with detailed rules in Annex 1 of CLP. Responsibility for classification rests with the entrepreneur, who must evaluate any hazardous properties on the basis of all available information (CLP Articles 6 and 15). For CMR substances and respiratory sensitising substances a harmonised classification always has to be done, which is decided at Community level (Article 36).

According to CLP there also has to be a classification and labelling register, which is managed by the European Chemicals Agency (ECHA) in Helsinki. All hazardous substances have to be notified to this register, regardless of the volume handled. The notification obligation also applies to other substances for which registration is not obligatory under REACH (SVHC substances). The register exists in a public version and comprises more than 100,000 substances. More than 5 million notifications to the register have been made.

¹⁵ Article 14 and Annex 1 of REACH. The European Chemicals Agency (ECHA) has prepared guidance for registration containing sections on "Estimation of exposure from articles" (Chapter R.17) and "Exposure scenario building and environment release estimation for the waste life stage", version 2.1, October 2012. See also section R.13.2.6 of the guidance: "Operational conditions and risk management measures related to the waste life stage".

The classification as a hazardous substance forms the basis for the information requirements under REACH and CLP (see next section), but is also important in other contexts. It dictates what waste is to be regarded as hazardous, for example.

These rules thus also apply to substances recovered from waste, with the restrictions indicated above and provided the recovered substance is no longer to be regarded as waste. A situation when neither registration requirements nor classification requirements apply is if *recovered material goes directly from waste to article*. For example, plastic waste or scrap metal in some cases can be directly melted and shaped into an object that meets the description of the concept of article in the rules on chemicals (see section 2). In such cases a chemical product never arises and one stage in the life-cycle is skipped. Registration requirements and other chemical requirements (for example information requirements) do not apply. A similar situation can be imagined to arise when waste directly acquires a use through being incorporated into a building project, for example as ballast material in a road. As the concept of waste is formulated (section 5.4.2), recyclers in practice themselves have great opportunities to dictate whether the material is to continue to be regarded as waste up to the time when it is converted into an article or be incorporated into a building structure.

To summarise the requirements for registration in REACH thus apply to chemical substances. The assessment of exposure and risk which is to be done applies to the use of chemicals as such but also the use in mixtures and in articles. The need for measures in waste management has to be covered. The rules apply in that sense to the whole life-cycle, including and use and waste phases.

Recovered chemical substances are in principle to be regarded as new chemicals which are covered by registration requirements. There are, however, many exceptions to this principle, and it is doubtful whether it has any effect. Even if registration takes place, the registration requirements are limited to chemicals handled in low volumes. Alongside the registration requirements, however, a general requirement applies for industry to identify hazardous properties in substances or mixtures that are marketed and to base information for users on this assessment. This requirement applies without restrictions to such recovered hazardous substances as are no longer regarded as waste. If waste is directly converted to an article, however, none of the requirements in REACH and CLP relating to chemical products is applicable.

5.2.2. The information requirements in REACH and CLP

To summarise, with regard to the information requirements in REACH and CLP: information on hazardous chemicals and the need for protective measures have to be given to professional users in the form of safety data sheets and to consumers through labelling,

- certain information on the content of substances of very high concern in articles has to be supplied in accordance with REACH to the recipient and on request to consumers,
- interpretation of the information requirements for articles is unclear, which weakens their impact,
- information on chemicals has to relate to the need for protective measures throughout the life-cycle, i.e. also relate to exposure through articles and precautions in waste management,
- the information requirements also have to apply to chemicals recovered from waste,
- recyclers must have access to safety data sheets etc. for recovered substances if they are to avoid the registration obligation, but do not have the right of access to the safety data sheets.

Information on chemical risks has to be supplied to the users under the provisions of REACH and CLP. REACH deals with the information to be provided in *safety data sheets* to professional users. CLP deals with the warning labelling on products to be provided to consumers.

Safety data sheets according to REACH are to be provided to the recipient of a substance, if the substance has hazardous properties (Article 31). If a chemical safety report has been prepared in conjunction with registration under REACH, the safety data sheet has to be based on that report. The exposure scenario that has been prepared has to accompany the safety data sheet. Safety data sheets are always to be supplied if the substance has hazardous properties, even in cases where registration is not required under REACH. Safety data sheets are thus required even if less than 1 tonne per year of the substance is handled. It is only any hazardousness of the substance that determines whether safety data sheets have to be prepared.

Many suppliers make their safety data sheets public, but there is no obligation to do so. Only the recipient (normally the purchaser) has an absolute right of access to the safety data sheets (employers must, however, ensure that the sheets are available to employees and their representatives, REACH Article 35). If chemicals are sold to the public and carry sufficient warning labelling (e.g. in accordance with CLP), safety data sheets need not be supplied to distributors or downstream users, unless the latter specifically so request (REACH Article 31(4)). Those who sell or distribute chemicals in consumer packaging thus do not normally receive safety data sheets, but may request that they receive them.

If chemicals are handled in volumes in excess of 10 tonnes annually, the safety data sheets can thus be based on registration in accordance with REACH, which contains a chemical safety report and an exposure scenario that is to cover the entire life-cycle. But even if registration is not required under REACH, measures aimed at safe waste management have to be reported (Article 31(6), Annex II). On the other hand, no special requirements are expressed on reporting emissions of the substance from articles. The rules on safety data

sheets are not focused on chemicals in articles, but as mentioned there is no doubt that in principle they have to identify needs for protective measures for the whole life-cycle.

Even if a safety data sheet is not required, there is a certain obligation for suppliers always to provide general information to the recipient, for instance whether any need for special protective measures has been identified (Article 32). Information always has to be provided on any restrictions on use that apply under other EU rules (e.g. working environment rules, restrictions or requirements for authorisation under REACH). Such information always has to be provided in safety data sheets.

The requirements apply to chemical products, including recovered chemical products that are no longer waste. The information in accordance with Articles 31 and 32 of REACH now described always has to be available to whoever recovers material and places it on the market as a new substance. As mentioned above, this is an essential requirement for the recycler (or the importer of recycled material) to avoid the obligation to make a new registration in accordance with Article 2(7) of REACH. The condition to have access to safety data sheets is without exception, despite there not being any obligation in REACH for suppliers to provide recyclers with safety data sheets. Even if a substance that does not require a safety data sheet is concerned, the recycler must have access to information on registration status under REACH, details of any authorisation requirements and applicable restrictions and other relevant information (see Article 32(1)). Article 2(7)(d) is the only provision in the legislation that means that information from the first life-cycle of a chemical is utilised in the next life-cycle, when the chemical has been recovered and placed on the market again (cf. the picture in section 4.3).

According to *CLP* information on hazardous properties has to be provided in the form of *labelling*, which is normally on the packaging. The information is normally provided through symbols, hazard statements and precautionary statements. The labelling is of significance for workers who handle the chemical and for consumers, but obviously also for waste operators if the packaging is still present when the chemical reaches the waste stage. The information according to the labelling is highly simplified and standardised compared with the safety data sheet.

The information requirements now described apply to chemicals, not articles. However, REACH also contains a new information requirement for articles containing substances of very high concern in quantities above 0.1% by weight (Article 33). The obligation applies to substances of very high concern identified on what is known as the candidate list for authorisation (144 substances at the time of writing). Information has to be supplied to the recipient on “sufficient information to which the supplier has access, with at least the name of the substance, so that the article can be used in a safe manner”. Consumers have to receive corresponding information on request within 45 days.

The general information requirement for substances of very high concern in articles is an important fundamental innovation in REACH and is in line with Swedish environmental objectives (cf. section 3.1.4). This rule is important from the point of view of life-cycles, as it extends information requirements for chemical products for the first time to the next stage in the cycle. However, the interpretation of how the level of 0.1% by weight is to be calculated in an article is uncertain. Sweden and several other countries consider that the level is to be calculated on the basis of the part of a complex article in which the substances of very high concern is present. Others consider that the calculation should be made on the basis of the

weight of the whole of the complex article. The different calculations can produce completely different results, and weaken the impact of the rule¹⁶.

To summarise, with regard to the information requirements in REACH and CLP:

- information on hazardous chemicals and the need for protective measures have to be presented to professional users in the form of safety data sheets and to consumers through labelling,
- certain information on the content of substances of very high concern in articles has to be supplied in accordance with REACH to the recipient and on request to consumers,
- interpretation of the information requirements for articles is unclear, which weakens their impact,
- information on chemicals has to relate to the need for protective measures throughout the life-cycle, i.e. also relate to exposure through goods and precautions in waste management,
- the information requirements also have to apply to chemicals recovered from waste,
- recyclers avoid having to register recovered substances according to REACH if these have been registered previously,
- recyclers must have access to safety data sheets etc. for recovered substances if they are to avoid the registration obligation, but do not have the right to receive safety data sheets.

5.2.3. Evaluation

- The evaluation of substances under REACH provides an opportunity to make a more detailed study of registered substances suspected as problematic, including in a life-cycle perspective.
- The evaluation has to take account of the use of a substance during its life-cycle, i.e. including use in articles and risks in waste management.
- The evaluation does not have any special focus on recovered substances.

REACH contains a chapter on *substance evaluation* of chemical substances, which means that an in-depth assessment is made by the responsible authorities of hazardous substances and any risks (Articles 44-48). Priority is to be given to substances that have structural similarities to previously known problematic substances or that occur in large quantities. The evaluation is principally based on data produced in connection with registrations according to REACH, but supplementary data can be requested from the industry. The work is coordinated by ECHA but is carried out by the authorities in the member states.

Although the substance evaluation is focused on chemical substances, in the same way as the registrations (the chemical safety report) it will be concerned with exposure due to use in articles and aspects of waste management. The result of the evaluation is presented in a report, which may contain proposals for measures, for example that the chemical should go on to authorisation or a decision on restriction under REACH (Article 48). The evaluation in itself does not have any direct legal implications. The result of the evaluation may, however, constitute such new information that suppliers of chemicals have to deal with and incorporate into an updated registration, in safety data sheets or in general information for users (cf. Article 32).

16 Se KemI Report No 1/12 p. 58 f.

The evaluation is focused on registered chemicals. As recovered substances are unlikely to be registered to any great extent (see above), it is possible that risk aspects of recovered materials will not play a major role in the evaluation of substances.

5.2.4. Authorisation

- Authorisation under REACH applies to substances that have been identified as being of very high concern and that have been listed in a separate index.
- The authorisation review relates to risks throughout the life-cycle, including use in articles and waste aspects.
- Recovered materials are subject to authorisation in the same way as virgin substances.
- If recycled materials contain impurities that are substances of very high concern, it may happen that these substances have to be authorised. However, they can generally be regarded as part of the substances to which the recovery relates.

Authorisation under REACH (Articles 55-66) applies to substances of very high concern, i.e. CMR, PBT and vPvB substances (see section 2 concerning these terms) or substances identified in each individual cases and that “give rise to an equivalent level of concern” (Article 57 f). This authorisation requires the substance to be listed in a separate Annex XIV with a timetable for authorisation. At the time of writing, there are 22 substances on this list and the first decisions on possible authorisations are to be made in 2014.

The authorisation covers use of the chemical substance as such, in mixtures or in articles (Article 56). Everyone placing the substance on the market must have authorisation. An assessment has to be made in authorisation of whether use can be regarded as “adequately controlled” according to the criteria in Annex I of REACH, i.e. the same risk assessment that is to be made in registration of chemicals handled in larger quantities. Account has to be taken among other things of “risks arising from diffuse or dispersive uses” (Article 60(1)). Based on these rules, it is clear that an assessment of the risks has to relate to the whole life-cycle up to recovery, including exposure from articles and exposure/emissions in connection with waste management. It can also be concluded with some certainty that the suitability of recovered materials is not assessed in authorisation. The recovered materials are regarded as new substances in conjunction with registration. It would be unreasonable for whoever originally places a substance on the market to have to take full responsibility for recovery of materials containing the substance. There is, however, no special regulation of the issue in the authorisation part similar to that applicable in registration. As far as I am able to judge, there is agreement among the authorities that apply REACH and its interpretations.

Recovered materials of very high concern are thus subject to authorisation in the same way as virgin substances. A problem in recovery of substances may be that the recycled material contains impurities that have not been successfully removed in the recycling process. These impurities may be substances of very high concern, even if the material intended to be recycled does not have such properties. The formulation of the definition of substance (section 5.4.2) means, however, that impurities are generally not to be regarded as separate substances, even if these occur in high concentrations. If an impurity cannot be regarded as attributable to the substance to be recovered, it is regarded as a substance contained in a mixture. It has to be authorised if it is present in the mixture at levels above 0.1% or at levels that mean that the mixture is characterised as hazardous (Article 56(6)).

DEHP is a substance (phthalate) used as a plasticiser in plastics. The substance is a substance of very high concern that has to have been authorised under REACH by 2015. Three recyclers of PVC plastic have applied for authorisation to recycle plastics containing DEHP¹⁷. Discussion is taking place at the same time in the EU in which recyclers are identifying problems in authorising recycled plastic materials. The materials may contain many different types of additives that constitute substances of very high concern but that have been previously authorised. The issue of a general derogation from authorisation for recycled materials has been raised by the industry, which has made reference to Article 58(2) of REACH. This provision states that uses or use categories may be exempted from authorisation requirements if there is specific Community legislation indicating minimum requirements concerning protection of human health or the environment for use of the substance. Attention has also been drawn to the concept of substance, which allows impurities up to 20% to be permitted as part of a substance (see section 5.2.6). In my opinion it is not possible to apply Article 58(2) generally to recycled materials. It is also difficult to understand why substances of very high concern would be permitted in recovered materials without further review. Authorisation under REACH appears to be a suitable process for conducting such a review. At the same time, the example highlights the practical problems that arise when recovered materials (i.e. chemical substances) are to be dealt with on the same terms as the virgin materials.

Those who apply for authorisation under REACH for recycled PVC must evidently consider the material to have undergone a recycling procedure such that the material is no longer to be regarded as waste but as a chemical product. If the material is still to be regarded as waste, REACH would not be applicable. The issue of authorisation of recovered materials is important and is very closely related to the definitions in waste legislation of what is waste or ceases to be waste. I return to the issue in section 5.5 and in the annex on recycled plastic.

5.2.5. Restrictions

- Restrictions on use or bans exist for around a hundred chemical substances in REACH. The rules may relate to articles – including imported articles – and chemical aspects of waste management.
- There are examples of restrictions where the requirements for recovered materials are set lower than the requirements for virgin materials.

Annex XVII of REACH contains restrictions in use or bans for around a hundred substances. Many of these apply to articles that contain the substances at stated levels (usually 0.1% by weight). In some cases emissions from production (e.g. nonylphenol) or waste aspects (e.g. handling of asbestos) are regulated. Restrictions may thus contain rules of various types relating to all parts of the cycle. Recycled material placed on the market is, in principle, treated in the same way as new materials, although the requirement levels may thus sometimes be lower. For cadmium in PVC, to take an example, a higher limit value applies to recycled PVC than to virgin PVC (Annex XVII, point 23).

The restrictions may be focused on chemicals (substances or mixtures) but may also be focused on chemical aspects of articles and also impose requirements relating to waste management. The restriction rules can therefore handle chemical aspects of imported articles, which is not possible with rules relating to the chemicals as such. If a substance has been

¹⁷ European Plastic Converters newsletter November 2013.

authorised, the European Chemicals Agency (ECHA) therefore has to evaluate whether there is a risk associated with the substance in imported articles that needs to be addressed with a restriction rule (REACH Article 69(2)).

The restrictions in REACH sometimes constitute a type of rules that might also end up in such special legal instruments as are focused on regulating articles/products and waste management rather than chemicals, and where restrictions on chemical content may be an important element. Such rules exist for example for electronics, batteries, packaging and end-of-life vehicles. The Ecodesign Directive is also focused on regulating articles. I shall return to these rules below.

5.2.6. The concept of substance in REACH

- How the term “substance” is defined is fundamental to chemicals legislation.
- The concept of substance has been developed in a practice, with the result that a substance may contain high levels of various types of impurities. What impurities and in what quantities may vary depending on how the substance has been produced.
- There are reasons to analyse in greater depth how the concept of substance is to be applied to recovered materials, particularly as the response to the question of whether one substance is identical to another is of crucial significance to the application of REACH.

Definition of substance

The term “substance” is fundamental to chemicals legislation. It is not defined in Chapter 14 of the Swedish Environmental Code (cf. Section 2), but the definition applicable in international contexts is also applied in Sweden. Similar definitions of substance can be found in REACH, in CLP, in the international system (GHS) and in the EU rules on pesticides.

The definition is important for several reasons:

- The assessment of any inherent hazardous properties of a chemical is based on the substance. It is the substance that is tested by standardised and internationally accepted methods. Although mixtures can also be tested by these methods, a mixture is generally assessed on the basis of information on how much of a hazardous substance the mixture contains (conventional method).
- Information requirements in the form of labelling and safety data sheets are based on properties of substances and have to be issued for substances (the information is then also formulated to fit mixtures).
- The registration requirements in REACH apply to substances. Volume limits for registration requirements are applied at substance level. Registrants registering the same subjects are obliged to share test data and cooperate in other respects.
- Rules for hazardous chemicals in articles are based on the content of a particular substance in the article.
- Recovered substances need not be registered if the same substance has already been registered.

For those to handle chemicals it is thus very important to know and apply the definition of substance, in particular to assess whether a substance that is handled is the same as a

substance that has already been registered under REACH¹⁸ In a life-cycle perspective, recyclers of waste are regarded in application of REACH as manufacturers of a substance. The recycler must also know and be able to apply the definition of substance.

The definition in CLP (Article 2(7)) of the term “substance” is:

“ chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition”.

The definition of substance is thus based on chemicals that are used in practice and occur in a market. These may be synthesised chemicals but may also be substances of natural origin, for example crude oil or minerals or plant material. Pure metals are also substances. The starting point is an element or chemical compound, but the substance may contain various additives needed for the substance to remain stable. Impurities are not regarded as separate substances within the meaning of chemicals legislation but form part of the chemical substance.

This definition clearly also permits substances originating from different manufacturers/imports to differ in several respects. Different manufacturing processes may, for example, lead to different types and quantities of impurities in the substance. Different types of additives to preserve stability can be imagined to occur, and so on. The fact that the definition is open in this way may lead to application problems, particularly when the rules are formulated so that it is important to determine whether two chemicals are identical, i.e. whether they are the same substance within the meaning of the legislation. In a life-cycle perspective, the issue may be whether a substance that has been recovered from waste is to be regarded as the same substance as a previously registered substance according to REACH. This assessment can be complicated by the fact that recovered substances may contain different types of impurities than the corresponding original raw materials. The question is whether it is even appropriate to consider the recovered substances to be “the same substances” as the original ones (development of EoW criteria is one way of dealing with such problems, see section 5.4.5).

The concept of substance in practice

Identifying a substance is not quite so complicated as the definition of substance suggests, however, as a generally accepted practice has been developed for application and there are lists of substances that occur in the market. The lists were necessary when the first registration requirements were introduced into EU chemicals legislation. The requirements applied to new substances, and it was necessary to know what substances were already on the market at a particular time (18 September 1981) and were therefore not covered by registration requirements. All the substances that existed at that time are in the list known as EINECS (European Inventory of Existing Commercial Chemical Substances). EINECS contains more than 100 000 substances. It is supplemented by two other lists. ELINCS (European List of Notified Chemical Substances) contains the substances that have been added since 1981 and that were notified (registered) under the chemicals rules up to the time when REACH entered into force in 2008. ELINCS contains 5292 substances. Finally there is a list of substances that were previously regarded as polymers but that were no longer regarded as such after the

¹⁸ The concept of substance is discussed in the ECHA guidance on which this section is based. See “ECHA, Guidance for identification and naming of substances under Reach and CLP, Version 1.2, March 2012”.

definition of this term was changed. This No-Longer-Polymer list (NLP) contains 703 substances.

These just over 100 000 different substances have thus been identified by the industry and checked by the authorities. The lists have been published and therefore have official status. Within the EU they are identified by seven-digit numbers, starting with 2, 3, 4 or 5. ECHA has published list of other substances that do not appear in these lists but that have been registered later under REACH, for example, or have been notified to the classification and labelling registry under CLP. These are also given seven-digit numbers, starting with any digit in the range 6-9.

In addition to EU numbers, substances are identified in various ways. The most important is what is known as the CAS (Chemical Abstract Services) service, which is set by an independent body under the American Chemicals Society. It is reported that that are CAS numbers for more than 73 million individual substances (www.cas.org). The name of a substance is set using a uniform chemical nomenclature (IUPAC). There may also be simplified names in general use (trivial name).

Practice has been developed for how to handle substances with complex contents. A substance may be well defined, so that it is known which components are included and within what ranges the components may vary. If the substance contains more than 80% by weight of one constituent (main constituent) and no more than 20% impurities, the substance is known as a “mono-constituent substance”. A well defined substance may also consist of several constituents in the range 10% – 80% and is then referred to as “a reaction mass of ... (the components)”. Particularly for substances of biological origin or for minerals it is often not possible to indicate the components precisely, as the composition varies. It is then no longer possible to talk of the components and impurities of the substance. The substances have to be named and identified for example according to the biological organism or the material that forms the starting point, supplemented by a description of how it has been treated in a process¹⁹. Such substances are known as UVCB substances (Substances of Unknown or Variable composition, Complex reaction products or Biological materials).

Impurities in a substance according to the ECHA guidance have to be stated when the substance is identified if they are present at over 1% in well defined substances and over 10% in UVCB substances. Impurities that are relevant for classification with regard to hazardous properties or for PBT/vPvB classification are always to be stated.

I have described practice for how substances are identified in relatively great detail, to show that within what is known as a substance there may be a broad range of ingredients, various types of impurities and even wide variations in the main components included. It is particularly important that substances may contain various types of impurities at significant levels. With the life-cycle perspective underpinning this report, the question is whether the recovered substances that are no longer regarded as waste should be treated differently in substance identification, for example due to the fact that other types of impurities may be contained in the recovered substances. This issue is briefly addressed in the ECHA guidance on waste and recovered substances²⁰. It is said that it is not always easy to identify the contents of recovered substances, as the composition of the waste stream concerned can vary.

¹⁹ Two randomly chosen examples: “*Lavender, Lavandula Latifolia, ext., sulfurized, palladium salt*” and “*Tin, melting residues*”.

²⁰ECHA, Guidance on waste and recovered substances, Version 2, May 2010, section 2.2.2.

The “manufacturer” (whoever recovers the substance) must then be able to justify why the substance can be treated as identical to that originally registered, for example by showing that measures have been taken to ensure that impurities hazardous to the environment or human health are not present in the recovered material. In view of how open the definition of the term substance is in practice, I consider it doubtful whether there is actually support in the legislation for this conclusion.

In order to be applicable in practice, the term substance must contain a number of simplifications and standardisations. Experience in application at expert level has, hopefully, had the result that these simplifications and standardisations have not led to risks to human health and the environment. The question is whether the term does not need to be developed and refined in a future when recycled materials become increasingly common. It may be wondered, for example, whether experts who work with EoW criteria cooperate with the experts who assess substance identity between virgin and recovered materials. With steadily increasing recovery of materials I feel that a more in-depth analysis needs to be made of how the concept of substance can be applied to recovered substances to ensure that any risks to human and health are managed in a reasonable manner.

I return to the concept of substance in section 7 and in the annex on recycled plastics.

5.3. Rules on persistent organic pollutants (POPs)

- The international rules on POPs prohibit certain substances of very high concern. The prohibitions have been introduced in a special EU Regulation.
- The rules on POPs mean that recovery of materials containing POPs is, in principle, prohibited. In the case of brominated flame retardants, however, less stringent requirements apply to recovered materials than to the virgin materials.

Persistent organic pollutants (POPs) are environmentally harmful substances of very high concern which are regulated at international level by the Stockholm Convention and the POPs Protocol to the Convention on Long-range Transboundary Air Pollution (LRTAP). The Stockholm Convention at present contains bans on 23 substances. Substances governed by the Convention have to fulfil a number of criteria. The selection criteria mean that the substances are persistent in the environment, that they accumulate in living organisms, that they are dispersed over long distances and that they are toxic.

The provisions of the Convention on POPs have been implemented in the EU through a special EU Regulation²¹, which also applies in parallel to other chemicals and waste legislation. The rules contain bans on producing and placing the substances on the market, as such, in mixtures or in articles. The rules also state that existing stocks of the substances are to be regarded as waste and contain detailed requirements on waste management. The waste must be managed in a way that means that the POPs are rendered harmless. Recovery of the substances is, in principle, prohibited, but there are options for derogations in Article 7 and Annex IV of the EU Regulation. Annex IV indicates limit values for permitted levels in recovered materials. If a limit value for a substance has not been set through an EU decision, the member states may apply their national legislation.

²¹Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC.

It has not been possible to reach agreement on a limit value in Annex IV for the flame retardant pentaBDE, despite long discussions. Under Annex I a level of 0.1% is now permitted for brominated flame retardants in plastic materials that are wholly or partially recovered. For virgin materials, a ban applies beyond what is more or less a detection limit of 0.001%. There are thus examples of higher limit values applying to recovered materials than to virgin materials with regard to the content of substances of very high concern.

The EU's POPs Regulation is an example of a regulatory framework containing provisions for the whole life-cycle, from production to final disposal of the waste. As recovery of POPs is, in principle, banned, the rules mean that stricter requirements are set for waste management of products that may contain POPs. For example, plastic material in electrical and electronic products must be sorted carefully if it is to be recovered, so that POPs do not accompany the material in recovery.

5.4. Rules on waste

5.4.1. *The Waste Framework Directive*

- The EU's Framework contains priorities for national waste policy (the waste hierarchy), where “prevention of waste” has top priority.
- The Framework Directive contains objectives for reuse/recovery of paper, metal, plastic and glass, as well as for non-hazardous building and demolition waste, to be attained by 2020. The Directive contains minimum requirements for how management of waste is to proceed and a requirement for the establishment of national waste plans.
- Prevention of waste includes reducing the level of harmful substances in materials and products. The Framework Directive contains the principles for the classification of waste as hazardous with respect to the content of hazardous substances.
- The Directive does not otherwise contain any special rules focused on non-toxicity of waste. The Directive encourages the introduction of producer responsibility, which can lead to purer products.

The fundamental EU rules on waste are contained in the Waste Framework Directive²². The Directive is a minimum directive based on Article 175 of the Treaty. It leaves it to the member states to adopt detailed provisions and in principle allows the member states to decide the level of ambition for national transposition. In practice, however, the rules have a harmonising effect in several respects, principally with regard to the definition of waste, the classification of types of waste and what waste is to be regarded as hazardous. The Directive has been transposed into Swedish law through the Waste Ordinance (2011:927).

The member states are obliged to follow a priority scheme in their national provisions for management of waste, known as the waste hierarchy (Article 4) as follows:

- Prevention
- Preparing for re-use
- Recycling
- Other recovery, e.g. energy recovery
- Disposal

²² Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

The hierarchy is a guide, and it is possible to deviate from it if this justified for environmental reasons. If, for example, a material in the waste is not suitable for recycling because it contains hazardous substances, waste incineration may be the alternative that should be prioritised.

“Prevention” includes “reducing the content of harmful substances in materials and products” (Article 3(12))²³. Prevention may also mean that the quantity of waste is reduced for example by products being re-used or having a longer life span.

Prevention is thus the point in the waste hierarchy that expresses a life-cycle perspective in the sense that the prevention can be focused on how a product is designed and what hazardous substances are added in production. The Waste Directive is otherwise focused on the management of waste and does not contain any rules on the design of products. Such rules are contained in provisions concerning special product categories (Directive on Waste Streams, section 5.6.2).

“Re-use” means that a product continues to be used for its original purpose. The rules on waste become applicable only if the product is considered to have become waste at an earlier stage. The market for second-hand products is not otherwise affected by the rules on waste. Preparing for re-use may, for example, include repair.

Recovery is a concept that is divided into the two items in the prioritisation scheme in the new Directive. “Recycling” is recovery for example of metals and plastics from suitable waste fractions. Other recovery includes energy recovery, which is thus to be given lower priority than recycling but is to be prioritised ahead of disposal. “Disposal” means that the waste is sent to landfill or is incinerated without energy recovery (Article 3(19) and Annex 1). Such a measure for waste management is thus only to be applied as a last resort. The volume of waste landfilled has also decreased sharply in many countries, including Sweden.

One way of stimulating prevention of waste and recovery of waste is the introduction of rules on *producer responsibility*. Producer responsibility means that manufacturers, imports or those who sell articles have responsibility for waste management, for example for the collection and recovery of waste (cf. Chapter 15 Sections 6-7a of the Swedish Environmental Code, Article 8 of the Waste Directive). The Waste Directive leaves it to the member states to regulate producer responsibility. There are also special EU rules on producer responsibility in the directives on waste streams.

The Commission has to present a report by 2014 on the establishment of objectives for 2020 to prevent waste and break the link between economic growth and environmental impact (Article 9 of the Waste Directive). This is in line with the EU's general objectives. The Swedish Environmental Protection Agency drew up a waste prevention programme in December 2013.

The Waste Directive contains some specific requirements for levels of re-use/recovery to be achieved by the member states by 2020 (50% for paper, metal, plastic and glass and 70% for non-hazardous construction and demolition waste, cf. Article 11). All member states have to have introduced schemes for separate collection of paper, metal, plastics and glass by 2015.

²³ The term "harmful substances" is not defined but should comprise at least "hazardous substances" according to the chemicals legislation.

Requirements for national authorisation or registration of waste management and requirements for national waste plans are also included. The issues of greatest significance for this report appear, however, to be the definition of waste, i.e. what is waste and when something ceases to be waste, as well as the rules on hazardous waste, i.e. waste containing hazardous substances.

The Directive contains the principles of classification of waste as hazardous based on the content of hazardous substances (see also section 5.4.3). The Directive does not otherwise contain any rules focused on hazardous substances. Development of producer responsibility, which is encouraged in the Directive, can obviously have consequences due to the producers of articles attempting to avoid hazardous substances in the articles to simplify waste management.

5.4.2. The definition of waste

- What is meant by waste is determined by the Framework Directive and the detailed case law developed by the European Court of Justice.
- It has been clarified in the Framework Directive on the basis of this case law that by-products from production processes are not waste if certain criteria are met. Nor do such by-products need to be registered in REACH if they are not separately imported or placed on the market.
- It is difficult in application of the general definition of waste to assess when material that is recycled ceases to be waste and is to be regarded again as a raw material or as a product/article. A possibility of deciding on criteria for when a recovered material ceases to be waste (End of Waste, EoW) has therefore been introduced into the Framework Directive.

Waste is a “substance or object which the holder discards or intends or is required to discard” (Article 3(1) of the Waste Directive, cf. Chapter 15 Section 1 of the Swedish Environmental Code). This definition was already present in the first waste legislation from 1975. The concept of “substance” is not the same as in the chemicals legislation – “substance or object” may be any objects.

The definition is difficult to apply and has evident shortcomings in a life-cycle perspective, as it is focused on identifying when something becomes waste but does not say anything about when something ceases to be waste. It is difficult to say what “discard” actually means. There are a large number of cases from the European Court of Justice relating to the definition of waste and that have specified the meaning of the term. An important factor in this case law is that it has to be possible to assess what is waste on the basis of objective criteria without taking account of subjective criteria, i.e. without having to assess the individual holder's subjective intention with an action. Case law is, however, difficult to apply, partly because so many different aspects must be weighed up in each individual case for it to be possible to assess whether something is waste or not²⁴.

The waste legislation imposes strict environmental and health requirements on the management of waste, for example requirements on authorisation of waste facilities and

²⁴ See for example European Commission: Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste (2012). A good synopsis from the British environmental agency DEFRA and others can be found in “Guidance on the legal definition of waste and its application” (August 2012).

requirements for waste movements²⁵. This applies in particular to hazardous waste. This has sometimes created incentives to avoid classifying objects as waste, so that the strict requirements do not need to be applied. The European Court of Justice has tried to counteract misuse through case law which leads to a very wide interpretation of the concept of waste. The introduction of REACH may possibly alter this, as REACH requires registration of recovered materials that have ceased to be waste, so that it may in certain cases be beneficial for the holder that the substances or objects continue to be regarded as waste.

In the latest version of the Waste Directive the concept of waste is developed on some points to address some of these uncertainties. It is clarified that by-products from production processes are not to be regarded as waste, if a number of conditions are met (Article 5). It is primarily to be ensured that the substance or object in question is an integral part of the production process and will be directly used without modification. Use of the by-product must be legal, i.e. any environmental and health requirements in the regulatory frameworks must be met.

This definition of the term by-product is based on European Court of Justice case law on the differentiation of waste and product. Examples of by-products may be slag from blast furnaces or gypsum that has been used in the treatment of flue gases²⁶. By-products are exempt from registration requirements in REACH, provided they are not placed on the market²⁷. There is thus an exemption from the principal rule in REACH stating that already the manufacturing of a substance leads to a registration obligation. This regulation of by-products appears reasonable. Precautions needed for by-products that do not fall under the registration requirements in REACH may be based on the rules on manufacturing processes, for example the Industrial Emissions Directive, and working environment rules.

A provision has been introduced (Article 6) on conditions that must be met for a specific waste to cease to be waste, which is an important new feature. Under Article 6 a particular type of waste ceases to be waste if it is undergone a recovery procedure, including recycling, and fulfils criteria drawn up according to four conditions:

- The substance or object is commonly used for specific purposes.
- There has to be a market and demand for such substances or objects.
- The substance or object has to fulfil the technical requirements for the specific purposes and existing legislation and standards for products.
- Use of the substance or object will not lead to overall adverse impacts on the environment or human health.

The criteria must when necessary include limit values for impurities and take account of any adverse environmental effects of the substance or object.

The criteria are established through decisions and are also to be applied explicitly in application of the directives on special waste streams (batteries, packaging, end-of-life vehicles and electronics). The decisions are normally taken by the Commission after it has consulted a committee of representatives of the member states. The criteria are usually known

²⁵ Cf. Regulation (EU) No 1013/2006 on shipments of waste.

²⁶ Cf. Commission Communication COM(2007) 59 final, which preceded the rules on by-products in the Waste Directive.

²⁷ REACH Annex V. I cannot see any reason why the term by-product would have a different significance in REACH and the Waste Directive, which is also the view of ECHA (see ECHA Guidance for Annex V. Exemptions from the obligation to register, version 1.1, 2012).

as as EoW criteria (End of Waste). If criteria have not been established for a particular type of waste, the general principles presented above and based on the court's case law apply. The countries can decide in such cases whether a particular waste ceases to be waste, but they must follow the principles established through the court's case law²⁸.

5.4.3. Hazardous waste

- Waste is regarded as hazardous if it has properties hazardous to human health or the environment. Particularly stringent requirements apply to the management of hazardous waste. The criteria for hazardousness in the EU Framework Directive are taken from the chemicals legislation (CLP).
- To make it easier to classify waste there is a detailed waste catalogue, which is currently being updated within the EU.
- No special account is taken of the definitions of substances of very high concern for the environment contained in REACH and the Stockholm Convention for the classification of waste as hazardous. An in-depth analysis ought to be made to assess whether the rules on waste can be developed to take account of properties of PBT, vPvB and POPs.

Waste can have hazardous properties, for example due to the waste containing chemicals hazardous to human health or the environment. If the waste can be characterised as hazardous, significantly stricter requirements apply to handling and shipments of the waste (see next section).

It is thus very important that the hazardous properties of a waste can be identified by those who manage the waste and by the authorities. The Waste Directive contains a list (Annex III) of properties that have the effect that waste is to be regarded as hazardous. These categories mostly agree with corresponding hazardousness criteria in the chemicals legislation (CLP).

In practice waste cannot be classified on the basis of such a complete hazard assessment of substances and mixtures that is done under the chemicals legislation. The classification must be based on the material, i.e. the waste. The classification is therefore based on an EU-wide list of wastes²⁹, in which a large number of different types of waste (839) are enumerated. Some of the types of waste have normally hazardous properties and are marked with an asterisk in the annex (fixed entries). For other waste types there are what are known as mirror entries with two alternatives – hazardous and non-hazardous. If it is doubtful whether a particular waste is hazardous or whether closer specification of the hazardous properties is required, the concentration limits indicated in the list of wastes (Article 2 of Decision 2000/532/EC) can be applied. This weighing together is done in principle in the same way as in the chemicals legislation, when it is assessed whether a mixture of substances has hazardous properties based on the hazardous properties of the substances contained and their levels in the mixture (CLP Annex I)³⁰.

²⁸ Article 6.4. Cf. European Court of Justice judgments in 2007 in cases C-194/05, C-195/05 and C-263/05, which applied to Italian derogations for certain materials from national waste legislation. The derogations were not approved by the European Court of Justice.

²⁹ Commission Decision 2000/532/EC, which was transposed into Swedish law through the Waste Ordinance (2011:927).

³⁰ Instead of this 'conventional' method, the properties of the mixture can be determined by testing the actual mixture or on the basis of epidemiological data, which is unlikely to be common with respect to waste.

A fundamental objective of Swedish chemicals policy is that the use of substances of very high concern is to cease (section 3.1.2). Such substances with environmentally hazardous properties partly fall outside the criteria on which the classification of waste as hazard is based and which come from CLP and older chemical regulations. They are identified instead in REACH as what are known as PBT and vPvB substances (REACH Annex XIII). The POPs rules (section 5.3) also have their own definition of which substances are identified as POPs.

No account is taken in Annex III to the Framework Directive and in the list of wastes of whether a waste has PBT or vPvB properties. The fact that a waste has such a property or is a POP thus does not mean that it has to be characterised as hazardous (it ought, however, often to fall under other criteria for hazardousness). The EU's list of wastes has not been updated since 2001. Work on a new version of the list is in progress and has reached an advanced stage, but has not yet been completed. According to information³¹, Sweden has pointed out in discussions on such a list that greater account ought to be taken of whether a waste contains substances with POP properties, without completely succeeding. There is, however, expected to be a reference to a number of POPs in the list.

It may be considered remarkable that these criteria for environmental hazard have not made a complete breakthrough on the waste side but in relation to identified POPs³². The criteria have been of very great significance with regard to chemicals policy, which is apparent from the Swedish environmental objectives. The candidate list for authorisation in REACH, which is based on PBT and vPvB criteria with regard to environmental hazard, has also had a great impact and serves as an effective instrument for non-toxicity. However, the criteria are lacking in Annex III to the Framework Directive, which is the basis for the list of wastes. It appears reasonable to address this issue in the review of the rules on waste due to the done in the EU in 2014, at least so that an in-depth analysis is made of any needs to develop the rules on waste.

The assessment of whether a waste is hazardous or not is also of great significance for application of the criteria regarding when waste ceases to be waste (the EoW criteria).

³¹ Verbal information from Axel Hullberg, Swedish Environmental Protection Agency.

³² There is also a reference to Annex XIII of REACH in the proposal for EoW criteria for plastics.

5.4.4. Waste shipments and the Basel Convention

- The rules on waste shipments mean that exports of hazardous waste to non-OECD countries from the EU are completely banned. Waste shipments are also strictly regulated in other respects.
- There are very large exports of waste for recovery from the EU. Illegal exports of waste occur, for example through hazardous waste being declared as non-hazardous waste or as second-hand articles.

Special rules apply to shipments within the EU and to exports of waste. Exports of hazardous waste are heavily restricted by the Basel Convention, which is based on the principle of prior informed consent, i.e. exports of hazardous waste are only take place if recipient countries and transit countries have been informed beforehand about the shipment and have not objected to it. A separate protocol to the Convention also bans exports of hazardous waste from OECD countries to non-OECD countries. The ban also applies to waste for recovery. The protocol on prohibition has not entered into force as it is not been ratified by a sufficient number of countries. The EU has, however, introduced a corresponding ban in Regulation (EU) No 1013/2006 on shipments of waste³³. Exports of hazardous waste to non-OECD countries from the EU are thus prohibited. In addition, all exports of waste for disposal are banned to countries outside the EU/EFTA.

The EU rules otherwise mean that shipments of waste in the EU may take place both for final disposal without recovery and for waste to be recovered. The EU is in principle to be able to deal with its waste without export, and a principle of proximity is to apply within the EU, i.e. waste is to be managed as close to the source as possible. In practice the rules mean a free market for waste that is to be recovered, while the member states have the right to refuse to accept waste that is not to be recovered but, for example, landfilled. With regard to hazardous waste, authorities in recipient countries and transit countries in the EU are to be informed about each shipment.

Waste for recovery is exported on a large scale, including to countries outside the EU. Exports of plastic waste to countries in Asia, for example, have increased sharply in the 21st century. Discussion is also taking place on illegal shipments of waste as a growing problem. These issues are addressed in a report for the European Environment Agency³⁴. The fact that illegal imports are increasing may, for example, be due to inadequate treatment capacity in the EU and to the cost of recovery being high. Electronic waste is often mentioned separately in this context. Despite electronic waste normally being considered to be hazardous waste, significant exports probably also take place to countries outside the OECD, including countries in Africa. This may concern products that on being exported are correctly or incorrectly designated as second-hand articles and not as waste. Problems arise if such products do not function at all in the recipient country or only function for a short time, often in countries that do not have systems for safe collection and management of waste. The waste may also be incorrectly classified as non-hazardous. According to the EEA report, exports from the EU of second-hand electrical and electronic products to countries outside the OEC

³³ The EU's ban is based on the definition of hazardous waste contained in the Basel Convention, which deviates substantially from the EU's definition in the list of wastes.

³⁴ Report No 7/2012 from the European Environment Agency (EEA): "Movements of waste across the EU's internal and external borders". It is possible that the significant exporting of waste for recovery to China has been affected and restricted by the stricter control implemented by Chinese authorities in 2013, known as the "green fence".

may total between 250 000 and 1 300 000 tonnes per year. These are in large part products that ought to be regarded as waste.

There is thus a risk of waste containing hazardous substances being recovered outside the EU without adequate treatment and purification. The risks to the working environment and also local environmental problems may be very great in such waste management. Recovered materials that are not pure may be used in the production of new articles and return to the cycle when the articles are imported into the EU. Stricter requirements in the EU in the form of high recovery levels and requirements for the content of hazardous substances may, in turn, lead to it becoming even more profitable to contravene the rules. Measures that ensure that the waste legislation and in particular the rules on waste movements are applied correctly are therefore very important. This applies both to checking that the rules are correctly implemented in the EU member states and checking that the rules are followed, which necessitates measures in the form of information and enforcement.

5.4.5. The EoW criteria

- Criteria for when recovered waste is no longer to be regarded as waste (EoW) have been adopted for two waste streams (certain scrap metal and glass cullet). It has been difficult to obtain agreement on criteria for other materials (for instance plastic and waste paper).
- Adopted and proposed criteria contain a requirement that the recovered material is not allowed to be hazardous under the rules on chemicals (CLP). However, only the criteria for plastics contain a reference to criteria for substances of very high environmental concern, i.e. to the candidate list of environmentally hazardous substances, which is an evident shortcoming.
- The EoW criteria cannot replace the risk assessment and risk management done through the chemicals legislation.

At the time of writing, EoW criteria have been adopted and decided upon for two categories of waste: scrap metal (iron and steel and aluminium) and glass cullet³⁵. Criteria are discussed for another type of scrap metal (copper and copper alloys) and for scrap paper. Considerable progress has also been made in work on drawing up criteria for biodegradable waste and for plastics.

The criteria decided upon or in the process of being drawn up have a similar structure and contain a number of components:

- Criteria for the quality of the recovered material (for example that specifications and standards applied in industry are met, that the recovered material does not have hazardous properties with respect to chemical content, in some cases supplemented by specified levels for particular substances and impurities).
- Restrictions on what waste is used as input in recover, for example that it must not constitute hazardous waste.
- Requirements for methods of treatment, for example separation of the waste to be recovered.

³⁵ Council Regulation (EU) No 333/2011 of 31 March 2011 establishing criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council and Commission Regulation (EU) No 1179/2012 of 10 December 2012 establishing criteria determining when glass cullet ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council.

The criteria also specify how it is to be checked that the various criteria are met. The recycler must have a certified environmental management system and is to provide an assurance (statement of conformity) for each delivery of recovered material that the requirements are met.

If the criteria are met, the recovered material is no longer regarded as waste within the meaning of the Waste Directive. It will not therefore be covered by the requirements for authorisation for waste management and requirements for shipments. On the other hand, the material normally becomes a chemical product, which is covered by the requirements in REACH.

In practice proposals for criteria are drawn up by the EU's JRC (Joint Research Centre) through the ITPS (Institute for Prospective Technological Studies) in Seville, Spain. The work is supported by groups of experts from the member states.

The criteria for glass

According to the criteria the glass has to be free of impurities, which means limit values of 50 ppm for ferrous metals and 60 ppm for non-ferrous metals. The glass must not have hazardous properties according to Annex III to the Waste Directive and the list of wastes in Decision 2000/532/EC. It must also fulfil the requirements of EU Regulation No 850/2004/EC on persistent organic pollutants (POPs), which are based on the Stockholm Convention.

Hazardous waste is not allowed to be used as a raw material in recovery.

With regard to packaging, the criteria are stricter than those that apply under the Packaging Directive. This is despite the fact that a decision was made in 2009 on a non-time-limited exemption from the Directive to permit continued use of recovered glass contaminated by heavy meals.

The criteria for iron, steel and aluminium scrap

The criteria are structured in a similar way to those for glass. The recovered material must not contain more than 2% by weight of impurities (iron and steel) and 5% (aluminium). The material must not have hazardous properties (apart from hazardous properties of alloying metals). Nor may the raw material (i.e. the waste going to recovery) have hazardous properties, if it cannot be shown that measures have been taken that ensure that the hazardous properties do not remain.

The criteria for plastics

The criteria for plastics have not yet been decided at the time of writing, but a decision may be imminent. A proposal for criteria has been made and is out for final consultation with the expert group³⁶. The criteria for plastics are of particular interest for the analysis made in this report, as they cover a large number of different types of material used in various types of articles. Additives in plastics have historically been problematic from the point of the view of the environment and human health. I base this report on the proposed criteria, but it is possible that these will be amended before they are finally adopted.

According to the proposed criteria the following applies with regard to the recovered material:

³⁶ See <http://susproc.jrc.ec.europa.eu/activities/waste/index.html>

- It has to meet customer specifications in the form of quality standards. There are a number of EN standards for recovery of plastics of various types, and these standards are to be used (there are standards for polystyrene, polyethylene, polypropylene, PVC and PET).
- The level of impurities in non-plastic materials is to be less than 2%.
- The material is not to be classified as hazardous under CLP. It is not to exceed the concentration applicable to SVHC substances in REACH Annex XIII and must not exceed the limit values in the POPs Regulation.
- The material is not to noticeably leach foreign materials such as oils, glues, paints etc.

The hazardousness of the material is assessed according to the criteria in CLP, i.e. the concentration limits applicable in the assessment of whether a chemical mixture is to be regarded as hazardous are applied. The reference to Annex XIII of REACH is difficult to understand, but the concentration limit of 0.1% by weight in a mixture which is applied in REACH as a condition for authorisation to be required (Article 56(6)(a)) is probably meant.

The raw material for recovery must not be hazardous waste, biowaste, hospital waste or contain personal hygiene products. The waste for recovery has to be kept separate throughout the recovery process, and the requirements in the directives for electrical scrap (WEEE) and end-of-life vehicles (ELV) have to be respected. It is otherwise required that there is a certified quality management system that is followed up through an audit by an independent body.

Criteria for paper

There is a proposal for criteria for recovery of paper for paper pulp³⁷. This proposal was not supported by the committee of member states which voted on it. The proposal has therefore gone to the Council³⁸, which could not agree to accept it or possibly amend it. The proposal has now been considered by the European Parliament, which has decided to halt implementation. The Commission must therefore draw up a new proposal if it wishes to pursue the issue further. There has been disagreement among other things on whether the criteria were also to apply to combination materials, for example packaging material of paper/plastic. The Confederation of European Paper Industries (CEPI) has been highly critical of a classification of waste paper as non-waste at a stage before it is converted to pulp.

The proposal (which has thus not been implemented) contains the following requirements:

- The material is to be quality-classified in accordance with the applicable European standard (EN 643)
- The proportion of material that is not paper is not to be lower than 1.5% (does not apply to filling material etc.)
- The material must not have hazardous properties according to CLP or the list of wastes or contain POPs at higher levels than is permitted in the POPs Regulation 950/2004/EC.
- The material is to be separated at source and in collection and kept separate.
- The paper in combination materials is to be separated and recovered as pulp. Other components of combination materials are to be recovered.

³⁷ "End-of-waste criteria for waste paper: Technical proposals", see <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4139>.

³⁸ COM(2013) 502 final.

As for other EoW criteria, there is a requirement in the proposal for the recycler to have an environmental management system. The recycler is to certify for each delivery that the requirements are met.

EoW criteria as a control instrument for non-toxicity?

The development of EoW criteria has evidently been problematic. In several cases decisions on criteria have not been successfully made despite extensive preliminary work. With regard to the criteria for paper, the basis of the criteria has been questioned through the criticism expressed by the pulp and paper industry.

With regard to the content of hazardous substances, the criteria and proposals for criteria have been formulated so that the recovered material is not allowed to have hazardous properties according to the definitions in the chemicals legislation (CLP). A reference to the limit values in the POPs Regulation has been included for some criteria. These limit values relate to the maximum levels of POPs in waste permitted for the waste not to be regarded as contaminated. However, the rules on POPs in themselves mean that waste containing POPs above the limit values must not be recycled, and these rules apply regardless of how the EoW criteria are formulated. The reference to the POPs criteria in the EoW criteria is therefore not actually necessary and does not add anything substantive, but may be justified by clarifying what already applies.

It is logical that the definition of non-toxicity is based on the rules of the chemicals legislation and not the coarser criteria applicable according to the list of wastes.

What is lacking in all the criteria and proposals, however, is a rule that the recovered waste is to be free of substances with properties as substances of very high environmental concern under Annex XIII of REACH. The exception is the proposed plastics criteria, where this is included. If EoW criteria are to be formulated so that they lead to non-toxicity in the sense that no hazardous properties are to be included, a reference to Annex XIII should be included. REACH criteria are similar to the POPs criteria but are not identical to them and are additionally applied to many more substances (cf. the candidate list in REACH).

The Waste Directive does not state that recovered waste covered by EoW criteria is not allowed to have hazardous properties. What is said is that “use of the substance or object will not lead to generally adverse consequences for the environment or human health” (Article 6(1) of the Directive). There are virgin substances that have such hazardous properties that cannot be avoided if they are function as intended, for example when they incorporated into an article. If the practice which appears to be developing with regard to EoW criteria leads to recovered substances with hazardous properties never being capable of being covered by such criteria, it can at least be discussed whether this is appropriate. This would mean that recovered substances with such properties would always be treated as waste until they cease to be waste for other reasons (see next section). Nothing prevents this, as there is no general obligation in my view to apply EoW criteria, even when such criteria exist. If the recovered materials are then incorporated into an article, they will fall outside the scope of rules on chemicals such as REACH (with some exceptions). I cannot judge whether this can lead to problems in practice, but the issue could be analysed in greater depth as part of a future life-cycle strategy or when future EoW criteria are drawn up.

An example of this situation is recovered glass, where bans on heavy metals in the glass do not apply to recovered material (see section 5.6.2 below). Another example is cadmium in recycled PVC plastics.

There is obviously no reason to object to the EoW criteria requiring non-toxicity and to strict rules on waste management continuing to apply to waste that does not fulfil the criteria, until it ceases to be waste for other reasons (see following section). It is too early at present to say to what extent the EoW criteria will be used in practice. No actual evaluation of chemical risks has, however, been included in the development of the EoW criteria, and the criteria cannot replace the risk assessment and risk management done through the chemicals legislation. The criteria are nevertheless an interesting example of enhanced environmental legislation in which the manufacturers (in this case the recyclers) of a material take responsibility for the quality of the material and where the quality requirements are combined with detailed requirements for certified environmental management systems.

5.5. When does waste become a product, and how is this product treated?

- Waste can cease to be waste when the criteria for what is waste are no longer met, when EoW criteria are met or when the material according to national rules is no longer waste.
- An important indication that a material is no longer waste is that a recovery procedure has been carried out in full.
- Recovered materials that are no longer waste are chemical products (substances or mixtures) for which chemical rules are to be applied, including registration requirements in REACH unless exemptions are applicable. Recovered waste can, however, in some cases be converted directly into an article, whereupon rules on chemicals do not apply.

Based on the description of the rules provided above, there is reason to try to summarise what applies regarding when waste ceases to be waste and what then happens.

To begin with it is necessary to note that the material must fall within the scope of the rules of waste. Non-contaminated soils, farmyard manure, wastewater and mining waste are examples of materials that are wholly or partially exempted from the rules on waste or are regulated by other legislation³⁹. They are not addressed in this report.

It is further important to remember that certain materials or products that have previously been regarded as waste do not always become waste under the currently applicable rules, i.e. the issue of ceasing to be waste never becomes relevant. This applies to products that become the object of re-use. Re-use is defined in the Waste Directive as “any operation by which products or components that are not waste are used again for the same purpose for which they were conceived” (Article 3(13)). The fact that re-use takes place does not mean that the re-used products have to be regarded as waste. The definition does not appear to rule out the possibility of a second-hand product becoming waste and then nevertheless being re-used, but it is then required that the product at some stage has become waste. For example, a product should become waste if someone has clearly discarded the product, i.e. it has been made clear in some way that the product has been handed over for waste management. The

³⁹ Articles 2 of the Waste Directive and Section 11 of the Waste Ordinance (2011:927).

fact that the product may have remaining economic value does not preclude it being regarded as waste. On the other hand, a possible content of hazardous substances does not play any decisive role in this assessment (cf. second-hand refrigerators containing freons). If the product is regarded as waste, it can be imagined that it undergoes waste management, for example by separation and repair if needed, i.e. preparing for re-use according to the Waste Directive, after which it can be placed on a second-hand market again.

Nor do by-products from industrial processes become waste (section 5.4.2). This exemption is of great practical significance. It is likely that most by-products will be regarded as chemical products (substances or mixtures), which means that they can be covered by registration requirements and requirements for safety data sheets etc. in accordance with REACH and CLP.

If the material or product has become waste, it may be finally disposed of by being sent to landfill or incinerated. The issue of ceasing to be waste will then not arise. If it becomes relevant to recycle the waste, however, the issue of when the waste ceases to be waste becomes very important⁴⁰ and crucial in deciding what legislation is to be applied – rules on waste or rules on chemicals/products such as REACH.

How waste ceases to be waste

There are a number of ways in which waste ceases to be waste in connection with recycling.

- *The waste has undergone a recovery procedure.*

If the waste has been recovered and has undergone a recovery procedure as referred to in Annex II of the Waste Directive, this is a clear indication that the material has ceased to be waste in application of the general definition of waste and European Court of Justice case law on the concept of waste. This does not, however, mean that other criteria can be completely disregarded in the definition of waste. For example, it must no longer be a matter of something that the holder “discards or intends or is required to discard”. According to the case law in this context it must be possible to show that there is a market for the recovered material or that it can be beneficial in some way. Account must also be taken of any harmfulness to the environment and human health.

In addition, the recovery procedure must be carried out in full. Annex II of the Waste Directive is not, however, sufficiently precise to be used as a clear criterion for when something ceases to be waste. It is not clear from the annex when a recovery procedure is fully carried out. In the *Mayer Parry*⁴¹ case processing of steel scrap to a material (“grade 3 material”) that could be used for steel manufacturing was not considered sufficient for the material no longer to have to be regarded as waste. The material in question contained certain impurities that meant that the recovery could not be considered to have been carried out in full. If a steel mill had used the material to manufacture thin sheet, blocks or wire of steel, on the other hand, the recovery would have been considered to have been carried out. The material was then no longer waste.

⁴⁰ Cf. Swedish Environmental Protection Agency memorandum: Hägglöf and Berglund, Underlag för en samordning av avfalls- och kemikalielagstiftningen – rättsliga förutsättningar (Basis for coordination of waste and chemicals legislation – legal factors), 2007. This memorandum examines a number of types of waste with assessments of when they cease to be waste after recovery. Relevant older legal cases are presented. It should be noted that pulp (cellulose fibre) is now exempt from an obligation to register under REACH (Annex IV).

⁴¹ European Court of Justice judgment on 19 June 2003 in case C-444/00.

The case ought also to be relevant with the new waste legislation. For a recovered material no longer to be waste, the recovery procedure must therefore be carried out in full. An indication of this is that the material has the same properties as the original material it is to replace. A requirement for completely identical properties in original raw material and recovered material would not, however, be reasonable (and cannot be read into the judgement).

Regardless of how the recycling proceeds, the fundamental definition of waste still applies. In order to be able to clear the recovered material, it must be possible to conclude that it is no longer “a substance or object which the holder discards or intends or is required to discard”. But this conclusion should often be possible in cases where a full recovery of the material has been carried out. According to ECJ (European Court of Justice) case law it must also be possible for the recovered waste to be used without harming human health and the environment⁴². When a use is explicitly permitted under special rules, the requirement of waste legislation would normally be met that the use must not pose a danger to health and the environment (see below on the European Court of Justice judgement of re-used telephone poles). Explicit EU rules that permit a use are rare, however. It is only in a small number of cases that EU rules in the area of the single market explicitly permit (or ban) a particular use. The question is what “without harming human health and the environment” means in the other cases.

Proof of non-harmfulness could be that the recovered material has been registered under REACH and that a risk assessment has been carried out for the use concerned under the rules on registration which shows that use is safe. Registration of recovered materials will not often take place, however, and is of limited value unless the material is handled in large volumes (see section 5.4.2).

If a recycler can show according to Article 2(7)(d) that he has had access to a previous registration for the virgin material in accordance with REACH and this documentation shows that use is also safe for his recovered material, it ought to be possible to view this as an indication that the requirement in waste law is met that the material can be used without harming health and the environment. For it to be at all possible to assess the risk of harm to human health or the environment, however, the recycler must know what hazardous substances, if any, the recovered material contains (or that hazardous substances are not present)⁴³. If the recycler does not know this, it is not possible to draw the conclusion that the documentation for the virgin material is also applicable to the recovered material. Nor can a hazard classification and risk assessment be made under the chemicals legislation (principally CLP) without such knowledge. Such a knowledge requirement can probably sometimes be difficult to fulfil for waste streams that contain mixtures of materials and where hazardous substances may occur.

The question can be asked whether a material always ceases to be waste when it is finally used for the purpose for which it is intended. For example, slag that can be used as a material in road construction (and which is regarded as waste and not as a by-product) can barely be regarded as waste when it has been incorporated into the finished road. However, the matter is

⁴² It has been argued in the discussion on application of the waste criteria that the specification of requirements for EoW criteria in Article 6(1) of the Waste Directive has to apply to the assessment of what ceases to be waste even in those cases where no applicable EoW criteria have been decided. I do not think that this is correct in consideration of how the provision is worded. The specification of requirements is, however, an expression of ECJ case law and may therefore provide guidance in cases where there are no EoW criteria.

⁴³ Cf. ECHA guidance on waste and recovered materials.

not quite so simple, as is apparent from the recently published judgments from the European Court of Justice on re-use of creosote-treated telephone poles (see below).

It is evident that it is difficult for both authorities and recyclers to apply these criteria, and in individual cases make an assessment of when waste ceases to be waste. It is likely that there are many cases where recovered materials are treated as if they were no longer waste, despite waste criteria actually still being applicable. This need not be a deliberate breach of rules, but can certainly often be seen as a consequence of the complexity and inaccessibility of the rules. Enforcement authorities and authorities responsible for enforcement guidance should regard facilitating application of the rules as a special task. Checks by the enforcement authorities in individual cases may be the best way of obtaining experience and assisting the recyclers on these issues. I am not, however, aware of any systematic attempts to carry out enforcement in this area in Sweden.

To avoid these complicated assessments there are, however, two other ways in which recovered waste can cease to be regarded as waste:

- *The waste fulfils EoW criteria*

If the waste is processed and fulfils EoW criteria, it is no longer regarded as waste (section 5.4.5). The complicated application of the general waste criteria to assess whether these are no longer met is then avoided. The fact that the criteria are met has to be apparent from the assurance given by the waste recycler under the criteria rules. As has become apparent, it is unclear in the present situation what significance the EoW criteria will have.

- *The waste is covered by national decisions on waste having ceased to be waste.*

If there are no EoW criteria, the authorities in the member states can decide in individual cases that a waste is no longer to be regarded as waste (Article 6(4) of the Waste Directive). As far as I know, no such special decisions have been made in Sweden, although the possibility exists (Chapter 15 Section 1 third paragraph of the Swedish Environmental Code). However, this does not prevent the applying authorities in practice being able to accept the assessment of the waste holder that the waste has ceased to be waste in accordance with the first point above, leading to the same result.

EoW criteria do not have to be applied

There is no obligation on a waste holder to apply EoW criteria when such criteria exist. The holder may in practice make the assessment that it is simpler for the material to continue to be treated as waste until it has been recovered and finally used.

It is reported that the Swedish Steel Producers' Association has not considered there to be reason to use the new EoW criteria. Recovery of scrap metal (iron and steel scrap) is an established phenomenon, where the level of recycling is very high. Those who handle the waste already have the necessary authorisation for waste management. There is therefore no need to show that the EoW criteria are met and go through complicated procedures for certification. Other products that arise in iron and steel production can, according to the Swedish Steel Producers' Association, often be regarded as by-products, i.e. they never

become waste but are utilised directly in other contexts, for example blast-furnace slag used in road construction⁴⁴.

As objective criteria have to be used in assessing whether something is waste, it is theoretically possible for the waste holder to see an advantage in the material continuing to be regarded as waste, for example to avoid application of REACH, while an enforcement authority judges that the material is no longer waste and that the rules on registration in REACH are applicable. This may not be a completely unrealistic example in cases where registration requirements can be avoided through the waste continuing to be waste until it can be directly converted into an article. I do not know of any such case.

What happens when the waste has ceased to be waste?

When a material is no longer waste, the rules applicable to materials and articles on the market apply. Recovered materials are likely most often to be regarded as chemical products (substances or mixtures) for which the rules on chemicals are applicable, although in practice they will not be covered by the registration requirements (section 5.2.1). It is, however, possible for the recovered material to be converted directly into an article within the meaning of chemicals legislation. The rules in REACH and CLP that apply to chemical products then become no longer applicable. This aspect is discussed under the example of plastics in the annex.

If waste is not recovered but is nevertheless recovered for a particular purpose, the question arises whether actual use means that the waste ceases to be waste. In a recent European Court of Justice case⁴⁵ this issue arose with regard to re-use of telephone poles treated with wood preservative that were used as underlay for duckboards laid over marshy parts of a Natura 2000 site in Finland. The poles were second-hand and had been treated with CCA agents (copper, chromium, arsenic). It was beyond dispute that the poles before re-use were waste and that they also met the criteria to be hazardous waste. CCA agents are banned under Annex XVII of REACH, but there are some explicit exemptions from the ban, according to which use of treated wood is permitted. The use in question could be regarded as such a use explicitly permitted under REACH. The question then was whether the fact that REACH permitted such use meant that poles used in this way are no longer to be regarded as waste. The European Court of Justice found that it is possible for hazardous waste used for a particular purpose to cease to be regarded as waste if the use does not entail danger to health and the environment and it is clarified that it is not a matter of something that the holder is discarding or intends or is required to discard (i.e. the general definition of waste). In such an assessment it is of significance, according to the Court, that such use on certain conditions is actually permitted under REACH. Direct application of these principles in the individual case was transferred to the national court in Finland.

The European Court of Justice thus states that it is conceivable that waste continues to be waste even if it is used for a purpose explicitly permitted under the EU rules on articles. With application to the example concerned, this could mean that the use of the poles was viewed as unlawful dumping of hazardous waste. The judgement is a logical consequence of the definition of waste and previous ECJ case law. The Court has not, however, developed what the consequences will be if waste is used for a purpose but is nevertheless still to be regarded as waste, i.e. what the consequences of waste rules continuing to be applicable will be. In

⁴⁴ Verbal information from Eva Blixt, Swedish Steel Producers' Association.

⁴⁵ Judgement of 7 March 2013 in case C-358/11.

practice, however, I think that waste used in a way that is explicitly permitted will rarely continue to be regarded as waste if all the other conditions for use are met (e.g. working environment requirements).

The rules on waste will be applicable until the measures for use of the material have been completed⁴⁶. A question that was not addressed in this case was whether the poles could be regarded as chemical products that were to be registered according to REACH or, where applicable, as articles that have been treated with biocidal products and that fell under the new rules on biocides in the EU. These questions in my opinion are not just theoretical, but the regulatory frameworks would in any case not be likely to be applicable in cases like this one, when a waste is used directly for its final purpose.

5.6. Rules on articles

- There are a number of regulatory frameworks applicable to products/articles and that are of great significance to bring about non-toxic or detoxified life-cycles. The rules may be focused on direct health risks from articles (e.g. toys) or cover different aspects (incl. chemicals) at several stages of the life-cycle. The EU directives on waste streams are the most important ones.
- The Ecodesign Directive has not been of any significance in limiting the use of hazardous substances in articles and cannot be expected to become so.
- The directives on waste streams relate to categories of articles managed in large quantities and containing hazardous substances, but the rules do not cover all important article and waste streams. Building products and textiles, for example, are not regulated.
- The European Commission in 2011 issued a report on the function of the directives on waste streams. It was noted there that better coordination is needed between these directives and the Framework Directive on Waste. An idea to introduce special rules relating to types of materials instead of product types (e.g. plastics) was not considered realistic.
- The directives on waste streams have been important and successful. There is, however, reason to supplement the studies that have been made on the directives with an analysis that clarifies whether the measures required under the directives for the various stages in waste management are adequate for non-toxic recycling.
- The rules on recovered plastic in food packaging are an example of far-reaching detailed regulation of chemical risks, which may be relevant for other uses where it is particularly important to check chemical exposure, for example materials in articles used by children.

The legislation on chemicals considered so far has regulated the chemicals directly (REACH, CLP etc.) or chemical aspects of waste management (the Waste Directive). As mentioned, there is also special legislation on specialty chemicals (pesticides, medicinal products etc.), but these rules are mostly not addressed in this report. Legislation can also be formulated so that it regulates chemical aspects of articles. Such rules can be restricted to the content of hazardous substances in articles, but also regulate several stages in the life-cycle and for example contain such requirements for waste management as are needed due to the article containing hazardous substances. Rules on articles may also contain other requirements linked

⁴⁶ The issue is discussed by Hägglöf/Berglund, see footnote 40.

to waste management, for example requirements for collection or recovery levels for certain types of article or requirements for the introduction of producer responsibility.

5.6.1. Rules on articles and health risks

Rules on articles may be focused on direct effects on health. One example is the Toys Directive 2009/48/EC, which limits the use of substances harmful to health in toys (CMR substances, heavy metals and nickel, certain allergenic substances).

The General Product Safety Directive (2001/95/EC) establishes generally formulated requirements for product safety. Health risks come within the scope of the Product Safety Directive, but not waste aspects and environmental hazard. The Directive can also be used to take quick decisions and withdraw products from the market. The Directive has been used for decisions relating to bans on plasticisers (phthalates) in toys and the fungicide DMF (dimethyl fumarate), which was present in imported furniture. These temporary bans have subsequently been converted into permanent bans and introduced in REACH Annex XVII.

There is also regulation of articles in the area of foods relating to food packaging, where it is obviously particularly important to counteract leaching of toxic substances. This legislation has recently been used for example to ban bisphenol A in baby feeding bottles. I shall return to this legislation below.

5.6.2. Directives on waste streams

During the 1990s the EU developed a number of directives regulating waste streams for important categories of articles. These directives may contain rules on collection targets, producer responsibility and management of the waste. They also contain certain bans and restrictions that affect the content of hazardous substances in the articles, and in that respect supplement the restrictions contained in REACH. These directives have also acquired great practical significance in a global perspective. The rules on electrical and electronic products are particularly important. The main features of the directives are described below⁴⁷.

Directive 94/62/EC on *packaging and packaging waste* contains requirements regarding what levels of waste recovery are to be achieved in the member states. The levels from 2008 are 60% by weight for glass, paper and cardboard, 50% by weight for metal, 22.5% by weight for plastics that are recycled and 15% for wood. The Directive also contains a limit value of 100 ppm for total levels of lead, cadmium, mercury and hexavalent chromium in packaging. In practice it has not been possible to maintain these limit values for glass and certain types of plastic packaging. Under a Commission decision there is a general, non-time-limited derogation for glass if the limit value cannot be met because of impurities in recycled materials used in the production of packaging⁴⁸. The derogation for plastics applies to plastic crates and pallets included in enclosed systems where the packaging is re-used. The derogation applies only to heavy metals originating from recycled materials⁴⁹.

⁴⁷ The Commission has carried out a study on the development needs with regard to these directives. Study on coherence of waste legislation, 2011. See <http://ec.europa.eu/environment/waste/studies/index.htm>

⁴⁸ Commission Decisions 2001/171/EC and 2006/340/EC. The limit values do not apply to lead crystal glass.

⁴⁹ Commission Decisions 1999/177/EC and 2009/292/EC.

Rules on *electrical and electronic products* are contained in two directives, commonly referred to as WEEE and RoHS⁵⁰. The original proposal for these directives was a joint directive, but it came to be split into two. The Restriction of Hazardous Substances Directive (RoHS) became a harmonised single-market directive (legal basis Article 114), while the waste rules in WEEE came to be based on the environmental provisions in the EU Treaty (Article 192).

RoHS contains bans on electrical and electronic equipment containing lead, mercury, mercury and the flame retardants PBB and PBDE. The bans apply to levels above 0.1% in homogeneous materials (cadmium 0.01%). These bans in Annex II of the Directive can be supplemented by other substances under a committee procedure (Article 6), but this has not happened to date. However, the Commission is due to issue a report on the issue by 22 July 2014 and may then present proposals to expand the list of banned substances. There are a large number of derogations from the bans for various specific applications where better alternatives have not been deemed to be available (Article 5 and Annexes III and IV). Such derogations are to be limited in time but may be extended following re-examination.

Under *WEEE* electronic waste has to be collected separately. Minimum requirements are established for how the waste is to be treated, among other things to remove hazardous substances (Article 8 and Annex VII). The producers (manufacturers, importers and certain retailers) are responsible for the costs of collection, treatment, recovery and disposal. Producer responsibility is individual with regard to waste from private households, i.e. the producer has to bear the cost of waste management of the producer's own products (differing rules apply to historical waste). The member states have to ensure that the collection of electronic waste reaches stated levels (e.g. collection of 85% of the weight of generated electronic waste has to be achieved by 2019). In addition, minimum levels for recovery and recycling have to be achieved at stated times. The levels range between 55 and 85%. There are corresponding rules in Sweden in the Ordinance (2005:209) on producer responsibility for electrical and electronic products, which is in the process of being updated.

*Directive 2000/53/EC on end-of-life vehicles*⁵¹ contains rules banning heavy metals in vehicles: lead, mercury, cadmium, hexavalent chromium (Article 4 and Annex II). The ban applies to levels above 0.1% by weight (0.01% with regard to cadmium). There are a limited number of derogations from the bans in Annex II for specific uses. The derogations principally apply to use in older vehicles and spare parts for older vehicles, but in some cases longer transition periods apply for application of the derogations (2015, 2016, in one case 2019). Some derogations are due to be reviewed by the Commission in 2014 and 2015.

Requirements apply to collection systems for end-of-life vehicles and scrapping certificates. Components or materials entailing risks to human health or the environment or that can be recovered/re-used have to be stripped before the waste undergoes further treatment (Article 6, Annex I). Re-use and recovery have to reach 95% in 2015 (85% of the average weight per year has to be re-used or recycled in that year).

Manufacturers are obliged to provide the information needed for waste management. Information is given by coding and labelling of materials, but the manufacturer also has to provide dismantling information for each type of vehicle. This information has to identify the

⁵⁰ Directive 2012/19/EU on waste electrical and electronic equipment (WEEE) and Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

⁵¹ Sometimes referred to as the ELV Directive.

“location of all hazardous substances in the vehicles” as far as it “is needed” by treatment facilities in order to be comply with the provisions of the Directive (Article 8).

In *Directive 2005/64/EC* supplementary provisions have been introduced into the European Community's type approval system for vehicles. The provisions mean that control has to take place in conjunction with the type approval that the manufacturers have organised their activity so that they can fulfil the requirements of Directive 2000/53. The EU rules have been introduced in Sweden through the Ordinance (2007:185) on producer responsibility for cars. It is clarified in the Swedish Ordinance that it is the producer (manufacturer/importer) who is responsible for the vehicles he has placed on the market being dealt with, i.e. individualised producer responsibility is applied.

The EU rules on *batteries* are contained in Directive 2006/66/EG⁵², which has been transposed in Sweden through the Ordinance (2008:834) on producer responsibility for batteries. The bans on particular use of mercury and cadmium in batteries are contained in the Ordinance (1998:944) on bans etc. in particular cases in connection with the handling, import and export of chemical products. The Directive still permits use of cadmium in nickel-cadmium batteries for power tools. A proposal to ban cadmium in such use from 2016 has not yet led to a decision⁵³.

The rules on batteries otherwise contain requirements for national collection systems for which the producers have to be responsible. The member states have to achieve a collection level of 45% by 2016. There are also rules on what levels of recovery are to be achieved for different recovery processes (Annex III B of the Directive). The battery fee previously levied in Sweden to pay for collection and recovery has been largely removed but remains with regard to nickel-cadmium batteries.

5.6.3. Ecodesign

The Ecodesign Directive 2009/125/EC is an EU directive of a framework nature which is supplemented by implementation measures at Commission level for different product groups. The Directive is only applied to energy-related articles/products, and to date has only been used to establish requirements applicable to energy aspects. It is, however, formulated so that it is possible also to set requirements for the chemical contents of articles and regulate waste issues, for example how an article is to be designed to facilitate recovery. In recent years there has been discussion in the EU on whether the scope of the Directive is to be extended to cover all categories of articles⁵⁴. KemI has been sceptical about such as an extension of scope with respect to chemical aspects (KemI Report No 1/12). The review recently conducted by the Commission also led to the conclusion that there was no reason to extend the scope now⁵⁵.

On this basis it does not appear either appropriate or realistic to pursue the issue of extending the scope of the Directive to deal with hazardous substances and waste aspects of the substances, i.e. aspects regulated by REACH and the rules on waste (in particular the directives on waste streams). At the same time, however, it can be noted that the Ecodesign Directive has been very successful in dealing with energy aspects. The Directive can be regarded in this respect as a model and as an interesting example of effective legislation for environmental aspects of products/articles. However, the Directive has a limitation in that it is

⁵² Directive 2013/56/EU amending Directive 2006/66/EC.

⁵³ The proposal is contained in COM(2012) 136 final.

⁵⁴ See KemI Report No 1/12, section 7.3.

⁵⁵ Commission report COM(2012) 765 final.

entirely focused on requirements for articles. It cannot be used to regulate production and chemicals used in production, nor waste management other than with regard to product design. Producer responsibility cannot be introduced pursuant to the Directive.

A recent study from the Nordic Council of Ministers⁵⁶ highlights in particular the importance of collaboration between ecolabelling criteria and binding ecodesign requirements. The study was concerned with washing machines, where ecodesign requirements regarding energy efficiency have been of great significance, while existing ecolabelling criteria containing chemical requirements were obsolete and no longer had any practical significance.

5.6.4. Biocidal products

Biocidal products (biocides) are pesticides for general use. They have a large number of different uses (disinfectants, wood preservatives, rat poison, insecticide, etc., etc.). Regulation of biocides is of some interest in the life-cycle context, as it has recently been broadened to cover biocides in articles.

Biocides must not be sold if they have not been approved in each member state (central EU approvals are also on the way under new rules). The rules on biocides are now in an EU Regulation from 2012⁵⁷. As otherwise applies to specialty chemicals, the rules on biocides with authorisation requirements etc. have applied to the biocidal product as such, i.e. the chemical product. However, biocides are used to an increasing extent to treat articles of various kinds, for example antibacterial agents in textiles. With regard to articles manufactured in the EU, it will be possible to check any risks to health or the environment with such use in articles, as the testing of use in articles takes place in conjunction with the approval of the biocidal product in the EU. However, this does not apply to imported articles, which have been possible to date to sell without restrictions.

The new rules on biocides amend this (EU Regulation Article 58). Articles treated with biocidal products may only be placed on the market if the active substance in the biocidal product has been approved within the EU for the use concerned. The article has to be labelled so that it is evident that it contains a biocidal product and what active substance it contains. Consumers have to have the right within 45 days to receive further information about the treatment with the biocidal product. The rules started to be applied to products placed on the market from 1 September 2013 (Article 94).

5.6.5. Food packaging

In addition to the product rules mentioned there is a type of articles that is regulated in detail in the EU with respect to chemical content, namely food packaging⁵⁸. The rules on such packaging are an example of what form a legislation can take that at least with regard to certain materials aims for complete control of all chemical risks. The reason why the rules are

⁵⁶ Report TemaNord 2013/549, Product policies on the environmental performance of washing machines.

⁵⁷ Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

⁵⁸ There are obviously, in addition to rules on food packaging, a large number of rules on chemicals in foods, for example food additives (cf. Kemi Report No 1/2012, section 6.2). The food rules additionally refer to "materials and products" in contact with foods, rather than using the term food packaging. Such materials could in themselves often be regarded as chemical products if they were covered by the rules on chemicals, which in practice they are not. The problems with chemicals in such materials are, however, such that the materials should be considered together with other product rules in this report.

strict is obviously that substances in packaging can leach across to foods and that people, especially children, may consequently be subject to direct and long-term exposure.

The fundamental provisions are contained in Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food. Under this Regulation, a number of materials and products can be further regulated through special acts decided upon by the Commission. Such implementing rules exist for regenerated cellulose film (Directive 2007/42/EC), ceramic materials (Directive 84/500/EEC) and elastomers and rubber (Directive 93/11/EEC). These rules contain either complete specifications of permitted materials and additives (cellulose film) or regulate certain problematic additives (cadmium and lead in ceramics, nitrosamines in teats for babies). There is also a recently adopted general regulatory framework for “active and intelligent materials” (Regulation (EC) No 450/2009).

The rules of greatest interest for this report are those that apply to plastics in food packaging, as these rules deal in particular with the problems associated with recovered materials. The EU rules in Regulation (EU) No 10/2011 contain a positive list of substances (including additives) that may occur in plastic packaging for food. Other substances are banned. Recovered plastic may be used for food packaging, but each recovery process from which the plastic originates must obtain special approval under Regulation (EC) No 282/2008. The approval is decided by the Commission following an opinion from the European Food Safety Agency (EFSA). The application for approval submitted to date applies to recovery of PET packaging in a number of different recovery processes. Some applications relate to recovery of the material in crates of recovered plastic (polypropylene) for manufacturing of new crates. The EFSA has supported a number of applications, but final decisions have not been made at the time of writing.

The examination of the recovery processes is based on the migration limit values relating to substances in packaging which under the food rules must not be exceeded. The processes are assessed by adding some typical impurities at high concentrations to the material going for recovery and then analysing how much of the impurities remains after recovery.

5.6.6. Conclusions on the product rules

The rules on products/articles now presented have been and still are of great significance in bringing about non-toxic or detoxified material cycles. This applies both to the rules focused on direct health risks from articles (for example toys and food packaging) and the directives on waste streams. The Ecodesign Directive has not been of any significance in limiting the use of hazardous substances in articles and cannot be expected to play such a role in the future.

The directives on waste streams relate to categories of articles that are managed in large quantities and that may contain hazardous substances. It can also be noted that there are categories of articles that are large and important with regard to both waste management and chemicals control but that are not regulated at EU level or national level. An example is building products, where special regulation of hazardous substances is lacking at EU level (the General Waste Directive now contains a recovery target of 70% for non-hazardous building and demolition waste, which is to be attained by 2020). Another example is textiles, where special product regulation may be justified (cf. KemI Report No 1/12).

With regard to the content of hazardous substances in articles, the directives on waste streams use a more reasonable method of calculation than that which certain countries and the

Commission claim with regard to REACH (see section 5.2.2). The concentrations in per cent by weight are calculated on the basis of the sub-component or the homogeneous material in which the substance occurs, and not on the basis of the whole article with all its sub-components⁵⁹.

The report issued by the Commission in 2011 on the functioning of the directives on waste streams (footnote 47) concluded that better coordination was needed between these directives and the Waste Framework Directive, for example with regard to terminology, calculation of recovery levels and application of the waste hierarchy. It was noted that effective measures were lacking with regard to the first stage of the hierarchy (prevention of waste). It was discussed in the study whether requirements focused on articles ought to be replaced by requirements relating to materials (e.g. plastics) to also cover waste streams that are not regulated at present. It was concluded that this is not possible for practical reasons and that product rules and any rules on materials should also complement one another in the future. The study did not address hazardous substances in waste separately, and is focused instead on resource efficiency. The analysis done in the study was quite superficial, but the conclusions nevertheless appear reasonable. The conclusion that product rules cannot be replaced by rules on materials appears to me to be very important. I also think it correct to identify plastic as a particularly complex material to manage.

Effective recovery of materials from waste which, in addition, is to ensure non-toxicity, requires the material to be correctly managed at all stages of the life-cycle. An advanced technical process for recovery is not sufficient if there is no check on the material that constitutes input to the process. Hazardous substances that occur as impurities in waste may be difficult to separate and often cannot be identified in a simple way. There may therefore be a need for systems that separate the waste streams from the start, so that the waste that occurs in pure fractions is prevented from being mixed with waste that may contain hazardous substances. Information needs to be supplied by those who manufacture an article to the waste operators, for example on how the product is to be dismantled and which parts contain hazardous substances. Society may wish to lay particular responsibility on manufacturers/importers of articles, so that they take responsibility for waste management and the targets that apply to recovery of materials (i.e. producer responsibility). Finally rules may obviously be needed that ban or restrict the presence of hazardous substances in the articles, among other things to facilitate recovery.

Such advanced and detailed rules for waste management and recovery must concern special types of articles and cannot apply to materials contained in articles. Even if the articles contain the same types of materials, the conditions are different for different types of articles. The use of hazardous substances in the materials may vary. It must further be possible for the rules to be applied to imported articles, which contain many different materials. The latter means that the chemicals legislation cannot be used, as it does not in the main apply to articles.

My conclusion is that it is the directives on waste streams that best fulfil the need for complex regulation for important categories of articles where the presence of hazardous substances may be a problem. National rules on producer responsibility are significant but not sufficient from the point of view of non-toxicity. Nor is the EU's Ecodesign Directive sufficient. It is therefore unfortunate that attempts at EU level to regulate further important categories of articles, such as textiles and building products, appear to have been abandoned.

⁵⁹ See for example Annex II of RoHS and Annex II of the End-of-Life Vehicles Directive.

The Commission's study on the functioning of the directives on waste streams is insufficient to assess whether the directives are adequate with regard to management of hazardous substances in the articles. It ought, for example, to be possible to supplement this study by analysing to what extent the rules contained in the directives on separate collection and on sorting/treatment of the articles at the waste stage are adequate for later recovery that leads to non-toxic materials.

The example of food packaging of plastic is very interesting. The principles underpinning this legislation could be applied in limited areas where it is particularly important to limit the risk of exposure to chemicals, for example with regard to products for young children or other sensitive groups.

6. Information requirements, prioritisation lists, standards and other soft instruments

- Soft instruments may be of very great significance for the development towards non-toxic material cycles.
- Information requirements ensure that knowledge of chemical risks is disseminated to users, consumers and waste operators but also contributes to the production and importing of non-toxic articles.
- It is a shortcoming that information produced according to the rules on chemicals is not supplied to waste operators. The fact that recyclers do not have access to safety data sheets etc. is an evident gap in the legislation.
- Information on substances of very high concern ought to apply to more types of substances. Difficulty in interpreting which articles are covered by the requirements is a serious problem.
- A simpler way of providing information, for example via the Internet, ought to be investigated.
- The candidate list in REACH has been of very great significance in limiting the occurrence of substances of very high concern.
- Ecolabelling is important for particular types of articles.
- Lack of clarity on the scope for green procurement appears to be a persistent problem.
- It is notable that economic instruments have had such a limited impact in this area.

6.1. What are soft instruments?

In addition to the rules presented above, there are a number of “soft” instruments, which in some cases are very important and are of great significance in limiting the presence of hazardous substances – as such, in chemical mixtures and in articles. They consequently also play an important role in limiting problems with hazardous substances in waste management and facilitating recovery. They may take the form of labelling or some other type of information that indicates the content of hazardous substances and the need for precautions (positive labelling) but also eco-labelling and similar quality criteria, which are to guarantee that certain hazardous substances *do not* occur in articles or chemical products (negative labelling). They may also be other instruments that create incentives rather than setting absolute requirements, for example systems for green public procurement and rules on environmental taxes or charges.

Such instruments are discussed in Swedish Chemicals Agency Report No 1/12, Bättre EU-regler för en giftfri miljö (Better EU rules for a non-toxic environment). It is proposed that Sweden should press for the EU to devise a new environmental strategy for environmental information as part of the work on a new environmental action programme.

The soft instruments are sometimes wholly or partially regulated by law, but are sometimes not governed by rules at all with regard to factual content (e.g. ecolabelling criteria). They consequently fall outside my remit. I limit myself in this report to trying to identify some gaps in the legislation. At the same time I think it important to emphasise that the soft instruments may be of very great significance in limiting problems with hazardous substances in a life-cycle perspective. One reason is that the more informal instruments do not need statutory regulation and neither are they therefore restricted by the fragmentation of the rules that exist and that mean that different regulatory frameworks are applied to different segments of the cycle (principally chemicals/articles/waste). The instruments can be of significance throughout the life-cycle. They contribute to limiting the presence of hazardous substances in articles. The occurrence of waste that is difficult to treat is therefore limited, which is in accordance with the prioritisation in the waste hierarchy.

I consider the candidate list for authorisation in REACH (section 5.2.2) to be a striking example of an informal effect of instruments. This list of substances of very high concern has certain direct legal implications (certain information and registration requirements) and forms the basis for the selection of substances that are to be authorised in REACH, but it does not in itself signify any bans. The list appears, however, to have gained very great significance as an informal instrument, as substances in the list are being actively deselected as far as possible by those who use chemicals in the production of articles or import articles containing chemicals. The list thus takes on a significance that goes far beyond its purpose in strictly legal terms.

Swedish Chemicals Agency Report No 1/12 addresses in particular issues concerning the development of instruments of this type. The Swedish Chemicals Agency has also recently addressed the development of economic instruments in the area (Report No 1/13, Memorandum No 7/13). In the following I will merely discuss some issues related to the application of instruments in a life-cycle perspective.

6.2. Information requirements

6.2.1. What rules exist?

According to the milestone target in the Swedish environmental objectives system, “information about substances hazardous to health and the environment in articles is made available to everyone affected by 2020”. It follows from the account presented above that there are information requirements of different kinds at the various stages of the life-cycle. Examples are given in the following list, which is not exhaustive:

- *Chemicals*: for hazardous substances (as such or in mixtures) information is supplied to professional users in safety data sheets and to consumers in the form of labelling.
- *Specialty chemicals*: lists of ingredients are required in several cases (foods, cosmetics) combined with other detailed consumer information in a number of cases (e.g. medicinal products, pesticides). Ingredients in detergents have to be listed.

- *Articles, general:* for substances of very high concern in articles (over 0.1%) information is to be supplied to professional users and on request to consumers. Also applies to recovered substances in articles.
- *Articles, special rules:* information on fragrances that can cause allergies is to be supplied on toys. Labelling of plastic materials in food packaging often occurs. Special labelling requirements on contents (not hazardous substances) exist for textiles and shoes.
- *Articles, waste streams:* According to the directives on waste streams, information in some cases is to be supplied on the content of hazardous substances in order to facilitate waste management (e.g. information on heavy metals in batteries). Packaging is to be labelled (detailed requirements are lacking). Electronic equipment is to be labelled (crossed-out wheelie bin). There are several different types of energy labelling. For end-of-life vehicles (ELV) the manufacturer has to provide such dismantling information and such coding standards for materials as are required for recovery. Similar requirements exist for electrical and electronic products.
- *Waste:* There are detailed information requirements for hazardous waste in the rules on waste shipments. Certification that waste fulfils an EoW standard is a guarantee about the absence of hazardous substances in the waste.

6.2.2. Development needs

The enumeration above shows that there are a large number of rules with requirements for information to be provided from one stage in the life-cycle to the next. Many of these information requirements apply to hazardous substances. There are comprehensive information systems for chemical products and particular specialty chemicals. The problem with these systems is that they only apply to the chemical product as such. When this has become part of an article the information obligation ceases. Actors in the material cycle who do not have the right of access to this information are downstream users who manufacture complex articles from sub-components, consumers and waste operators.

Information requirements have been introduced through REACH for substances of very high concern in articles. These rules are in principle important, but they have come up against application problems in the form of disputes over interpretation (section 5.2.2). They additionally apply to a limited number of hazardous substances and do not even cover the substances which, in the Swedish view, should be characterised as substances of very high concern⁶⁰.

In my view some needs for development should be pointed out in particular:

- Safety data sheets with exposure scenarios ought to be available for those who produce complex articles from sub-components that contain hazardous substances, even if the components are not chemical products. This can happen through the information requirements under REACH being expanded (Article 33) or through special groups of articles being covered by information requirements⁶¹.

⁶⁰ According to the Swedish milestone target very allergenic substances ought to be regarded as substances of very high concern, which does not apply under REACH. Requirements for harmonised classification apply for certain such substances in CLP which shows that the need for special treatment of such substances is also appreciated in the EU.

⁶¹ On these issues see KemI report No 3/11, *Kemikalier i varor, Strategier och styrmedel för att minska riskerna med farliga ämnen i vardagen* (Chemicals in articles, Strategies and instruments for reducing the risks of hazardous substances in everyday life).

- Waste operators/recyclers ought to have access to safety data sheets and other information from REACH registrations, to ensure that recovered materials are safe and have uses that are non-problematic from the point of view of toxicity. Article 2(7)(d) requires recyclers to have access to such information, but under the rules they do not have the right to be notified of it. This is, in my view, the most obvious gap in the regulatory framework with regard to coordination between rules on chemicals and waste.
- The problem with the interpretation of the 0.1% level that triggers information requirements for chemicals in articles according to REACH must be resolved.
- The issue of whether supply of information through labelling or documents can be replaced by information electronically through websites on the Internet ought to be studied in earnest.

The fact that there is no general access to safety data sheets etc. is due to them being considered capable of containing industrial secrets that must be covered by confidentiality. It ought to be possible to solve such problems by confidentiality being retained for certain items of information in certain cases, but the issue needs to undergo special investigation. Such an analysis must also take account of the information requirements contained in the directives on waste streams and that impose requirements on manufacturers to supply for example dismantling information and information about the contents of hazardous substances (section 5.6.2).

These issues could be addressed in a new strategy for environmental information in the EU proposed in KemI Report No 1/12.

6.3. Prioritisation lists, ecolabelling and procurement criteria

It has already been pointed out that the candidate list in REACH has been of great significance. It is of great significance for the strategic choices made by those who develop new chemical products and articles supplied to the cycles. It ought reasonably also to be of great significance for those who recycle materials and who wish to be able to place the materials on a market. The candidate list now contains 144 substances that have been identified as substances of very high concern. It is supplemented by other types of lists. The International Chemical Secretariat's list of substances of very high concern at present contains 626 substances, which have been selected with application of the criteria in REACH⁶².

Ecolabelling and procurement criteria are often based on information from prioritisation lists. In many areas (for example textiles), such criteria are of very great significance for which products are produced, imported and placed on the market. The criteria may also include environmental aspects that cannot be regulated through the traditional regulatory frameworks for articles, namely which production methods have been used in the manufacturing of an article. Such criteria are often focused on climate impact but may also govern which chemicals have been used in production, even if these chemicals do not remain in the final product. The principles that apply to the international trade in goods (the GATT agreement, WTO) mean that such issues cannot be regulated through legislation on articles that has an impact on trade.

It has been pointed out in KemI Report No 1/2012 that green procurement and environmental criteria for such procurement are of great significance. The Government Committee

⁶² See <http://www.chemsec.org/what-we-do/sin-list>.

investigating public procurement has in its final report SOU 2013:12 addressed the question of the extent to which Community law limits the possibility of green procurement and notes that there are differing views on the issue. If there is such lack of clarity, it is important that clarification in the form of a clear position is obtained at EU level.

6.4. Environmental taxes and charges

Economic instruments, with some exceptions (e.g. pesticides, batteries, commercial fertilisers) have not been used to control the use of hazardous substances. The rules contained in the Waste Tax Act (1999:673) exist to limit the quantity of waste sent to landfill.

In recent years there has, if anything, been a phasing-out of the environmental taxes introduced during the eighties and nineties. The Swedish Chemicals Agency, in a report and memorandum, has recently developed proposals for economic instruments directly focused on chemicals in articles⁶³.

7. Analysis and conclusions

7.1. Chemicals and waste – two worlds

- There is a clear division in the regulatory frameworks in the area of chemicals and waste. In order to deal with the chemical aspects of recycled materials there is a need for enhanced collaboration between the two areas in accordance with the environmental objective of non-toxic and resource-efficient material cycles.
- Objectives for clean materials in the area of chemicals may be perceived as a complicating factor when aiming to achieve ambitious targets for recycling. However, it appears unavoidable that ways of managing waste other than recycling may become necessary if uncontaminated waste streams cannot be brought about (principally incineration).
- The challenge for those concerned with the rules on waste and the rules on chemicals is to try jointly to find ways of applying the principles of risk management in the rules on chemicals also to recovered materials, but in a manner that takes account of the special circumstances in the waste area.

The legislation that exists in the area and that has been presented in the report is roughly divided into two parts: chemical rules and waste rules. The regulatory frameworks are also separate, although there are points of contact.

I believe that it is evident from the analysis in this report that the areas are regulated in separate regulatory frameworks and that there is a fragmentation with regard to application of the frameworks. Although there are often links between the different sets of rules, this fragmentation leads to a risk that those who apply the rules find it difficult to raise their sights beyond the regulatory area that they master themselves. It is therefore important to promote contacts and collaboration between the different areas.

⁶³ Swedish Chemicals Agency Report No 1/13, "När kan ekonomiska styrmedel komplettera regleringar inom kemikalieområdet?" ("When can economic instruments supplement regulations in the area of chemicals?") and memorandum No 7/13.

There are rules that have broader scope and that cover more stages of the life-cycle. Examples are the directives on waste streams and the rules on POPs. But also for these regulatory frameworks is the trend for the parts of the rules that concern chemicals and the waste parts to be handled in separate processes with regard to application and implementation. This is understandable and reflects the division that exists in both authority structures and also in statutory terms in the chapters of the Swedish Environmental Code. A similar division exists in most countries, although the northern European countries and Sweden have gone further than many other countries with regard to integrating the two areas. Many efforts have been made to introduce and achieve a breakthrough for a life-cycle approach, for example the Swedish Environmental Protection Agency's GRK strategy for non-toxic and resource-efficient material cycles and the EU's IPP strategy (Integrated Product Policy) and the roadmap for a resource-efficient Europe and the forthcoming environmental action programme. The Swedish system of environmental objectives has also reflected this division into chemicals and waste as two separate areas. Particularly through the life-cycle target (section 3.1.3), however, the life-cycle approach has also started to have more of an impact in this area.

Legislation is fundamentally conservative, and it can take time for new principles to make a breakthrough in specific rules. REACH and the EU's Waste Directive are, however, new regulatory frameworks and attempt partially to address the life-cycle problems through a number of new features. The question is whether these rules are sufficient or whether they need to be supplemented. In my opinion much remains to be done, with regard to both legislation and authority structures. The latter applies to both legislating and applying authorities. A similar division between those who handle rules on chemicals and those who recycle materials from waste is, I feel, also clear on the side of entrepreneurs. It is not always considered self-evident that recycled materials ought to fulfil equally stringent environmental and health requirements as virgin materials. It is important in this context that the Government has now established a principle of comparability as part of the environmental objectives for new and recycled materials

It is also important to try to avoid viewing the environmental objectives applicable in the area as being in conflict with one another. If ambitious targets are to be established for recycling to achieve resource and energy efficiency, ambitious objectives in the area of chemicals are perceived as being an obstacle. Application of rules on chemicals such as REACH to recycled materials may, for example, mean that certain fractions that contain impurities cannot be recycled and cannot be included in the recycling targets for materials. They must instead go to waste incineration (if available). This is unavoidable in practice. The challenge for those concerned with the rules on waste and the rules on chemicals is to try jointly to find ways of applying the principles of risk management in the rules on chemicals also to recovered materials, but in a manner that takes account of the special circumstances in the area of waste. I shall return to this issue below. I also attempt in this section to present summary conclusions on some statutory shortcomings and assess how well the rules agree with the fundamental political objectives in the environmental area.

7.2. Shortcomings and gaps in the regulatory framework

Recycled materials that have been waste are treated according to the same principles as virgin materials in the regulatory frameworks. A detailed study shows, however, that the legislation is not always uniform, complete and consistent.

- Recycled materials normally need not be registered as a substance in REACH if the same substance has been registered previously. The exception even applies if recovered substances have uses other than those that have been risk-assessed in previous registrations, which cannot be justified. It is unclear what is meant by “the same substance”, and the materials in waste may in some cases become articles without the rules on chemicals becoming applicable.
- The prioritisation of recycling in the waste hierarchy could be clarified so that unsuitable materials are not recycled.
- The development of EoW criteria (end of waste) has been highly problematic, but principally for reasons other than chemical aspects. The handling of hazardous substances by the criteria can be discussed, but these criteria cannot replace the control of risks that takes place through the legislation on chemicals.
- The legislation on waste has not adopted the criteria for substances of very high environmental concern in REACH.
- Those who recycle materials in waste must have the right to study information on chemical aspects prepared for the virgin materials under REACH and CLP.
- The information requirements on substances of very high concern under REACH are inadequate, and their application is complicated by disputes over interpretation.
- An analysis of how producer responsibility works, ideally at European level, ought to be carried out to assess whether individual responsibility can be accomplished that contributes to purer articles.

A number of items have been identified in the report where it can be questioned whether the legislation is uniform, complete and consistent. This analysis is summarised in this section and is followed by a discussion of needs for development in the next section.

Registration in REACH of recovered substances (section 5.2.1)

Materials that are recovered from waste and no longer waste are in principle to be managed as chemicals under the chemicals legislation (REACH and CLP). The rules mean, however, that the registration of recovered substances under REACH need not take place if the same substance has been registered previously. There are a number of fundamental problems with regard to application of this derogation:

- the assessment of what is “the same substance” provides scope for various interpretations. The concept of substance is unclear and allows substances to be regarded as identical even if they vary greatly, for example with regard to the content of such hazardous substances as are characterised as impurities.
- The derogation from the registration obligation in REACH can be applied even if recovered substances have uses other than those that have been assessed in terms of risk in previous registrations.
- Recycled materials in some cases can be directly converted from waste into articles. Registration requirements and other requirements applying to chemicals (e.g. requirements for authorisation under REACH) will not then apply.

The derogation from registration and risk assessment for such uses of recovered substances as deviate from the uses previously assessed for virgin substances in terms of risk can never, in my view, be substantively justified.

Prioritisation of recycling in the waste hierarchy (section 5.4.1)

The waste hierarchy in the Waste Framework Directive prioritises recycling ahead of other ways of utilising waste, for example through incineration with energy recovery. This prioritisation is not to apply entirely without exception. Account has to be taken of the consequences for human health, which obviously includes risks from hazardous substances in recycled materials. At the same time, the rules on waste contain very strong incentives for recycling through the recycling targets established in the Waste Framework Directive and the directives on waste streams and that apply to materials.

The prioritisation in the waste hierarchy is justified by the fact that recycling can provide various types of environmental gains, such as reduced climate impact and reduced use of limited natural resources, but also positive contributions to a non-toxic environment in a broader perspective. Examples of the latter may be increased recycling of textiles leading to reduced need for new production and consequently a reduced need to use and spread pesticides in cotton cultivation and reduced dispersal of environmental toxins from the textile factory.

The objective for waste streams to become non-toxic is the point of departure for this report. It is evident that a very strong focus on recycling in waste policy poses a risk of material containing hazardous substances being recycled to a greater extent than is appropriate. For waste that contains impurities and is mixed and which therefore is difficult or impossible to sort into pure fractions, controlled incineration is perhaps a better alternative than recycling. This may apply, for example, to inadequately sorted domestic waste⁶⁴.

Risks of this kind can be partly avoided if effective sorting and separation of types of waste is brought about in an early stage of waste management, so that it is known which streams can be recycled without risk. The rules on particular waste streams are an example of this (cars, electronic waste, batteries). There is, however, a limit to how many types of articles can be managed through such detailed rules, and there are limits on how far-reaching requirements can be imposed on consumers to sort their waste. Another fundamental problem is that capacity for waste incineration with energy recovery is limited in parts of Europe (incineration also takes place in connection with cement production). There is concern at the same time over increased incineration that takes place at the cost of recycling and among other things leads to increased waste shipments, which in turn is due to the uneven distribution of resources for incineration⁶⁵. At the same time, there is strong pressure on the countries that continue to landfill large proportions of their waste to limit their landfilling. These factors contribute to strengthening the incentives for recycling. On the other hand, there are forecasts that total incineration capacity in the long term will exceed the supply of fuel in the form of waste.

⁶⁴ What is known as “post-consumer waste”. It is obviously easier to bring about pure waste streams for waste that comes for example directly from industrial processes (“pre-consumer waste”).

⁶⁵ Cf. a study from GAIA (Global Alliance for Incinerator Alternatives) containing a detailed analysis of the situation: “Incineration overcapacity and waste shipping in Europe: the end of the proximity principle?”, January 2013. Downloaded from http://www.resource.uk.com/article/News/Incineration_overcapacity_%E2%80%98threatens%E2%80%99_recycling-2653#.UqWfpTuJ8E.

As the incentive for recycling is so strong, a natural conclusion to be drawn is that it must be ensured that the materials recycled are covered by legislation that actually ensures that the materials do not pose health or environmental risks. These requirements must be met by the recyclers.

Development of EoW criteria (section 5.4.5)

Waste legislation has always been difficult to apply with regard to the issue of when waste that is recovered ceases to be waste. The EoW criteria are one way of cancelling the classification as waste. Existing criteria and those that are proposed have been worded in such a way that the recycled material is not allowed to have any hazardous properties under the chemicals legislation. Formulating the criteria in this way is not something that is an absolute requirement in the Waste Directive. It means that recycled materials sometimes have to be purer and freer of toxins than the virgin materials in order to fulfil EoW requirements. There are no general requirements for materials stating that they must not have hazardous properties. Many chemicals are specially regulated through provisions that permit certain hazardous properties in the materials. As the EoW criteria are not mandatory, there is a risk of far-reaching purity requirements meaning that the criteria will not be applied in practice and that the waste will instead continue to be treated as waste until it is, for example, directly converted into an article and in that way avoids the rules on chemicals. It is not certain that this is a positive development.

An alternative would be for EoW criteria instead to be formulated so that they approve certain hazardous properties in recycled materials if these are used for specific purposes where materials with such properties are allowed to be present under the rules on chemicals and articles, and provided the materials are pure and non-hazardous in other respects. If this leads to the EoW criteria being applied to a greater extent, better control of the material stream is obtained. On the other hand, such development would necessitate a greater degree of collaboration between rules on chemicals and rules on waste than occurs at present. Those who apply the rules on waste and develop EoW criteria would need to implement sophisticated risk assessments for the intended users for recycled materials, which does not happen today.

The development of EoW criteria has been problematic in several ways. There are strong reasons for monitoring application in the future and assessing whether the system of criteria needs to be developed and improved. The chemical aspects should be included in such a review. Future EoW criteria may also be formulated in different ways than are relevant at present.

Substances of very high concern in waste legislation (section 5.4.3)

The phase-out of substances of very high concern is a main priority for chemicals legislation, in Sweden, at EU level and internationally through the Stockholm Convention.

Hazardousness to the environment for such substances (PBT, vPvB) is defined in REACH (Annex XIII) and not in the rules that otherwise contain definitions of hazardous properties.

The rules in the legislation on hazardous waste are based on the definitions in CLP, but have not addressed the issue of substances being defined as particularly hazardous to the environment, not even in cases where such substances have been identified as POPs under the Stockholm Convention.

It is difficult to understand why Annex III of the Waste Framework Directive, which was decided upon in 2008, was not adapted to the rules in REACH, which came two years previously.

Inadequate information to recyclers etc. (section 6.2.2)

Under REACH recyclers do not have to register recycled materials if the material has been registered by someone else and the recycler has access to information on any risks prepared by the original registrant (principally safety data sheets). However, the recycler does not have any right to study the safety data sheets.

This is not a satisfactory solution if recycling of non-toxic materials is to be encouraged. If the legislation designates holding of particular information (safety data sheets) as a condition in a rule about the obligation to register, the legislation must also state how the recycler may get access to the safety data sheet.

Other actors in the material life-cycle may also need to study information prepared under REACH and CLP. This applies in particular to those who produce complex articles from sub-components containing hazardous substances.

Information requirements on articles (section 6.2.2)

Information requirements have been introduced through REACH for substances of very high concern in articles. The rules are fundamentally important, but have encountered problems in application in the form of a serious dispute with regard to interpretation of their scope. This lack of clarity limits the impact of the rules. They additionally apply to a limited number of hazardous substances and do not even cover the substances which, in the Swedish view, should be characterised as substances of very high concern.

Individualised producer responsibility?

Producer responsibility means that manufacturers of articles and importers are given responsibility for end-of-life articles to be dealt with and managed in accordance with requirements in the waste legislation. The responsibility is primarily economic, but may also mean an obligation to organise and carry out collection, recovery etc. Responsibility can also be imposed on other actors in the supply chain, such as wholesalers and retailers. In Sweden the rules are based on Chapter 15 Sections 6-7b of the Swedish Environmental Code and special ordinances for different types of articles. Rules on producer responsibility are also contained in the directives on waste streams (section 5.6.2)

There is an advanced system of producer responsibility in Sweden which covers eight categories of articles:

- batteries
- cars
- tyres
- electronics
- packaging
- waste paper
- medicinal products
- radioactive products and stray radiation sources

Producer responsibility is evidently an important and successful instrument that effectively puts into practice a life-cycle approach. Combined with other instruments, such as requirements to attain specified levels of recycling, producer responsibility can contribute to the development towards the prioritised objectives in the waste hierarchy. Less waste is produced and recycling increases.

Producer responsibility ought also to be able to contribute to hazardous substances being used to a lesser extent in the articles, as non-toxic articles make waste management cheaper and easier and consequently reduce the producer's costs. When the rules on electrical and electronic products were decided in the EU (the WEEE Directive, section 5.6.2), the issue of individualised producer responsibility was discussed intensively. The question was whether the producer's financial contribution to the collection systems would be individual, i.e. whether this contribution would be calculated based on each individual producer's actual costs to deal with his own products. The alternative was a more collective way of calculating the contribution as an average cost, which would make the system simpler to manage.

This provision was finally introduced into the WEEE Directive (Article 12(3) in the recast version of WEEE, Directive 2012/19/EU):

“For products placed on the market later than 13 August 2005, each producer shall be responsible for financing the operations referred to in paragraph 1 relating to the waste from his own products. The producer may choose to fulfil this obligation either individually or by joining a collective scheme.”

The idea behind the provision was thus that particular producers would only be responsible for costs of handling waste originating from their own products. If a producer developed articles that were non-toxic or in other ways were simpler and cheaper to deal with and to manage as waste than articles from other producers, this would have an impact in the shape of lower costs and mean an incentive for continued product development towards cleaner articles.

This provision has not been introduced into Swedish legislation⁶⁶. According to information received⁶⁷, nor does the Swedish system work in practice so that this rule is put into effect, and the situation is similar in other European countries. Implementation (or rather lack of implementation) was criticised in an NGO report from Greenpeace⁶⁸: “Lost in transposition”.

It ought to be possible for individualised producer responsibility according to the principles contained in WEEE to serve as an effective instrument to limit the use of hazardous substances in articles if the manufacturers and importer consequently obtained a clear advantage from supplying clean products. This could supplement other types of instruments, such as eco-labelling schemes. A factor militating against individualised producer responsibility is probably that it leads to increased complexity of the scheme. Collective solutions based on a single system for recovery in each country probably also mean that individualisation becomes more difficult to implement than if there are many actors competing in the area of recovery.

⁶⁶ Sections 12-17 of the Ordinance (2005:2009) on producer responsibility for electrical and electronic products and Swedish Environmental Protection Agency general guidelines NFS 2007:6.

⁶⁷ Verbal information from Viktor Sundberg, Electrolux.

⁶⁸ <http://www.greenpeace.org/international/en/publications/reports/lost-in-transposition/>

It would, in my view, be important to carry out an analysis of how producer responsibility works, ideally at European level, to assess whether individual responsibility can be put into practice in an effective way.

7.3. How to assess risks associated with recycled materials?

There is a lack of an adequate basis for assessing whether the rules applicable today can in practice deal with the chemical aspects of recycled materials in a reasonable way. Such a basis for decisions ought to comprise:

- a broader analysis of the quality of recycled types of materials aimed at assessing whether the materials in practice contain hazardous substances that can lead to problems,
- an analysis of how waste and chemicals legislation is applied in practice to recycled materials, with regard both to REACH/CLP and to the rules on waste with the EoW criteria,
- a focus on enforcement both in Sweden and at EU level, where guidance on enforcement is developed jointly by authorities in the areas of chemicals and waste.

The fundamental question that this report tries to answer is whether the rules that apply today address the chemical aspects of recycled materials in a reasonable way.

If it is considered that the materials that are recycled today are so clean and free of impurities that they can, in the main, be equated to virgin materials, it must be justified to set less stringent chemical requirements for the recycled materials (or at least unproblematic from the point of view of health and the environment). The information on inherent properties and risk management measures prepared for the virgin materials must, however, in such cases be available to the recycler, so that the information can be passed on in the life-cycle of the recycled material. It is this thought that underpins the derogation from registration requirements in Article 2(7)(d) of REACH. There are a number of problems with this rule that show that it is not entirely thought through, problems that have been identified in this report. However, the recycler who places the material on the market retains responsibility under all circumstances for classification, assessment of the need for protective measures, formulation of safety data sheets etc.

If such an optimistic view is taken of the quality of the recycled materials, it ought also to be possible most often to accept that materials remain waste until they are converted to an article within the meaning of the chemicals legislation, with the consequence that they will not be covered by the stricter rules of chemicals legislation on registration, authorisation etc. Nor is it then a problem that it is possible in practice for those who manage waste to govern when a waste is to cease to be waste, through EoW criteria or in some other way.

The problem, however, is that waste is often a mixture of different objects and materials and that it is therefore difficult to decide whether the waste contains hazardous substances, and if so in what quantities they are present. This applies at least to the waste coming from households, but the same also applies to other waste streams, for example demolition waste. It then becomes difficult to check the quality of recycled materials. Although the rules on waste apply a distinction between hazardous and non-hazardous waste, this distinction is too rough and is, in addition, not designed to be applied to what is recycled.

I have not been able to find any studies that entail a broader analysis of the quality of recycled materials and that are intended to assess whether the materials contain hazardous substances that may lead to problems. There is, as far as I know, no synopsis of how recovered substances have been handled in practice in REACH, for example what registrations of recycled materials there are and how the issue of substance identity has been addressed in accordance with ECHA's guidance.

There is reason to carry out a more detailed analysis of this issue, i.e. how recycled materials are managed through both waste legislation and chemicals legislation. Such an analysis ought also to take account of how the rules in REACH/CLP and the waste rules relating to EoW criteria are applied in practice. It is possibly appropriate to wait a few years for such an analysis, until more experience has been gained from application.

Enforcement measures taken by the responsible authorities ought, however, already be relevant today. If the material is still regarded as waste, the enforcement may relate to the question of whether the waste management rules in waste legislation are fulfilled. As has emerged from the report, there are chemical requirements that must be met for recycled materials that are no longer waste. It is fundamental that a recycler who markets such materials must know the properties of the material, for example whether it contains impurities in the form of hazardous substances. This necessitates the material being analysed or it being possible for the properties to be identified in some other way. Enforcement may also relate to the question of whether the criteria are met to avoid having to register recycled materials under REACH and the question as to whether the information requirements under the rules on chemicals are otherwise met.

I have not found that any systematic enforcement focused on these issues occurs. The basis for such enforcement (enforcement guidance) could be developed jointly by the authorities in the areas of waste and chemicals and followed by a commitment to enforcement actions by the authorities. The experience from enforcement would be an important basis for assessing any needs for development with regard to the legislation. Cooperation on these issues could also be established at EU level through ECHA's Forum for Exchange of Information on Enforcement.

7.4. How should the legislation be developed?

- The fundamental rules in the area should be adequate to deal with the problems of chemicals in recovered materials. On the other hand, it is possible to develop regulations at a lower level, and in particular the guidance on REACH and CLP.
- The directives on waste streams are the most successful examples of legislation concerned with hazardous substances in material cycles. Consideration should be given to supplementing these rules.
- A broader review of the rules on the right to environmental information is justified.
- It is difficult to implement special systems of rules for materials (e.g. plastics).
- The Ecodesign Directive can be developed to handle certain aspects of waste but not the content of hazardous substances in articles.

The basic legislation in the area is in the EU rules on chemicals (REACH/CLP) and waste (the Waste Directive). These regulatory frameworks are new, and it is not realistic to imagine any form of merging of the rules to put a life-cycle perspective into effect in the foreseeable

future. Although there are some fundamental shortcomings in the rules, they should be largely adequate to handle risks associated with hazardous substances in recycled materials and steer in the direction of non-toxic life-cycles. In section 7.2 I have pointed to some amendments to the rules that ought to be implemented. In my view there also appears to be great uncertainty as to whether the EoW criteria on when material ceases to be waste will actually work as intended. However, this issue falls partly outside my remit. A review of application according to previous sections can otherwise obviously lead to a need for other changes being identified.

On the other hand, I think that there should be scope for development through regulations at a lower level (Commission level) and perhaps in particular through the development of guidance. The only authority instruction that exists where an attempt is made to describe how chemical risks associated with recycled materials are to be managed in practice is the ECHA guidance (footnote 14). This could be enhanced on several points if it is to be of real practical benefit for the recyclers.

The directives on waste streams are the rules that have been of greatest significance in bringing about non-toxic life-cycles (section 5.6.2). Such legislation focused on type of article appears to be best placed to ensure that materials with hazardous substances are separated from harmless materials at an early stage in waste management, which is crucial if the life-cycles are to be detoxified. Producer responsibility is a very important component in these rules. A clear priority ought therefore to be to develop such rules for suitable groups of articles.

There are information requirements on hazardous properties and precautions for chemical products, but the information is not passed on in the life-cycle. Beyond the need for amendment in REACH pointed out above (section 7.2), there may be reason to consider a broader review of the rules on right to environmental information⁶⁹.

Developing regulatory frameworks for materials (e.g. plastics) instead of for types of article may be regarded as attractive as it leads to comprehensive rules, irrespective of how the material is used. It is unrealistic, however, to implement it, however, as it would lead to double regulation and the materials are used in so many different areas with different circumstances. Development of application of the Ecodesign Directive does not appear realistic with regard to chemical aspects, although this directive ought to be able to handle other aspects, such as design requirements to simplify recovery.

⁶⁹ See proposal in KemI Report No 1/12, section 7.8.

7.5. Are the environmental objectives met, and what is to be achieved with a new environmental action programme?

- Of the three Swedish objectives identified at the start of this report, one – phase-out of hazardous substances – has gained broad acceptance as a principle in the EU and in part also internationally.
- Non-toxic and resource-efficient material cycles are not being discussed just in Sweden but in the EU as well. The principle of treating new and recycled materials in a comparable way applies under the legislation, but there are a number of exceptions in practical application. If such exceptions are deemed necessary, they should always be limited in time.
- A great deal remains to be done if the information on chemicals in articles is to be improved.
- The new environmental action programme in the EU provides an opportunity to address a number of the issues discussed in this report.

7.5.1. Are the environmental objectives achieved?

Finally there may be a reason to look back at the environmental objectives assessed as relevant for the assignment (section 3.1) to see whether the legislation (primarily in the EU) steers in the direction of these targets.

- *Phase-out of substances of very high concern*

The substances of very high concern with properties hazardous to human health (CMR) have long been separately controlled through the legislation on chemicals (bans on consumer use), in rules on specialty chemicals (e.g. foods) and also some special rules for articles (e.g. toys). A general objective to phase out the substances has been introduced in the EU through REACH. A new way of classifying substances of very high concern has also been introduced through REACH with respect to environmental hazard (PBT, vPvB according to REACH Annex XIII). An equivalent to this has also made a breakthrough as a result of the international rules on POPs. The candidate list in REACH has been of great significance in focusing attention on these substances. New rules on pesticides have introduced clear targets for the phase-out of substances of very high concern. The criteria for particular environmentally hazardous substances under REACH have, not, however, had an impact on the rules on waste.

I generally think that the objective that substances of very high concern should as far as possible disappear from life-cycles has gained broad acceptance in the EU and also internationally. The review of controlled substances in RoHS that is due to take place in 2014 (section 5.6.2) is interesting in this context, as electronic waste is a significant waste stream leading to problems with recycling.

- *Non-toxic and resource-efficient material cycles with the objective of comparability*

The life-cycle approach is something that has had a great impact in the political rhetoric in the EU, although it is mostly justified by resource efficiency, climate-policy aspects and the need to prevent waste. The principle of comparable requirements for the content of hazardous substances in new and recycled materials has not been expressed with equal clarity. As the legislation is formulated there is, however, no doubt that recycled materials in principle are

treated in the same way as new materials (provided the former are no longer to be regarded as waste). This applies both to chemical rules and to rules on the environmental and health aspects of articles. On the other hand, it quite often happens that derogations are made in individual cases, and that higher levels of hazardous substances are permitted in recycled materials than in new ones, if application of the chemical requirements for new materials would make recycling more difficult. A number of such derogations are presented in this report (cadmium in PVC, heavy metals in glass packaging, POPs in plastics etc.). The general derogation from registration in REACH for recycled materials can scarcely be reconciled either with a target of comparability and in addition is not thought through in all respects.

It is unavoidable that the issue of less stringent requirements for recycled materials is sometimes raised when considering stringent requirements for new materials, for example new requirements for phasing out substances of very high concern through authorisation under REACH. In my opinion this ought not to clash with a target of comparability if the derogations are restricted to a reasonable transition period. On the other hand, derogations that are unlimited in time should not be accepted. There are then no incentives to develop better recycled materials.

The authorisation of recycled PVC and DEHP which is in progress under REACH may highlight several of the problems addressed in this report, in particular the principle of comparable treatment of recycled and new materials.

- *Information on chemicals in articles*

The report (section 6.1.2) identifies a number of points where rules on information on hazardous substances could be disseminated more effectively. It does not appear easy to gain a hearing for such proposals at present at EU level, partly because of the heated debate on the information requirement for articles in REACH. The fact that the issue is being discussed in the international chemicals cooperation (SAICM) may possibly contribute to highlighting the issue in the EU.

7.5.2. The seventh environmental programme of action – a new opportunity?

It is obviously of great interest for the issues discussed in this report that the EU is adopting a new environmental action programme which is strongly focused on life-cycle problems and is even talking of a new Union strategy for a non-toxic environment by 2018 (the programme is otherwise in general not so operationally oriented).

Work on a new strategy has not begun at the Commission, but is likely to be initiated with a number of studies and other documentation being developed as a basis for later taking positions. There will then be an opportunity for Sweden to feed in ideas on what should be done. In section 7.3 above I have proposed some areas where I think there is a need for a general basis for decisions. Other issues may be the possibility of developing new rules for important waste streams (section 5.6.6) and the need to develop information systems for chemicals in life-cycles (section 6.1).

An opportunity to raise some of these issues is also contained in the review of the recycling targets in the Waste Directive which is due to take place in 2014.

Annex: The example of plastics

- Plastic waste occurs in very large quantities. Around 6.6 million tonnes of plastics are recycled annually and enter the cycle.
- Plastics consist of chains of molecules (polymers) but also often contain large quantities of additives that are required for the material to have desired properties. A Norwegian/Danish study has identified 43 substances of very high concern that occur or have occurred as additives in plastics. An extract from the Swedish Chemicals Agency Products Register made for this report shows that substances of very high concern for human health (CMR) are very common in plastics. Such substances remaining in plastic waste have to be managed if the material is to be recovered.
- Recovered plastic is generally regarded as a mixture of substances in application of chemicals legislation. Additives in the plastic material/mixture with hazardous properties that occur at specified levels (usually 0.1 or 1%) lead to the material having to be classified as hazardous.
- Registration of recovered plastic under REACH is generally not necessary because of the derogations in REACH from registration requirements for polymers and for recovered materials. On the other hand, recovered plastic material must be classified if it has hazardous properties and information has to be provided to the users. Whoever recovers plastic materials must have detailed knowledge of the properties of the material. The information obtained from registrations and safety data sheets and relating to the virgin material must sometimes be supplemented by the recycler.
- If plastic waste is directly converted to an article, i.e. never becomes a chemical product, the chemicals legislation is not applicable. However, some provisions with regard to articles apply, for example the requirement to inform users and consumers about substances of very high concern in the article.
- Plastic waste is generally regarded as non-hazardous in application of the EU waste legislation. The special rules that apply to the management of hazardous waste do not become applicable. Pure waste fractions of the most common types of plastics may be exported to countries outside the OECD, but they must not be halogenated and contain, for example, brominated flame retardants.

Background

Plastic is the type of material most often mentioned when the risks of hazardous substances in articles are discussed. Plastics are produced in very large quantities and are used in packaging, building materials, vehicles, electrical and electronic products as well as in other articles for consumer use. Plastics also become one of the most important and difficult-to-manage waste streams, and the plastic materials can often be difficult to recover.

Almost all plastics break down very slowly and remain in the environment if they are not managed. A problem related to this is pollution of the oceans with plastic waste. Other problems are the utilisation of natural resources (oil) for plastic production and climate impacts due to manufacturing and handling of plastics. The use of hazardous substances in plastics is, however, also a fundamental problem. Many of the environmental and health problems associated with articles are due to additives in plastic materials.

Increased recovery of plastics may mean that such substances to a greater degree than previously enter material cycles through recovery. It is therefore justified in my view to

examine in particular how the chemicals legislation works for plastics in a life-cycle perspective. This annex addresses this issue and for obvious reasons contains some repetition of the information in the report. I also attempt to provide a picture of which additives with properties hazardous to the environment and health that used in plastics today and that can pose problems in future management and recovery of plastic waste.

In conjunction with the review of waste legislation in the EU which is due to take place in 2014, the Commission has published a green paper containing background material on a European strategy for managing plastic waste in the environment⁷⁰, which among other things has served as a basis for this section. There are a number of reports and other material dealing with plastics recovery. On the other hand, it is difficult to find reports or studies that address the problems of hazardous substances in recovered plastic.

References in this annex to sections relate to the sections of the main text of the report unless otherwise stated.

Facts about plastics and recovery of plastics

World production of plastics is close to 300 million tonnes per year (in the EU just over 50 million tonnes). Plastics gradually become waste. The quantity of plastic waste in the EU has been estimated at 25.2 million tonnes in 2012⁷¹. Most of this (62.2%) is plastic packaging material. Other categories of articles that generate relatively large quantities of plastic waste (5-6% of the total quantity per category) are electrical and electronic products, building and construction materials and materials used in agriculture.

61.9% of plastics waste in Europe is recovered (recycling or incineration with energy recovery). The remainder (9.6 million tonnes) mainly goes to landfill. The quantity going to landfill is decreasing annually (by 5.5% in 2011–2012), but how much plastics waste is landfilled varies widely between different countries in Europe. Around ten countries including Sweden have bans on the landfilling of plastics waste, while other countries still landfill almost all their waste. This applies in particular to countries that do not have incineration capacity.

Most of the plastic that is recovered goes to incineration with energy recovery. However, a significant portion goes to recovery of the plastic material, principally in the form of mechanical recovery⁷². 26.3% of all plastics waste in Europe goes to material recovery, and this figure does not vary so much between the different countries. A total of around 6.6 million tonnes of plastic is thus recycled annually in Europe. The trend is for recovery to increase and for the quantity sent to landfill to decrease. One reason for this is the incentives for recovery created through waste policy and application of the waste hierarchy (see section 5.4.1). The technique for recovery and the systems for separating the waste streams are also being improved continuously, which means that the economic yield from recycling materials

⁷⁰ Green Paper on a European strategy on plastic waste in the environment, COM(2013) 123, final. The Green Paper is based, among other things, on a study on plastic waste in the environment, see <http://ec.europa.eu/environment/waste/studies/pdf/plastics.pdf>. The material on which the EU's EoW criteria for plastics are based contains a good background description: End-of Waste Criteria for Waste Plastic for Conversion, Technical Proposals, Final Draft Report, March 2013.

⁷¹ Statistical information from Plastics – the Facts 2013, PlasticsEurope (<http://www.plasticseurope.org/>). Information on plastic waste in the statistics and in this report relates to post-consumer waste, i.e. consumer-used plastic which, when it becomes waste, is collected via various collection schemes. Pre-consumer waste may, for example, be spillages of materials arising in production and re-used.

⁷² The quantity of plastic waste recovered through feedstock recycling is low, 86 000 tonnes in 2012.

is improving. However, recovery is made more difficult by the fact that there are so many different types of plastic materials and that it is difficult to have the collected waste sorted and separated in the way needed for recycling. There are also problems with impurities and various additives to the plastic of chemicals that end up in the waste. A certain proportion of the plastic waste will therefore probably always need to go to incineration instead of recycling. An alternative in recycling is what is known as downgrading (see below)⁷³.

Trade in plastics waste in the EU and export of wastes outside the EU is very significant, which can largely be explained by inadequate capacity for recovery and waste incineration.

What is plastic?

The fundamental ingredient of plastic materials is *polymers*. Polymers in plastics consist of long chains of similar units (monomers) and are produced synthetically, generally with petroleum products as raw materials. There are a large number of different plastics with different properties. Most are what are known as thermoplastics, which can be recovered relatively easily from pure fractions, but some plastics can only be recovered through the polymer being broken down into its constituents and these then being polymerised again (feedstock recycling).

Recovery can be complicated by the fact that plastics waste may consist of several different types of plastic, which may be difficult to separate from one another. Another problem is that the waste may contain hazardous substances that are not wanted in the recovered product. If the recycled material contains impurities or if the quality of the polymer is lower than in virgin material, this may lead to that the recovered material cannot be used in qualified uses but only in simpler applications, for example as a filler. Such downgrading is common in the use of recovered plastic.

The SPI labelling for the identification of plastics which has been introduced by the plastics industry (a triangle of arrows with a digit in the middle) contains six fundamental types of plastic:

1. Polyethylene terephthalate (PETE, PET)
2. High-density polyethylene (HDPE)
3. Polyvinyl chloride (PVC)
4. Low-density polyethylene (LDPE, LLDPE)
5. Polypropylene (PP)
6. Polystyrene (PS)
7. Others (acrylic plastic, nylon, polycarbonate etc.)

Additives in plastics

Some plastics are pure and consist only of the pure polymer with few or no additives. This applies in particular to plastic for packaging. However, many plastics contain large quantities of additives, which serve different functions. Some are needed for the production of the polymer, others to give the plastic desired properties. Examples are plasticisers, flame retardants, stabilising agents, antioxidants, foaming agents and antibacterial substances (biocides). Additive may also be dyes, fillers (e.g. talc) and reinforcing substances (e.g. glass fibres, carbon fibres).

⁷³ Cf. for example Hopewell, Dvorak, Kosior: *Plastics Recycling: Challenges and Opportunities*, Phil. Transactions of the Royal Society 2009. Available at <http://rstb.royalsocietypublishing.org/>.

The additives are generally not chemically bound to the polymer but are present in pure form in the material. This means that the substances often migrate and can leach out, so that humans and the environment may be exposed. The additives can occur at very high levels in the plastic materials. This applies in particular to flame retardants and plasticisers, which can account for 70% of PVC plastics. Fillers and reinforcing agents may also occur at high levels, while other additives are present in lower concentrations (from a fraction of a per cent to a few per cent with regard to organic substances).

Additives in plastics with hazardous properties are a great problem with regard to bringing about a non-toxic environment. The polymer in itself more rarely has hazardous properties⁷⁴, but it may contain impurities, for example in the form of remaining monomers that are reactive and have hazardous properties. An example much discussed at present is bisphenol A, which is used for the manufacturing of polycarbonate and epoxy plastics. Studies also show that small plastic particles (“micro-plastics”) may be harmful to living organisms. These may be intentionally produced but may also arise in mechanical breakdown of plastics waste. The issue is chiefly discussed in connection with pollution of the marine environment with plastics⁷⁵.

A Norwegian/Danish study⁷⁶ has identified 43 substances of very high concern that occur or have occurred as additives in plastics. These are substances that are either on the candidate list in REACH as a substance of very high concern or on the Norwegian prioritisation list for hazardous substances. Examples of substances are short- and medium-chain chloroparaffins, phthalates such as DEHP, brominated flame retardants, bisphenol A, cadmium and lead compounds, nonylphenol, arsenic compounds, organotin compounds and triclosan.

Additives in plastics used today

The additives in plastics with properties hazardous to human health and the environment that have been identified in the Norwegian/Danish study can evidently pose problems in the management of plastic waste, for example in incineration or landfilling of the waste. In the recycling of plastics there is also a need to take a position on whether impurities in the form of additives with hazardous properties require special measures. Many additives used previously are no longer allowed to be used in new materials but may be present in plastic waste for a long time into the future. This applies in particular to plastics with a long service life, for example those used in building products. Examples are ozone-depleting substances (freons) and pigments containing cadmium, lead or chromium.

It can be discussed whether the presence of hazardous substances in plastic waste is a transient problem which is due to additives that are no longer used but that remain in waste during a transitional period. Many of the additives mentioned in the study certainly still occur

⁷⁴ A review of the registration requirements in REACH was carried out by the European Commission in 2012. In the report on which the review was based it was found (section 4.3) that polymers relatively often are classified for hazardous properties, in particular allergenic but also environmentally hazardous properties and serious harm to human health (CMR). Despite great uncertainty with regard to the underlying data, it was concluded that around 50% of all polymers ought to be classified as hazardous to the environment and public health. The report did not consider additives in plastics (except for those contained in the polymer). See http://ec.europa.eu/enterprise/sectors/chemicals/documents/reach/review2012/registration_requirements_en.htm. Problems in waste management may arise in the incineration of certain plastics, for example chlorine-containing PVC.

⁷⁵ See for example <http://www.imo.org/MediaCentre/PressBriefings/Pages/36-microplastics-gesamp.aspx>

⁷⁶ Norwegian Climate and Pollution Agency: Hazardous substances in plastic materials, TA 3017/2013. See <http://www.miljodirektoratet.no/old/klif/publikasjoner/3017/ta3017.pdf>.

in plastics, however, or have been replaced by others that may also have hazardous properties. To obtain a picture of additives used in plastics today, data on what chemicals go to plastics production have been compiled for this report from the Swedish Chemicals Agency Products Register. The figures are presented in two tables⁷⁷.

Table 1 below shows how many substances with properties hazardous to health occur in different types of plastic that were registered in the product register in 2012. The table shows in the first columns the number and volumes of such substances as have been registered for use in a particular type of plastic and that are carcinogenic, mutagenic or toxic to reproduction (CMR). Only substances that occur at levels necessitating hazard classification are included (>0.1%). The subsequent columns show the numbers and quantities of substances with some form of hazard classification and all substances that have been registered (classified and non-classified)⁷⁸.

⁷⁷ The figures in the tables relate to notifications to the products register in 2012. Notifications to the register have to be made by all who manufacture or import substances in volumes in excess of 100 kg. Erik Diurlin at the Swedish Chemicals Agency Products Register assisted with preparation of the tables.

⁷⁸

- The substances in the table are taken from notifications to the Products Register under Chapters 39 and 40 in the Annex to the Ordinance (2008:245) on chemical products and biotechnical organisms.
- Only substances in thermoplastics are included. Notifications for the following uses have been separated out: Acrylate polymers, styrene-butadiene rubber (SBR), carbamide plastics, polyesters, rubber (unvulcanised), polyethers, alkyd resins, phenol plastics, natural rubber, silicones, melamine plastics, butadiene rubber (BR), synthetic rubber, others, nitrile-butadiene rubber (NBR), amino plastics, chloroprene rubber (CR), fluorine-containing polymers, isoprene rubber (IR, IIR, IIR, BIIR).
- Classification with regard to hazard means both self-classification and harmonised classification.
- Substances are individual substances (CAS number) for the type of plastic concerned. The same substance may occur in more than one type of plastic.
- No sifting-out of substances deemed to be of less interest has been done in Table 1 (compare Appendix 1, where such processing has been done).

| Type of plastic/polymer | CMR substance (>0.1%) | | All substances with classification | | All substances regardless of classification | |
|---|-----------------------|----------------------|------------------------------------|----------------------|---|----------------------|
| | Volume (tonnes) | Number of substances | Volume (tonnes) | Number of substances | Volume (tonnes) | Number of substances |
| PO, Polyolefins, other | 78730 | 21 | 81300 | 91 | 152 804 | 197 |
| PE, Polyethylene (PEHD, PELD) | 34629 | 38 | 45879 | 150 | 931 720 | 357 |
| PP, Polypropylene and co-polymers | 7085 | 15 | 8410 | 52 | 123 499 | 116 |
| PVC, plastified | 3097 | 34 | 28323 | 116 | 34 866 | 194 |
| PA, Polyamides | 3206 | 30 | 12780 | 118 | 29,137 | 313 |
| Other vinyl polymers or vinylacetate, vinylalcohol polymers | 15309 | 24 | 41235 | 116 | 63 928 | 252 |
| PS, Polystyrene and co-polymers | 10744 | 28 | 21211 | 155 | 135 973 | 342 |
| ABS Acrylonitrile, butadiene and styrene polymer (ABS) and co-polymer | 1332 | 8 | 1927 | 37 | 16 197 | 73 |
| PVC, non-plastified | 125 | 8 | 235386 | 13 | 235 436 | 22 |
| Halogenated olefins, other | 2026 | 15 | 10028 | 94 | 15,833 | 161 |
| PC, Polycarbonate | 9 | 7 | 65 | 29 | 20 043 | 73 |
| PET, Polyethylene terephthalate | 10 | 8 | 13 | 17 | 35,747 | 43 |
| PMMA, Polymethyl methacrylate | 7 | 25 | 235 | 98 | 733 | 173 |
| PVC, co-polymers | 9 | 4 | 94 | 20 | 208 | 50 |
| PIB, Polyisobutene | 2 | 5 | 745 | 16 | 1 672 | 22 |
| Total | 156 321 | 117 | 487631 | 546 | 1 801 000 | 1552 |

Table 1. Hazardous substances in plastics according to the Swedish products register.

Appendix 1 contains a selection of the most commonly occurring substances according to the products register with information on any CMR classification and total quantities.

Data in the tables relate to Swedish conditions and cannot provide a complete picture of which additives are used today and for example enter the country in the form of finished articles of plastic. It can be concluded from the tables, however, that substances of very high concern are still present in large quantities in plastic materials. From a life-cycle perspective there must be a willingness to deal with these problems when the plastic is recovered.

Is plastics a substance?

In the context of waste, plastic is often referred to as a “material”, without any further specification. To assess in what way the chemicals legislation is applicable, however, a position must first be adopted on whether the plastic is a chemical product or not (substance or mixture⁷⁹). With regard to recovered plastic this applies when the recovery has gone so far that the plastic can no longer be regarded as waste (waste according to REACH is not to be regarded as a substance, mixture or article). Plastics waste ceases to be waste when the material has been recovered and EoW criteria are found to be fulfilled (if such criteria exist)

⁷⁹ For the following, see section 5.2.1 above and the ECHA guidance on recovered substances (footnote 14), in particular Appendix 1 section 1.5.

or when the recovery procedure has been fully implemented and it can be noted that the criteria in the definition of waste are not otherwise met (cf. section 5.5).

When the recovered plastic material is no longer waste, it can be regarded as a chemical substance (substance or mixture), but it can also change directly from being waste to being an article. When this takes place it is no longer relevant to apply the rules of chemicals legislation on chemical products. For example, plastic waste that contains a particular quality can be directly melted and moulded into a plastic product that meets the criteria to be an article, i.e. shape and design appear more important than chemical content. The material then never becomes a chemical product.

If, on the other hand, the recovered plastic ceases to be waste but takes on the form of an intermediate product (e.g. plastic granules), the rules on chemical products become applicable to the product. A plastic polymer is a chemical substance in the application of chemicals legislation. By definition, additives to the chemical substance that are necessary for the stability of the substance and impurities from the manufacturing process are seen as part of the substance (definition of substance in REACH Article 3(1)). Intentional additives that serve purposes other than stabilising are separate substances and are thus not to be regarded as part of the polymer. This is conditional on them not having reacted chemically with the polymer and having become part of it. Plastic material in the form in which it is manufactured and placed on the market (for example as granules or powder) is thus often a mixture of several different substances. The polymer is one of these substances.

Recovered plastic (polymers) which is no longer waste may contain impurities in the form of various additives that were present in the original plastic material but that do not fulfil any desired function in the recovered material. Impurities may also have occurred as a result of difficulties when managing the waste to separate other materials that were present in a complex article (e.g. electronic products with many different materials, printing inks and packaging). According to the definition of substance, impurities are regarded as part of a substance if they occur at levels of no more than 20% (section 5.2.6). Impurities in a recycled plastic polymer are thus according to the ECHA guidance, always considered to be part of the polymer if they do not exceed this percentage level⁸⁰. If, on the other hand, an additive is deliberately recovered, it is to be regarded as a separate substance under chemicals legislation. The same applies if an impurity is present at a higher level than 20%.

In application of the rules on chemicals (REACH/CLP, but also the Swedish Environmental Code), recovered plastics are thus usually to be regarded as mixtures of substances: the polymer and additives other than stabilisers (the latter belong to the polymer, even if they are not chemically bound to the polymer). Impurities in the material up to 20 % can be regarded as part of the polymer.

Registration in REACH

With regard to the requirement for registration under REACH, polymers need not be registered if the monomer from which the polymer is constructed has been registered under REACH further up the supply chain concerned (REACH Article 6(3))⁸¹. If this has not been

⁸⁰ ECHA: Guidance for monomers and polymers, version 2.0, April 2012.

⁸¹ Cf. concerning application of REACH the ECHA guidance: Guidance for monomers and polymers, version 2.0, April 2012. The exemption from registration requirements in REACH has been discussed in a report, which did not, however, lead to any amendment proposal from the Commission (see the communication COM(2013) 49 final).

done, the manufacturer or importer of the polymer must register the monomer contained (Article 6(3)). A corresponding requirement applies to such additives as are chemically bound to the polymer and are therefore regarded as part of it. This is of significance with regard to imported polymers, where the contained monomer and any additive have not been registered in the EU in the supply chain⁸². The requirement for registration applies if the content of monomer or additive is 2% by weight of the polymer.

Article 6(3) is in principle also applicable to recovered plastics. If the plastic that is recovered was originally manufactured in the EU, the monomer normally has to have been registered in the EU under REACH. The exemption from registration requirements in Article 6(3) then becomes applicable. Otherwise (for example if recovery takes place from imported plastic waste), the recycler under this provision in principle has to register the monomer from which the polymer is constructed. An comparable situation applies to chemically bound additives in the recovered plastic, unless these can be regarded as impurities attributable to the polymer.

These rules are not written with recovered materials in mind, and may evidently be difficult or impossible to apply to recycled plastic, at least if the waste consists of a mixture of plastics that originally come from different directions. A way out, however, comes in Article 2(7), in form of the far-reaching derogation from the requirements for registration for recovered substances. Registration is not required if the following conditions are met:

- the plastic material has been recovered within the EU,
- the substance recovered is the same as a substance already registered according to REACH,
- the information on the substance required in the form of safety data sheets etc. is available to the recycler.

The substance must thus have been recovered within the EU for the derogation to be applicable. This does not rule out importing into the EU of substances in recovered materials, but some form of control and examination of the recovered material must have taken place within the EU after importing. This is thus seen as sufficient for the material to be regarded as having been recovered within the EU. It is mentioned as an example in the guidance on waste and recovered materials that control requirements in accordance with applicable EoW criteria have been met (point 2.3 of the guidance)⁸³. In addition, the recycler must have access to safety data sheets or other information in a supply chain for the substance(s) concerned (in practice additives in plastics with hazardous properties) to cite the derogation. However, there is no rule giving the recycler the right of access to this information.

Note that the derogation is not conditional on the substance/material having been registered previously in the same supply chain: it is sufficient for someone in any supply chain to have registered the same substance. The problem of what is to be regarded as “the same substance” has been discussed in the report (sections 5.2.6 and 7.2).

⁸² Cf. European Court of Justice judgment of 7 June 2009 in case C-558/07, where this rule is questioned with regard to imported polymers. The court did not find reason to reject the provision.

⁸³ This application of the provision means that the imported material is to be regarded as waste that is not finally recovered, and that the requirements of waste legislation must be met by the importer. After "recovery" (i.e. control), the material can normally be regarded as a chemical product if the other criteria are met for when a material ceases to be waste (section 5.5). If the material on importing into the EU is not designated as waste but as a product, the registration obligation applies under REACH, as the derogation for polymers in Article 6(3) normally cannot be applied and neither is Article 2(7)(d) applicable.

If registration is to take place, this is to be done when the material has been recovered, provided it is no longer to be regarded as waste. The recovery is regarded as manufacturing and consequently gives rise to an obligation to register under REACH. Taken together, however, the rules mean that recovered substances in plastic materials in practice rarely or never need to be registered under REACH. This does not, however, mean that the recycler does not have any responsibility for the contents of the recovered product.

Classification and information requirements according to REACH/CLP

Although substances in recovered plastic ought rarely to need to be registered, this does not mean that the recycler is freed of responsibility for handling hazardous substances in the plastic material. A recycler who acts as a supplier of a substance has to supply safety data sheets etc. to professional users according to the same rules as apply to suppliers of virgin substances (cf. section 5.2.2), if the substance or mixture has hazardous properties. Even if a safety data sheet is not required, the recycler has to provide “any other available and relevant information about the substance that is necessary to enable appropriate risk management measures to be identified and applied” (REACH Article 32(1)(d)).

If the recovered plastic material is identical to a virgin material, the recycler can often utilise and without amendment pass on the information contained in safety data sheets for substances in the virgin material (if such substances exist) or other information to which the recycler has access as an element of application of Article 2(7)(d) of REACH. According to the ECHA guidance a number of requirements are imposed on the recycler, who must

- take account of the fact that additives that are deliberately recovered or impurities at levels of more than 20% are to be regarded as separate substances in the mixture,
- check that the substances in the mixture/plastic material have actually been previously registered, so that it will be possible for Article 2(7)(d) to be referred to,
- check whether the recovered material contains hazardous substances that are not present in virgin material and that mean that the plastic material/mixture is to be regarded as hazardous (in practice that the substance is present at levels of more than 0.1% in the material for a number of hazardous properties),
- check that the recommended use of the recovered materials falls within the uses that have been risk-assessed according to the exposure scenario in the registration for the substances in the virgin material.

This is dependent on the recycler having very good detailed knowledge of what the recovered material contains. If the recovered material is to be identical to virgin material or is to have other areas of use than those that have been assessed in previous registrations, new safety data sheets may, for example, need to be prepared or existing sheets may need to be modified.

If the material fulfils the proposed EoW criteria for recovered plastic (section 5.4.5, the proposal for criteria has not been implemented), it is clear that the material does not have hazardous properties, and this problem normally does not need to be highlighted.

Authorisation under REACH

Discussion has taken place in the context of REACH on the requirement for authorisation of recovered substances⁸⁴. The plastic industries has pointed to the difficulties faced by all recyclers in applying for authorisation for recovered plastics, which may contain a large number of different additives (plasticisers, dyes etc.) that are no longer authorised due to their hazardous properties. There is therefore a wish for some form of derogation from authorisation. There is an option under REACH to exempt uses from the authorisation requirement (Article 58(2)), but provided that “on the basis of the existing specific Community legislation the risk is properly controlled”. It is unlikely that the exemption could be applied generally to recovered material, nor has it been applied in such a way to date.

Additives in plastics often have properties that mean that they are assessed as substances of very high concern, which have to be specially authorised under REACH. As has been mentioned, a large number of such substances appear on the candidate list for authorisation. The first substances to come up for authorisation under REACH are the phthalates DEHP and DBP, which are used in large quantities as plasticisers in PVC. DEHP has been risk-assessed previously under the EU's rules on chemicals and is banned for a number of uses (toys, medical devices, food packaging etc.). The same applies to DBP. Authorisation under REACH of remaining uses is becoming very important and will take place in 2014.

A number of users of DEHP/DBP in virgin materials have applied for authorisation for general use in PVC (except for uses that are now prohibited)⁸⁵. Two users have applied for authorisation for recovered PVC material containing up to 20% DEHP. The intention, according to the applications, is to recover PVC and not DEHP, but it is difficult to avoid DEHP in the PVC that is recovered. The fact that the plasticiser is still present may also facilitate use of the recovered material in plasticised PVC.

The recyclers evidently consider that the material that is recovered is no longer to be regarded as waste but as a chemical product covered by REACH. In the absence of EoW criteria for plastic (section 5.4.5) this does not appear to be a self-evident conclusion, particularly about a material about which there is no complete knowledge of contents (section 5.5, recovered plastic containing DEHP could not, however, fulfil the EoW criteria). This case also highlights fundamental issues regarding whether recovered materials are to be treated differently than virgin materials in application of the chemicals legislation. It is therefore of great interest for the issues discussed in this report.

Rules on plastics in articles

Almost all rules on articles (section 5.6) are focused in one way or another on plastics, which can be largely explained by the widespread use of plastics in articles and the need to limit the use of hazardous substances in consumer products. Some aspects of interest in a life-cycle perspective in the rules on articles with regard to plastics are summarised below.

- *Bans on use of certain additives in plastics*

⁸⁴ Verbal information from Lars Gustafsson, KemI. Registration of the substance can generally be avoided (see above).

⁸⁵ <http://echa.europa.eu/addressing-chemicals-of-concern/authorisation/applications-for-authorisation-previous-consultations>

Rules that restrict or ban the use of CMR substances (e.g. in toys) or heavy metals (e.g. in packaging) often affect the use of additives in plastics. Special rules on restrictions of substances used as additives in plastics are found for example in REACH (Annex XVII) and in RoHS (certain flame retardants). The rules on food packaging of plastic contain complete regulation of which polymers and additives may be used.

These rules apply without distinction between virgin and recovered materials. Recovered plastics must thus fulfil the same requirements as newly manufactured plastics. Some exceptions to this principle of equivalence are described in this report. One example is cadmium in recovered PVC.

- *Requirements for recovery processes*

One way of ensuring that recovered plastics do not have hazardous properties is to specify requirements for the recovery process. Such requirements may apply to the purity of the materials that constitute input to recovery, i.e. requirements for separated waste streams or requirements for the sorting of mixed waste. With regard to plastic for food packaging, very strict requirements are set in the regulatory framework for recovered plastic to be allowed to be used (section 5.6.5). PET plastic is the type of type of plastic where recovered material is used. PET bottles are collected in separate collection schemes (often deposit schemes), which means that the raw material for recovery is relatively pure. In addition, each individual process for recovery must have separate approval at EU level. Despite these requirements, there is still intense debate on the risks to health in use of certain plastics in food packaging, particularly the risk of endocrine disruption⁸⁶.

The proposal for EoW criteria for plastics (section 5.4.5) also contains certain requirements for the material used as raw material for recovery not to be allowed to contain extraneous substances above specified levels. The criteria also state that the recovered material must not have hazardous properties, but do not specify which recovery process is to be used. The criteria have not been decided.

The directives on waste streams (section 5.6.2) contain some simple rules on the treatment of waste, principally requirements for components containing hazardous substances to be dismantled and managed separately. For example, plastics containing brominated flame retardants are always to be removed in the treatment of electronic waste⁸⁷.

- *Information requirements*

The labelling of articles of plastic with a triangle containing a number (SPI labelling) is not mandatory and statutorily regulated. The requirements for the labelling of plastic articles are otherwise limited, but some labelling may be required under the directives on waste streams and rules on food packaging (section 6.2.1). As plastics may contain substances on the candidate list under REACH, the information requirement for substances of very high concern in articles under Article 33 of REACH is of particular interest (section 5.2.2). This legislation is unique in giving consumers a special right to receive information from supplies about any content of a substance of very high concern in an article⁸⁸.

⁸⁶ Cf. <http://www.foodpackagingforum.org/>.

⁸⁷ Directive 2012/19/EU, Annex VII.

⁸⁸ There is a form to request such information at the Swedish Chemicals Agency's website, see <http://www.kemi.se/sv/Innehall/Lagar-och-andra-regler/Reach/Kandidatfor-teckningen-i-Reach/>.

Classification of plastics waste

It is of crucial importance to the management of plastic waste how the waste is classified according to the EU's waste list and under the Basel Convention. Whether the waste is classified as hazardous waste is particularly important. This is of significance to what requirements are set for waste management (what authorisations are needed etc.) but also what restrictions apply with regard to waste movements (see sections 5.4.3-5.4.4).

It can be indicated in the EU's waste catalogue⁸⁹ (with an asterisk) whether a particular category has hazardous properties. Each type of waste has a six-digit number. In some cases there are two entries in the catalogue, depending on whether the type of waste has hazardous properties or not. In such cases the waste should be classified as hazardous if it cannot be shown (by chemical analysis or in some other way) that the waste does not have hazardous properties⁹⁰.

Plastic waste is principally characterised in the waste catalogue as non-hazardous waste. This applies for example to plastic waste from organic-chemical processes (07 02 13, additives may, however be hazardous waste according to 07 02 14). The same applies to plastics shavings and turnings (12 01 05), pure plastic packaging (15 01 02), plastic not stated under another heading (16 01 19), plastics that have arisen in the treatment of waste (19 02 04) and plastics in household waste (20 01 39). With regard to construction and demolition waste, however, there are dual entries, firstly for plastic (17 02 03) and secondly for glass, plastic and wood containing or contaminated with dangerous substances (17 02 04*). With regard to construction and demolition waste, whoever handles the waste must thus make an assessment and analysis of whether the waste has hazardous properties.

Other classification lists, coming from the Basel Convention, apply in some cases in the application of the rules on transport in Regulation (EC) No 1013/2006. This is of particular significance for application of the ban on exports of hazardous waste to non-OECD countries. Pure waste fractions of the most common types of plastics may be exported, but they must not be halogenated and contain, for example, brominated flame retardants⁹¹.

⁸⁹ The EU's waste list is in the process of being reviewed and amended. However, the review is expected primarily to lead to adaptation to the terminology of new chemicals legislation (CLP), and not to major substantive changes.

⁹⁰ Swedish Environmental Protection Agency guidance: Klassning av farlig avfall – detta är farligt avfall (Classification of hazardous waste – this is hazardous waste), 2013.

⁹¹ Annex III, part 1, list B of the EU Regulation, corresponding to Annex IX of the Basel Convention.

Appendix 1: Substances occurring in plastics according to the Swedish Chemical Agency's Products Register

| CMR substance | CAS No | Acronym | Name | Amount (ton) | Plastic type |
|---------------|-------------|---------|--|---------------|---|
| | 166412-78-8 | DINCH | 1,2-Cyclohexanedicarboxylic acid, diisononyl ester | > 10000 | PVC (alternatives to DEHP, DINP) |
| | 53306-54-0 | DPHP | 1,2-Benzenedicarboxylic acid, bis(2-propylheptyl) ester | > 10000 | PVC |
| ** | 2768-02-7 | | Silane, ethenyltrimethoxy- | 1000 - 10 000 | Plastic, unspecified |
| * | 1309-64-4 | | Antimony oxide | 100 - 1000 | ABS, PMMA, PA, PP, PE, PVC, Thermoplastic polyester |
| * | 117-81-7 | DEHP | 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester | 100 - 1000 | ABS, PMMA, PS, PVC, Thermoplastic polyester |
| | 28553-12-0 | DINP | 1,2-Benzenedicarboxylic acid, diisononyl ester | 100 - 1000 | PVC |
| ** | 68515-48-0 | | 1,2-Benzenedicarboxylic acid, di-C8-10-alkyl esters, branched, C9-rich | 100 - 1000 | PVC |
| ** | 3319-31-1 | TOTM | 1,2,4-Benzenetricarboxylic acid, tris(2-ethylhexyl) ester | 100 - 1000 | PVC |
| ** | 103-23-1 | DEHA | Hexanedioic acid, bis(2-ethylhexyl) ester | 100 - 1000 | PVC-film, PUR, Rubber |
| ** | 6683-19-8 | | Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, 2,2-bis[[3-[3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl]-1-oxopropoxy]methyl]-1,3-propanediyl ester | 100 - 1000 | EPDM, PA, PE, POM, PP, PUR, PVC |
| ** | 128-37-0 | BHT | Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl- | 100 - 1000 | ABS, PE |
| | 31570-04-4 | | Phenol, 2,4-bis(1,1-dimethylethyl)-, phosphite (3:1) | 100 - 1000 | EPDM, PA, PE, PC, PP |
| ** | 96-69-5 | | Phenol, 4,4'-thiobis[2-(1,1-dimethylethyl)-5-methyl- | 100 - 1000 | HDPE, LDPE, PP, ABS, PVC, PUR, EPDM elastomer |
| | 2082-79-3 | | Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, octadecyl ester | 100 - 1000 | ABS, EPDM, PA, PE, PC, PP, PS, PUR |
| ** | 68937-41-7 | TIPP | Phenol, isopropylated, phosphate (3:1) | 10 - 100 | PS, PVC, Epoxy resin, PUR |
| ** | 63449-39-8 | | Chlorinated paraffins | 10 - 100 | OP, PE, PP, PVC |
| ** | 1308-38-9 | | Chromium oxide | 10 - 100 | PVC, PE, PP |
| ** | 131-11-3 | DMP | 1,2-Benzenedicarboxylic acid, dimethyl ester | 10 - 100 | Thermoplastic polyester |
| | 13674-84-5 | TCPP | 2-Propanol, 1-chloro-, phosphate (3:1) | 10 - 100 | PUR, Polyvinylacetate, PS, PVC, PC, Epoxy resin |
| ** | 27138-31-4 | | Propanol, oxybis-, dibenzoate | 10 - 100 | PO |
| ** | 1332-07-6 | | Boric acid, zinc salt | 10 - 100 | ABS, EP, PE, PC, PP, PS, PUR, PVC |
| | 115-86-6 | TPP | Phosphoric acid, triphenyl ester | 10 - 100 | PVC, PC/ABS, PPO, Thermoplastic polyester, Phenol resin |
| ** | 119-47-1 | | Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl- | 10 - 100 | PS, PO, ABS, PP, Polyacetal, Rubber, latex |
| ** | 301-10-0 | | Hexanoic acid, 2-ethyl-, tin(2+) salt | 10 - 100 | Plastic, unspecified |

| CMR substance | CAS No | Acronym | Name | Amount (ton) | Plastic type |
|---------------|------------|---------|--|--------------|--|
| ** | 26523-78-4 | TNPP | Phenol, nonyl-, phosphite (3:1) | 1 - 10 | PE, HIPS, PC, ABS, PVC, SBR |
| ** | 8007-18-9 | | Antimony nickel titanium oxide yellow | 1 - 10 | Plastic, unspecified (pigment) |
| * | | | Organic tin compounds | 1 - 10 | PVC, plastic, unspecified (stabilisers) |
| * | 84-69-5 | DisoBP | 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester | 1 - 10 | PO |
| ** | 19372-44-2 | | Calcium, bis(2,4-pentanedionato-O,O')- | 1 - 10 | PVC (heat stabiliser), PA |
| | 84852-53-9 | | Benzene, 1,1'-(1,2-ethanediyl)bis[2,3,4,5,6-pentabromo- | 1 - 10 | PE, PP, ABS, HIPS, PA, PBT/PET, SAN |
| * | 79-01-6 | Tri | Ethene, trichloro- | 1 - 10 | PVC |
| * | 556-67-2 | | Cyclotetrasiloxane, octamethyl- | 1 - 10 | PDSM (polydimethylsiloxane silicone polymers) |
| ** | 136-53-8 | | Hexanoic acid, 2-ethyl-, zinc salt | 1 - 10 | PVC |
| ** | 12767-90-7 | | Boron zinc oxide (B6Zn2O11) | 1 - 10 | Plastic, unspecified |
| ** | 80-51-3 | | Benzenesulfonic acid, 4,4'-oxybis-, dihydrazide | 1 - 10 | Rubber, plastic (foam blowing agent) |
| ** | 53880-86-7 | MPTD | Thioperoxydicarbonic diamide, dimethyldiphenyl- | 1 - 10 | Elastomerer |
| ** | 136-52-7 | | Hexanoic acid, 2-ethyl-, cobalt(2+) salt | 1 - 10 | Plastic, unspecified |
| ** | 7576-65-0 | | 1H-Indene-1,3(2H)-dione, 2-(3-hydroxy-2-quinolinyl)- | 1 - 10 | ABS, PMMA ,PS, PVC, Thermoplastic polyester |
| ** | 6674-22-2 | | Pyrimido[1,2-a]azepine, 2,3,4,6,7,8,9,10-octahydro- | 1 - 10 | Plastic, unspecified |
| ** | 1330-78-5 | | Phosphoric acid, tris(methylphenyl) ester | < 1 | PVC, PS, PUR-foam |
| | 101-02-0 | TPP | Phosphorous acid, triphenyl ester | < 1 | PVC |
| ** | 98-29-3 | | 1,2-Benzenediol, 4-(1,1-dimethylethyl)- | < 1 | Plastic, unspecified |
| * | 84-74-2 | DBP | 1,2-Benzenedicarboxylic acid, dibutyl ester | < 1 | PP, PVC |
| ** | 68511-62-6 | | Nickel, 5,5'-azobis-2,4,6(1H,3H,5H)-pyrimidinetrione complexes | < 1 | ABS, PA, PE |
| ** | 136-51-6 | | Hexanoic acid, 2-ethyl-, calcium salt | < 1 | Plastic, unspecified |
| ** | 128-80-3 | | 9,10-Anthracenedione, 1,4-bis[(4-methylphenyl)amino]- | < 1 | ABS, PMMA, PA, PC, PS, Thermoplastic polyester |

* = CMR 1 or 2, harmonized classification. ** = CMR 1 or 2, notified classification.

Comments to the table:

The substances are derived from a list of 2 598 registered substances used in sectors assessed as relevant (SNI codes C20.16, C20.17, C22.1, C22.2). 1 018 of these substances were classified with regard to hazardous properties. 385 were classified as CMR cat. 1 or 2 (ECHA, Classification & Labelling Inventory).

CMR substances in concentrations below 0.1 % were sorted out (limit for classification and obligation for safety data sheet).

A number of substances were discarded as less relevant to an assessment of additives:

- Polymers
- Inorganic high volume substances (carbon black, zink oxide, talc, glass, limestone, titanium oxide, calcium carbonate, silicon dioxide)
- Substances that are hardeners, monomers or cease to exist after reaction (57-13-6, 107-13-1, 9016-87-9, 101-68-8, 75-35-4, isocyanates etc.)
- Mineral oils

The following 12 substances have been included in the table due to high volumes or structure similarity with CMR substances: 166412-78-8, 53306-54-0, 28553-12-0, 31570-04-4, 2082-79-3, 13674-84-5, 115-86-6, 78-40-0, 57583-54-7, 78-42-2, 84852-53-9, 101-02-0.

A few substances reported by a small number of companies have been sorted out for confidentiality reasons.

Information on type of plastic in the right column is derived from the general literature and from studies of occurrences of hazardous substances in plastic.



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