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EU WASTE FRAMEWORK DIRECTIVE AND SCIP DATABASE FOR ABB ELDS

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Opinnäytetyö tehtiin toimeksiantona ABB Oy Distribution Solutions:lle. Teollisuudessa käytetään paljon erilaisia kemikaaleja. Vaaralliset kemikaalit ovat kiertotalouden kannalta hankalia, mutta Euroopan kemikaalivirasto ECHA on Jätedirektiivin puitteissa luonut SCIP-nimisen tietokannan helpottamaan jätteenkäsittelyä. ABB ELDS:llä on useita komponentteja, jotka sisältävät REACH SVHC kandidaattilistan aineita. Kaikki komponentit ja komponenteista koostuvat moduulit, joissa ylittyy 0,1 painoprosentin määrä vaarallista kemikaalia ovat velvoitettuja tulla viedyksi SCIP-kantaan.

Opinnäytetyössä arvioitiin SCIP-tietokannan yhteneväisyyttä kiertotalouden kanssa, sekä tietokannan sopivuutta ABB ELDS:lle. Opinnäytetyössä kerrotaan kyseisen bisnesyksikön materiaalitietojen keruusta, ja analysoidaan SCIP-tietokannan mahdollisia haasteita materiaalitietojen keräyksen puitteissa. SCIP-tietokantaa tutkittiin ECHA:n tarjoaman, verkossa olleen prototyypin kautta.

Opinnäytetyössä todettiin, että ABB ELDS:llä on täydet valmiudet ottaa SCIP-tietokanta käyttöön ilman suurempia toimenpiteitä. Materiaalitietojen keräys on ollut toiminnassa jo useita vuosia, joten varsinaisesti mitään uutta ei ole sen suhteen tiedossa. Tiedot on ainoastaan nyt raportoitava eteenpäin jokaisesta komponentista, joka ylittää 0,1 painoprosentin määrärajan jonkin listatun vaarallisen aineen kohdalla. SCIP-tietokanta otetaan käyttöön kolmannen osapuolen tarjoaman ohjelmiston lisäosana, jonka kautta tiedot on vaivatonta saattaa jätteenkäsittelijöille.

Avainsanat Kiertotalous, REACH, SCIP, Jätedirektiivi, ABB ELDS

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ABSTRACT

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This thesis was assigned by ABB Oy Distribution Solutions. Many chemicals are used in industries. Hazardous chemicals are problematic in terms of circular economy but in accordance with the Waste Framework Directive, ECHA has created a SCIP database to make waste management easier. ABB ELDS has several components that contain chemicals from the REACH SVHC Candidate list. All components and modules that contain hazardous chemical more than 0.1 % weight by weigh are obligated to be notified into the SCIP database.

This thesis assessed the compatibility of SCIP database with circular economy, and the suitability of the SCIP database into ABB ELDS' component library process. The thesis explains the material compliance collection process and analyses the challenges in such process. The SCIP database was studied with ECHA's prototype of the SCIP database.

The thesis concludes that ABB ELDS meets all the needed software and information requirements to start making successful SCIP notifications. Material compliance data collection has been going on for years so no significant changes are ahead. Now the collected compliance data need to be reported forward, which concerns all the non-compliant articles and complex objects. The SCIP database will be taken into use as a SCIP module provided by a third-party company in addition to their software tool; it makes the burden of notifying articles and complex objects significantly easier and faster and saves up resources.

Keywords	Circular economy, REACH, SCIP, Waste Framework Directive, ABB ELDS

CONTENTS

ABBREVIATIONS

AVL – Approved vendor list

ECHA – European Chemicals Agency

ELDS – ABB Electrification Products, Distribution Solutions business unit

FMD – Full Material Declaration

IEC – International Electrotechnical Commission

IUCLID – A software to record, store, maintain and exchange data on intrinsic and hazard properties of chemical substances

REACH – Registration, Evaluation, Authorisation and Restriction of Chemicals

RoHS – Restriction of Hazardous Substances

SCIP – Substances of Concern In articles as such or in complex objects (Products)

SVHC – Substances of Very High Concern

WFD – Waste Framework Directive

WTO – World Trade Organisation

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1 INTRODUCTION

All our everyday items, furniture, computer screens and clothing are made from a mixture of chemicals. Circular economy is about recycling materials – the way of using, re-using, and disposing these materials, minimizing water, and making the most of the available resources within and around those processes. Setting risks to the environment and to humans should be avoided, so the use of hazardous chemicals in products ought to be reduced throughout their entire life cycle. However, while our society becomes increasingly sustainable and moving closer towards a circular economy, the longer the chemicals are staying in use and making it increasingly difficult to remove those that are causing trouble within the life cycles of the products. /19/

In order to provide innovative and safe alternatives, promoting clean material cycles and reducing hazardous chemicals throughout the life cycle of a product, the EU has taken some serious actions towards just that. There are set obligations by the European chemical legislations, but they also provide incentives for industries to replace hazardous substances with less dangerous ones. Recycling is made easier by producing better materials without the hazardous chemicals. Manufacturing cleaner materials also preserves the environment, and it is the key to creating a working circular economy. Investments and innovations of safer alternatives increase the competitiveness of the European industries on the international market by showing of becoming more ecological and making the waste and chemical handling traceable and more transparent. /19/

The way we take care of handling chemicals needs to be consistent with the way we handle waste. Providing information for everyone concerning the life cycle of the product, especially on where hazardous chemicals end up, is the key to thriving circularity. When assembling and importing goods within the EU, there are several set legislative aspects that need to be taken into consideration. The Waste Framework Directive acts as the most significant driver for such legislation aspects. The EU has published a prototype of a new database called SCIP, which is aimed for consumers and waste operators to gain information about dangerous chemicals in certain products. One of the goals of the database is also to encourage substitution of dangerous chemicals and assist consumers in making safer choices. /19/

1.1 Background

As of the 5th of January 2021, all EU producers and assemblers, importers, and distributors and other actors who place articles on the EU market have the obligation to report data about articles and complex objects that contain substance(s) of concern (SVHCs) 0.1 % weight/weight of the article. The reporting of such chemicals in complex objects and articles will be put into practice through the SCIP database launched under the Waste Framework Directive. This obligation also concerns ABB, which makes the topic of this thesis important for the company, and therefore this research paper was assigned by ABB Oy Distribution Solutions. /17/

The upcoming challenges lie within the large amounts of reportable data, which include a vast amount of varying types of products, and nearly unlimited combinations of modules and components inside the products. In addition, additional challenges come from the large number of manufacturers and suppliers, which are scattered around the globe. This means that not all manufacturers and suppliers are covered by the EU legislation and restriction of chemicals, since most of them are located outside the EU. The compliance data need to be collected separately, since there are no set requirements in terms of reporting the data. The success of the data collection varies between manufacturers and suppliers, which itself may slow down the process of reporting chemical data of articles and objects to the SCIP database.

1.2 Aims and objectives

The main objective of this thesis is to introduce the SCIP database provided by ECHA for companies that supply articles and products containing SVHCs of more than 0,1 % weight by weight (later w/w); ABB ELDS being the main focus in the thesis. The aim of the database is to gather information about the articles in order to make waste treatment safer, easier and more efficient. The second objective is to discuss the implementation of the said database into the global component library at ABB ELDS.

1.3 Research questions

This thesis aims to answer to two main questions concerning SCIP database at ABB ELDS:

- What is the SCIP database and its working principle, and how it relates to circular economy?
- How the SCIP database could be implemented into the component acceptance process?

1.4 Critical Evaluation of the Availability of Literature

Since the SCIP database is a relatively new topic in the environmental evaluation community, and because the notification obligation has not yet started, there is not much research made about the topic. The available literature argues about the wording of the WFD’s section about the database and how there might be legal problems in terms of ‘revealing’ secret company data /43/. The literature can only speculate the effects on companies and the eventual effect of the database on the environment since nothing has yet been done. Therefore, most of the referenced information has been provided by environmental officials (e.g. ECHA), first-hand experience on the SCIP database prototype and user experience on the compliance data collection process at ABB ELDS.

2 ABB LTD

In terms of driving the digital transformation of industries, ABB is a global technology leader. While everything is steadily getting more and more digitalized, ABB aims to improve and develop new products, and meet the demands. Due to the ever-growing field of technology and digitalization, ABB is a large employer on both local and global scale. /1/

2.1 About the Company

ABB was founded through a merge, where two companies, ASEA of Sweden and Brown, Boveri & Cie of Switzerland, decided to become one in 1988. Nowadays ABB is a Swiss-Swedish multinational corporation, and the headquarters are located in Zurich, Switzerland. In Finland, G. Strömberg founded their electrical company in Helsinki in 1889. Over the decades, the company grew and started to gain global acknowledgement, and through the merges, ABB was founded. /1/

The innovations have continued over the 130-year period. ABB operates in over 100 countries globally and employs approximately 147 000 employees. In Finland, the number of employees is around 5 400, and they are scattered across 20 locations. The main locations are concentrated in Helsinki, Vaasa, Porvoo and Hamina. In terms of technology industries, ABB is one of the largest employers in Finland. /2/

One of ABB's goals in terms of environment is to reduce their environmental load by doing their part in taking care of their ecology and the environment in the communities and countries they work in. Their core business activity is to provide energy-efficient systems, services, and products. With their products, their customers can also decrease the load on environment and natural resources. Controlling the effect on environment is one of ABB's priorities in terms of business. For example, ABB is carrying out the environmental management system by applying the ISO 14001 -standard in all their systems. Environmental policies are essential part of ABB's commitment on sustainable development, and such policies are part of the strategies and daily business activity. /3/

2.2 Distribution Solutions

In terms of intelligent electricity networking, ABB is one of the leaders in the field. Distribution Solutions -business line in Finland develops, manufactures, sells, and markets protective relays for power distribution network. The products also include devices for industrial monitoring, controlling and automation. The Relion product line includes products for control, measurement, protection and supervision for ANSI and IEC markets. /7/

The working principle of the protective relay is that it detects a fault in the electric current, informs the further network about the fault, and when the fault is recognized, the relay disconnects the faulted part from the system, hence protects human lives and improves the trustworthiness of the electrical network. In addition to the production of the protective relays, the factory located in Vaasa also produces devices of control and monitoring for remote accessibility. They are broadly used in energy companies and industries in Finland. /7/

2.3 Environment Policies

What comes to environment and the importance of different impacts on it, ABB provides systems, services, and products that lessen their customers' environmental impacts. The business is not affected by this, and ABB has a large scale of focus points in terms of environment, including energy and climate, water, and right materials and their compliance. /4/

Regarding good governance, material compliance is a crucial part of it. Globally, stricter legal frameworks have been put into practice. This is compulsory for ABB as well. In practice it means that the use of hazardous substances in ABB products and processes need to be phased out. Furthermore, ABB expects their suppliers to actively support ongoing efforts to manage and demonstrate product compliance with regulations such as REACH, RoHS, and similar legislations. /5/

According to the official ABB Environment policy statement, they contribute to eco-efficiency and environmental stewardship in the communities and countries where they operate. The systems, products, and services ABB provides, enable the customers to lower their use of natural resources and energy. Environmental management systems that ABB applies include the standard ISO 14001 and promoting environmental responsibility along the value chain by encouraging everyone on the chain to adopt international environmental standards. /6/

ABB also carries out regular audits concerning the facilities' environmental performance and in connection with acquisitions, divestments, and merges. The declarations about the environmental performance concerning the core products of ABB are documented by publishing environmental product declarations based on life-cycle assessment. /6/

3 MATERIAL LEGISLATIONS, REGULATIONS, AND STANDARDIZED DOCUMENTATION

In terms of material documentation and its requirements, transparency of the used materials in products is the key. One of ABB ELDS' main values in terms of material compliance is that they aim to work with companies that have made contributions to sustainable development and are responsible economically, socially, ethically, and environmentally. In terms of legal requirements, ABB is responsible to ensure that the products are compliant with the requirements. In brief, the proper documentation of components used in products is required to prove the transparency. /8/

3.1 ECHA

European Chemicals Agency is a regulatory agency of the European Union and works for the safe use of chemicals. It manages the administrative and technical traits of the execution of REACH. Its main task is to implement the EU's legislation concerning chemicals, which in turn benefits human health, the environment and competitiveness across Europe. ECHA focuses on the most hazardous substances, and it helps industries, such as ABB, to comply with such legislation. However, regardless of ECHA being the main facet that sets the requirements, Finnish Safety and Chemicals Agency (Tukes), Ministry of Social Affairs and Health, and Ministry of the Environment are the facets that communicate and set the actual guides for the local industries. /15/

3.1.1 REACH

REACH is a regulation of the European Union and takes place under ECHA. The regulation has been created and widely used to protect human lives and environment from the risks that some chemicals may pose. It makes competition easier and stronger for EU chemical industries, and it is widely used to promote alternative methodologies for hazard assessments of substances. REACH applies to all chemical substances, both in industry and everyday life products. Under the REACH regulation lies the SVHC Candidate List which currently includes 209 chemical groups (see Appendix 1). This list updates twice a year so that the candidate chemicals may be added onto the list; the most recent candidate list was updated in July of 2020 and four new chemical groups were added to the list. The aim of this list, and the process behind it, is to substitute these chemicals eventually with ones that are not (as) harmful. In addition, the chemicals on the SVHC Candidate List may be put on the Authorisation list in the future. This means that industries are required to apply for permission in order to continue the usage of these chemicals that have been added to the Authorisation list. This list includes chemicals that are toxic for reproduction, mutagenic, carcinogenic, have respiratory sensitising properties and many other harmful effects on human life. /10, 11, 13/

The REACH regulation requires the manufacturer and/or the importer to recognise, measure and estimate the amount of SVHCs in the products and/or its parts. If the amount of SVHCs exceeds 0.1 % weight by weight in the product, the manufacturer and/or the importer is required to inform the delivery chain and the consumer to ensure the safe use of the product. However, the end user, usually the customer, of the product needs to be informed only when they ask for it. /10, 11, 13/

The way the SVHC list concerns ABB ELDS and other industries, too, is that the components and products should aim for compliance with the REACH regulation. Compliance in this instance means that information of the components is being collected from the suppliers and manufacturers. This information includes data about the chemical composition of the electrical component or mechanical part. If the part, mechanical or electrical, contains any SVHC substance over the threshold of 0.1 % w/w, the part is not compliant. There are companies that provide this service where this third-party company regularly collects compliance data from the suppliers for the manufacturing company, which is ABB ELDS in this instance.

While the REACH regulation itself does not bound companies by law, it still sets requirements in terms of chemical documentation and there are penalties for non-compliance with the provisions of REACH, and asks companies to check their legal obligations in relation to the safer use of their substances in use /11/. According to the Ministry of Environment, the goal for 2020 is to reduce the significant negatives effects of chemicals on health and environment. This thesis mainly focuses on REACH regulation, since the information for SCIP database only concerns the REACH SVHC Candidate list substances. /12/

Under REACH, there are two important definitions to be made in order to understand them in the context of this thesis and the SCIP notifying process:

1. article = "*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*" /34/. For example, a screw.

2. complex object = consists or is made up from more than one article, such as a circuit board module with components. /34/

3.2 RoHS

While REACH is a general regulation that addresses and controls all chemicals that might be used in the manufacturing process of the product (paints, solvents, coatings, etc.), RoHS restricts the substances that are currently present in electrical and electronic equipment, such as wiring, components, cabling, and sub-assembling. The basic principle that connects RoHS and REACH is that all the chemicals under RoHS are under REACH SVHC, but not vice versa. /16/

RoHS-2 New Substances (or RoHS 3) is the most recent directive that forbids the use of ten different chemicals and substance, but also gives out exceptions for certain types of industries. In terms of CE marking of products, RoHS 2 compliance is required. The original RoHS label is somewhat outdated because in order to use the CE marking, the product must be RoHS compliant. At ABB ELDS, the use of RoHS label is not currently relevant. The CE marking is an indication that authorised representatives and manufacturers of a product guarantee that the product fulfils the essential requirements that are set out in the germane EU regulations and directives. /16, 42/

Obviously, the RoHS marking becomes more important when delivering products outside the EU, which is when the CE marking does not apply. Different countries have their own RoHS directives, which may differ from the RoHS used across the EU. Some countries require more documenting, some require less. More often, the directives are usually the same with some changes and requirements. /21/

Table 1. Chemicals under RoHS 2 New Substances -list, the last four are the RoHS 2 addition. /40/

Substance	Concentration
Cadmium (Cd)	0.01 %
Mercury (Hg)	0.10 %
Lead (Pb)	0.10 %
Hexavalent chromium (Cr6+)	0.10 %
Polybrominated biphenyls (PBB)	0.10 %
Polybrominated diphenyl ethers (PBDE)	0.10 %
Bis(2-Ethylhexyl) phthalate (DEHP) (added in 2015)	0.10 %
Benzyl butyl phthalate (BBP) (added in 2015)	0.10 %
Dibutyl phthalate (DBP) (added in 2015)	0.10 %
Diisobutyl phthalate (DIBP) (added in 2015)	0.10 %

In terms of exemptions, several categories grant usage of certain chemicals for certain industries. This categorisation makes it easier for different industries to catch up with the limitations of certain substances (listed above in Table 1). ABB ELDS is part of the exception group 9, which includes industrial monitoring and control equipment. For example, lead in electrical industry is a challenging substance; it is widely used due to its great properties in soldering but is also on the REACH SVHC Candidate list. Lead also has a concentration limit of 0.1 % of the weight of the component or the product. Without exemptions, the products or the component can contain lead exactly 0.1 % w/w or less. Otherwise, it needs to be advised for customers per their request. However, with the RoHS exemption that includes category 9, aluminium alloys can contain lead up to 0.4 % by weight. This exemption expires on 21st of July 2024 and needs to be reapplied in order to get the exemption to continue the use of lead. /22/

When collecting compliance information from suppliers and manufacturers, the RoHS exemptions usually explain the non-compliances with certain parts and components; mostly containing lead in electrical industry. All the chemicals mentioned above are also on the SVHC Candidate List. If the RoHS exemption is applied and has not expired, the failed status of the REACH SVHC compliance data collection is acceptable. /22/

3.3 Third Party Company's Software Tool for Material Compliance Data Collection

A third-party company provides a software tool for material compliance data collection. ABB ELDS has purchased licences and the service in order to outsource the collection of RoHS and REACH SVHC compliance data from suppliers and manufacturers. ABB ELDS material compliance team gathers AVLs and BOMs of the products, and these lists are then sent to the third-party company. They contact these vendors in order to obtain compliance data, which commonly includes the most recent REACH SVHC candidate list compliance, RoHS compliance, and FMDs. FMDs are complete lists of the entire composition of a product, down to the homogenous level (see Appendix 2 for reference). /27/

In terms of material compliance, the FMDs are important and most desired lists, since with the FMD the REACH SVHC compliance data can be declared. For example, if the manufacturer/supplier only provides the FMD, the third-party company can calculate the percentages of hazardous chemicals from the information declared on the FMD. Then, depending on the result of the percentage calculation, the component is either REACH compliant or non-compliant; if the amount of hazardous chemical exceeds the 0.1 % w/w threshold, the component is non-compliant. The third-party company imports the compliance data into the software tool and are available for ABB ELDS material compliance team. /27/

In order to declare the compliance of a product, the supplier (or the vendor) needs to provide full information about the composition of the product or a certificate that states the compliancy or the non-compliancy. In some instances, the third-party company is unable to contact the vendor in order to receive information about the compliance or the contact is unwilling to send their data to a third party. This means that the product in question becomes escalated to the customer. Escalation obligates the ABB ELDS' material compliance team to solve the problem of why the compliance data collection failed, and then try to request for the compliance data themselves. Usually unresponsiveness is due to old contact information or the inability of the supplier/manufacturer to response to the request. If the supplier or manufacturer repeatedly fails to provide compliance data or is unresponsive regardless of being asked for data several times, the troublesome supplier or manufacturer can be deleted from the AVL. However, the third-party company still has the main responsibility in collecting the compliance data, ABB ELDS material compliance team helps only when necessary. /27/

The escalation of parts and components slows down the collection process significantly, and the compliance data are not always up to date. This is unfortunate because the REACH SVHC Candidate List updates twice a year, and some of the compliance data of the components in the library of the software tool can be years old. The large number of suppliers and manufacturers also affects the pace of the compliance data collection process. Even when the supplier or manufacturer is responsive, the reply can take up to months until the process of the collection is finished. This aspect will influence the SCIP notifying process that will be discussed later in this thesis. /27/

3.4 Standardized Technical Documentation

International Standards are widely recognised and accepted agreements about the technical descriptions of the characteristics of the product, service, system, or object in question. Regionally and nationally, they are widely adopted and applied into the manufacturing process, trade processes and organisations, consumers, laboratories for testing, governments, regulators, and other parties of interest. The adoption of such standards is voluntary, but they are often used in national regulations and laws globally. International Standards generally reflect the best outcomes and experiences of industries, researchers, regulators, and consumers internationally. They also cover many common needs in many countries, and they form one of the most important bases in terms of removing the technical barriers to trade. That is why the WTO recommends its members to reference to international standards rather than national or regional ones if possible. /14/

3.4.1 IEC 63000:2018

IEC 63000:2018 is a standard for technical documentation, which is for the assessment of electronic and electrical products concerning the restriction of hazardous substances. Anything that is ever done or made by the officially set standards is a clear sign of quality. This mentioned standard explains that there is a large group of certain substances that should be avoided in the industry. It specifies the quality and scope of the technical documentation that the manufacturer needs to compile in order to declare the compliance with the applicable substance restrictions. /9/

According to the standard, it would be inefficient for the manufacturing company to test all the components to ensure that they are compliant with the regulation. Instead, the manufacturer works with their suppliers to make sure that the materials are compliant and appropriately documented. The manufacturer has the right to demand documentation of proof that the supplied materials really are compliant with the requirements, even if the supplier is based outside the EU. This is exactly what ABB ELDS does with its suppliers, and the collection of compliance data is compliant with the standard, which also supports the positive effects on the environment. /9/

4 CIRCULAR ECONOMY

Circular Economy is an approach of promoting sustainable development to battle environmental challenges. In circular economy, the value of materials and products is preserved for as long as possible, and it aims in encouraging competitiveness and sustainability in the long run. This has lately received growing attention in discussing development in industries, and these sorts of discussions are mainly being led by policy makers, such as the European Union (therefore ECHA). Acting at the EU level can propel investments, create an even playground, and eliminate obstacles stemming from European legislations or its insufficient implementations. In this business and policy-making context, circular economy is a welcome approach as it is viewed as an important approach in terms of achieving sustainable economic and environmental development. This approach is especially underpinned due to dissatisfaction with the traditional and still prevailing linear 'extract-produce-use-dump' energy and material flow model of the current economic scheme. It has its problems, especially when the goal is to gain sustainability socially, economically, and environmentally. /20, 26/

4.1 Linear and Circular Economy Models

There are two main economy models concerning the usage of goods and materials.

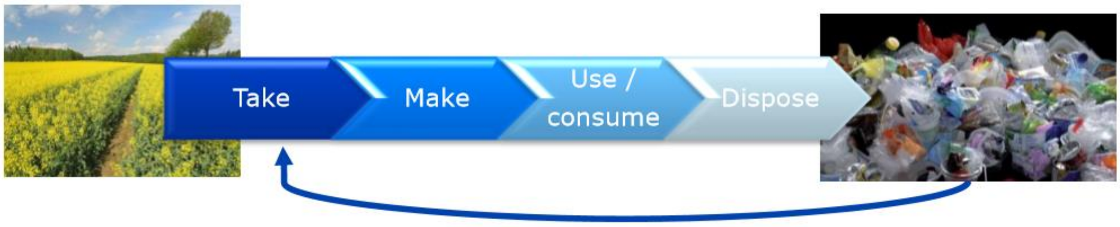


Figure 1. The linear economy model. /23/

The linear economy model carries out a philosophy where materials are taken from the nature, harvested, or mined, then made into goods, which are then sold to the consumer to be used. At the end of the products lifecycle, they are disposed and possibly dumped to a landfill or burned. If this model (Figure 1) is not replaced, the world will move towards a tipping point where it will fail to sustain itself. /24, 25/

Briefly, the linear economy does not support the reuse of perfectly good materials in a product, but they are discarded. Often the sort of waste electrical products end up as pollutes the environment by sitting on a landfill for decades open to weather conditions and bare ground. Something ought to be done to that problem, so that instead of the electrical waste aging in a landfill, the precious metals and compounds should be getting renewed and reused. /24, 25/

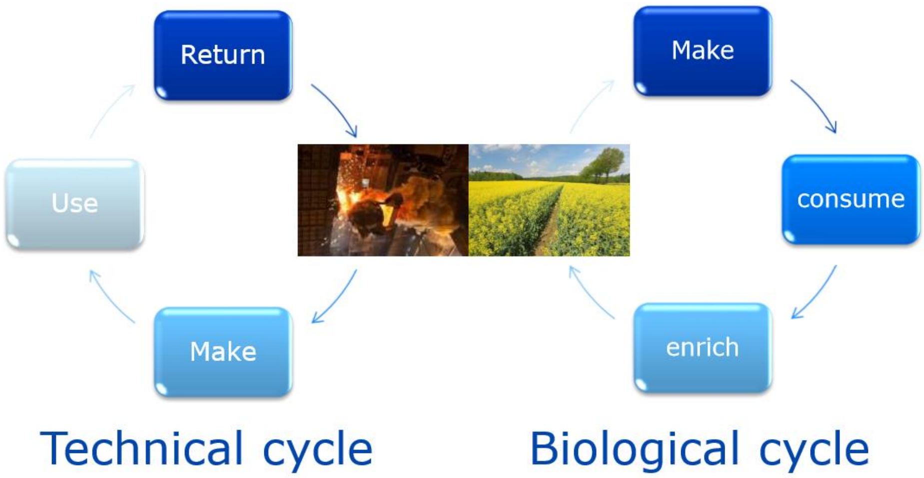


Figure 2. The circular economy model. /23/

The main three principles of circular economy are the 3Rs: reduce, reuse, and recycle. This differs from the linear economy significantly; in circular economy the use of new resources is reduced into a minimum (Figure 2). Reusing of parts and products is being maximized, which includes chemicals and metals that are very important in manufacturing electrical components. Usually these materials (noble metals, semiconducting materials, conflict minerals) are scarce and mining new materials every time electrical components are being manufactured is not sufficient. By reusing these materials (metals and whole components even), stress on the process of acquiring new raw materials can be lessened. /24, 25/

There is a difference in the perspective between linear and circular economies. The linear economy focuses on eco-efficiency. This aims to minimize the impact on ecology for the same output and extends the period in which the system becomes overloaded. Waste prevention is the main purpose of circular economy. /24, 25/

At ABB ELDS, most of materials are comprised of oil and plastics, steel, copper, and aluminium, and most of these materials are reclaimable when the product's life ends. ABB's products are designed to be recycled, and almost all the products come with recycling instructions so that they can be dismantled easily. ABB ELDS takes on circular economy, and with that method, the company can save up 95 % of the energy it takes to produce the metals that are in use. However, circular economy is a rather new approach in terms of handling waste and taking care of the environment. /29/

The SCIP database, and it being compulsory for all EU producers, promotes the circular economy, and potentially encourages companies to take circular economy even further; unifying the way of handling waste among EU producers supports the large-scale changes which are needed to support a more environment-efficient way of producing goods. That is an excellent way to accelerate the rate of choosing more environmentally friendly parts and components and puts pressure on the preliminary research when the manufacturers and components are being chosen when designing new products. /29/

5 SCIP

One of the main goals of this thesis is to introduce SCIP, the new database established by ECHA, and to theorise its effects on the company's documentation obligation in the future and potential challenges in deciding manufacturers and materials for components. In July 2018, the revised Waste Framework Directive 2008/98/EC entered into force and gave ECHA the role to establish and maintain a database that has all the information about SVHC's in articles as such and/or in complex objects (products). The companies that supply and/or manufacture articles that contain SVHC Candidate List chemicals within the EU market are obliged to submit information about those chemicals. /28/

> *2. The European Chemicals Agency shall establish a database for the data to be submitted to it pursuant to point (i) of paragraph 1 by 5 January and maintain it. The European Chemicals Agency shall provide access to that database to waste treatment operators. It shall also provide access to that database to consumers upon request.*
>
> (Revised Waste Framework Directive 2008/98/EC Art 9(2)) /39/

The SCIP database supports the circular economy by following the three main objectives:

1. Support the substitution of concerning substances in articles that are placed on the EU market by decreasing the generation of waste that contains hazardous substances.
2. Further improve operating waste treatments by making information available.
3. Initiate appropriate actions over the whole lifecycle of articles, including the waste stage and allow authorities to monitor the use of substances of concern in articles. /28/

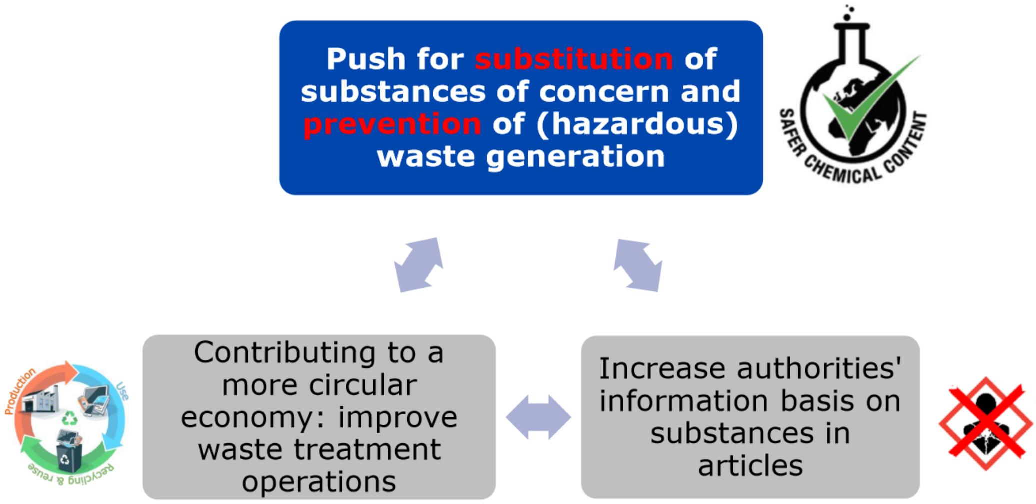


Figure 3. The main objectives of the SCIP database visualized. /28/

The main goal of SCIP is to substitute the SVHC Candidate List chemicals in articles with safer alternatives, and therefore aims to prevent the generation of waste that contain those hazardous substances. The SCIP database aims to ensure the availability of information on articles that contain Candidate List substances throughout the whole lifecycle of the product of concern. This information can be consulted by anyone without delay. /30/

The SCIP database promotes the circular economy and helps the waste treatment operators by making the incoming waste easy to treat (Figure 3) with sufficient amount of information about the chemicals within the waste. In practice, this means that the articles and products that contain SVHCs can be treated with the care the chemical requires to be handled and sorted in a safe manner. Furthermore, due to the main goal of SCIP, ECHA is putting more pressure on industries that are still using articles that contain SVHCs, which again results in seeing the SCIP database almost as a nuisance and additional load. Being a nuisance will hopefully result in eventual substitution of all the chemicals listed on the candidate list. However, there are several challenges lying within that process, since there are chemicals with properties that are very difficult to substitute with any other chemical. /28, 30/

5.1 SCIP Prototype and Format

The prototype of the SCIP database was founded in February 2020 for companies to familiarise themselves with its main working principle and the data import. As from 5 January 2021, companies that supply articles that contain SVHCs on the Candidate List in a concentration above 0.1 % w/w on the EU market, are required to submit information on these articles to ECHA. The SCIP database was established under the WFD to improve product safety and reduce hazardous waste. In prior to reporting the products and articles that contain SVHCs more than 0.1 %, the information needed for the SCIP notification has already been communicated throughout the production chain under REACH Article 33(1); starting all the way from the manufacturer. /17/

During the design stage of the prototype, ECHA promised to take into consideration the usefulness of the SCIP database versus its burden on industries. It has been admitted by other companies and ABB ELDS that SCIP has a potential of becoming a massive burden on industries due to the large volumes of data that need to be reported into the database. In addition, the transparency versus the legitimate confidentiality concerns have been taken into consideration by ECHA. Information about the legal entity will not be revealed to outsiders or competitors, including productional company secrets. The prototype and the eventually revealed final version of the database will also be customized in a way that it will be suitable for all legal entities and industries. It will be kept simple and will reuse the existing data structures already built into the ECHA cloud and IUCLID. /18/

Within the SCIP format, the information is structured and formatted in the XML-based file forms. The SCIP format is compatible with IUCLID, which is a tool developed by collaboration of ECHA and OECD. It promotes the harmonisation of data concerning chemicals. The format is defined to consider the legal text of Article 9(1)(i) of the Waste Framework Directive, REACH Article 33(1) and the Commission's "Non-paper on the implementation of Articles 9(1)(i) and 9(2) of the revised Waste Framework Directive 2008/98/EC", and ECHA's Guidance on requirements for substances in articles. /18/

5.2 Working Principle of the SCIP Prototype

The SCIP prototype can be accessed through the ECHA cloud online. It distributes ECHA's IT applications into a private cloud environment, such as IUCLID, where dossiers can be created and imported into SCIP database. Before one can use the database and create dossiers of articles and complex objects, one needs to register under one's company's legal entity. A private person cannot register into the cloud but needs to declare their company's details. After registration the log in is straight forward and simple. One needs to keep in mind that the following section has been written based on the SCIP prototype on ECHA cloud, some of the data might have been expired since the research on it has been made. This chapter aims to explain merely basic principle and the needed information for a successful SCIP dossier import. /35/

The first view after logging in requires the subscription of the ECHA cloud services. One can choose between a full version and a trial version. In the full version, the dashboard opens. This menu includes a list of different categories for dossier creation. The home screen gives the opportunity to import previously filled IUCLID-formatted files. This option to import is also important in terms of importing the most recent REACH SVHC list because it is not in the cloud by default. However, ECHA is planning to change that to be automated, which will make the workload smaller for companies. Otherwise, that would be needed to be imported twice a year. /35/

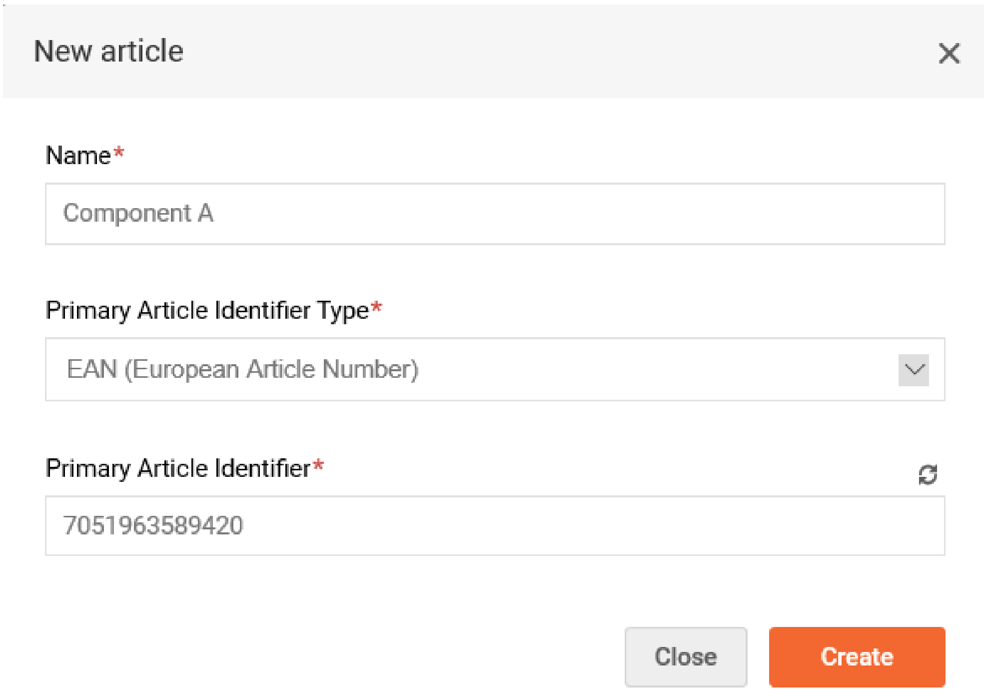


Figure 4. The first required information form of creating a SCIP dossier. /35/

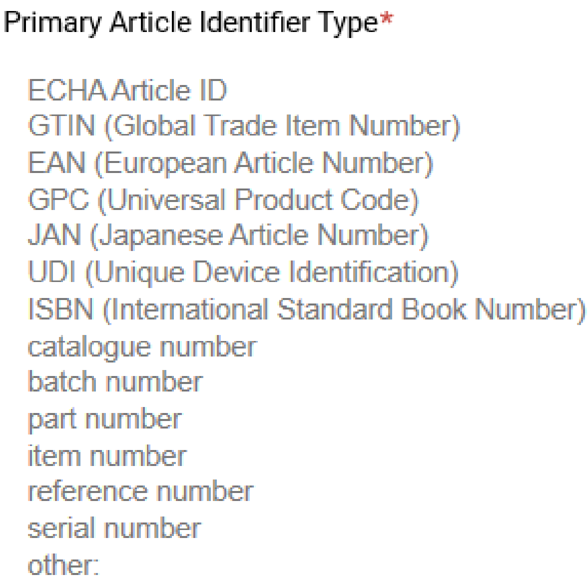
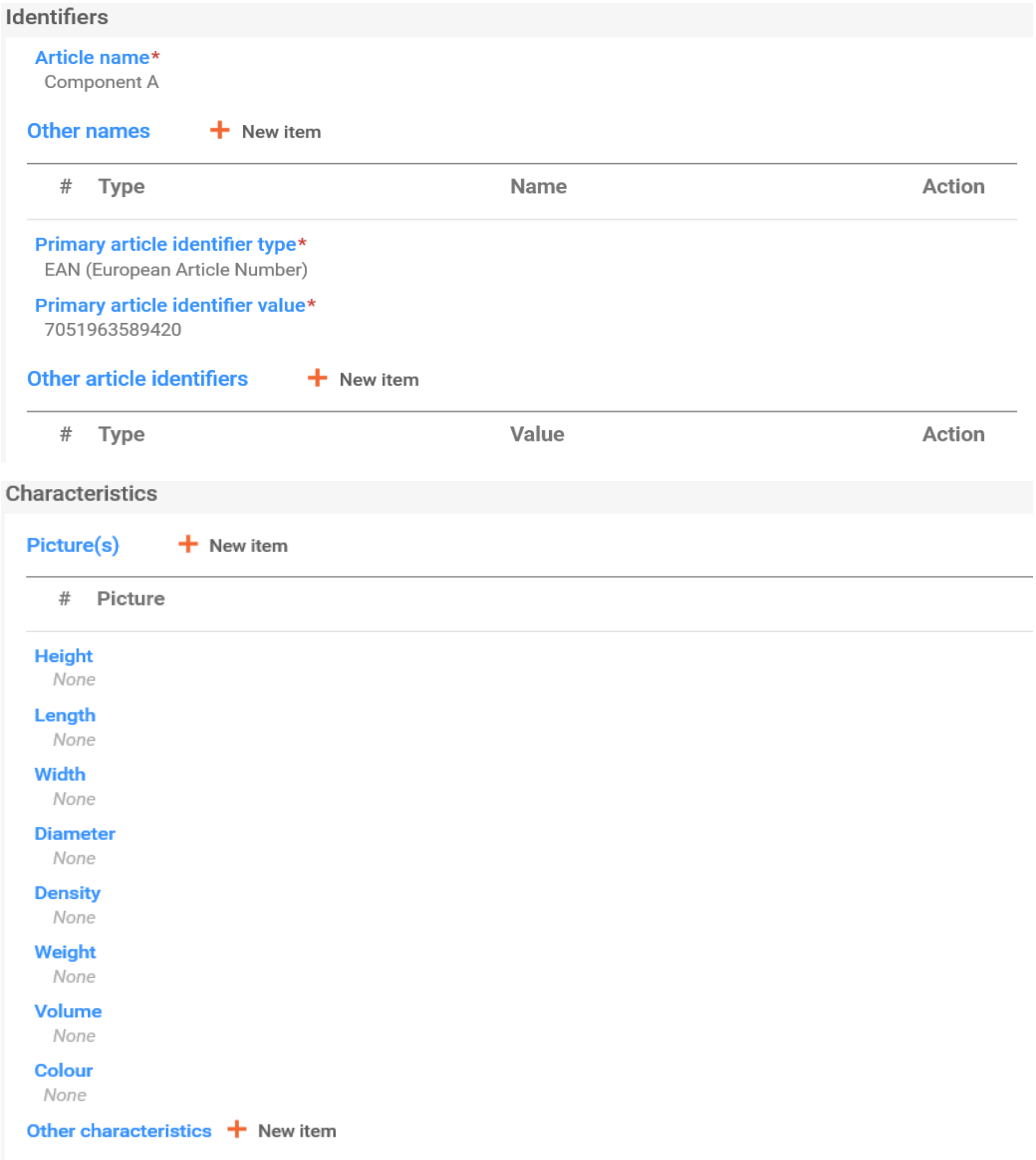


Figure 5. All possible identification number possibilities provided. /35/

In Figure 4, the SCIP dossier creator first asks for the name of the article and primary article identifier type, which can be any from the list in Figure 5. International Article Number (EAN, originally European Article Number) has been used as an example. Before one can create a successful SCIP notification and import it as a dossier to the database, the product must be familiar to the notifier. Creating a successful notification requires a lot of information and knowledge of fine details, which will be explained more in detail below. /31/



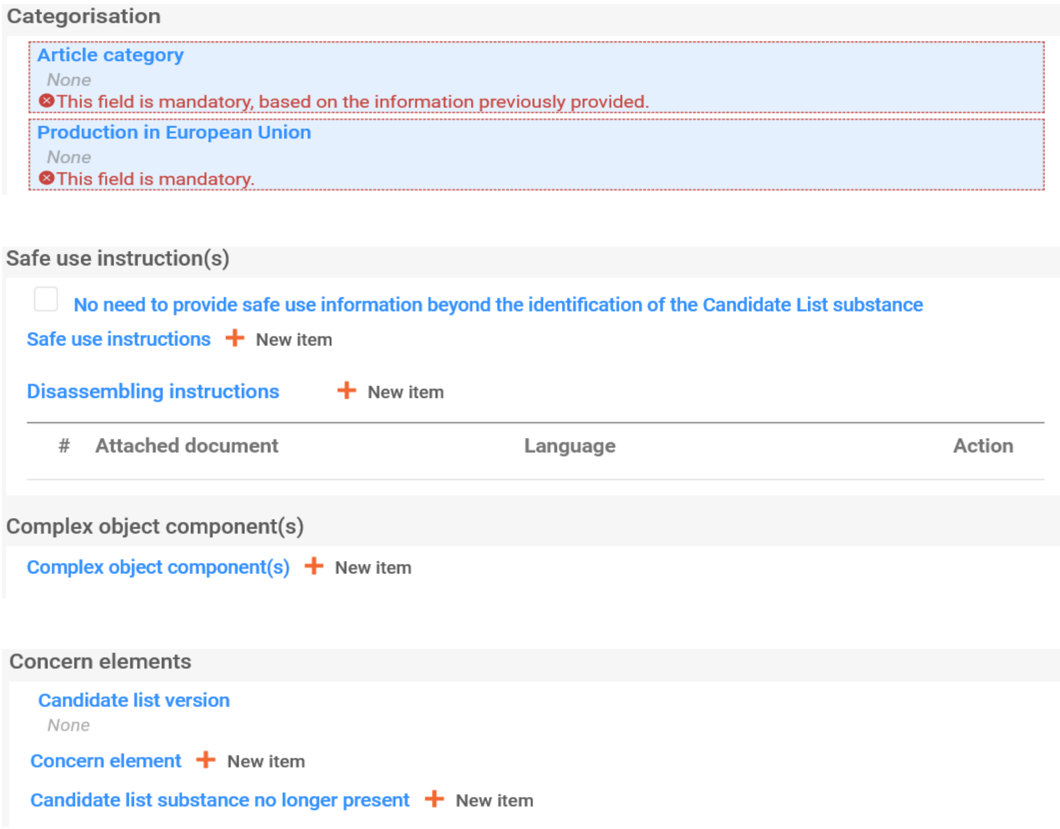


Figure 6. The complete SCIP notification form on ECHA Cloud. /35/

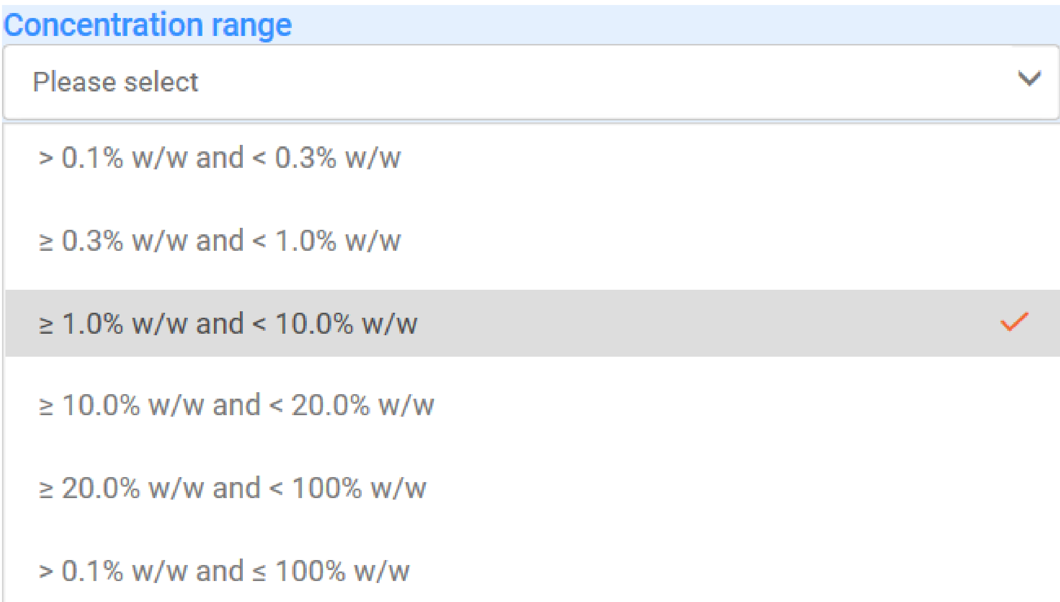


Figure 7. The options for the concentration rate. /35/

Creating a successful SCIP notification requires plenty of information of the product or the article, but only a few sections are mandatory in terms of notifying. Figure 6 shows the amount of information that can be notified, but only the ones highlighted in red are especially important and one should pay special attention to them. The ones highlighted are about categorization, which means that the product category needs to be notified, and whether the product is produced in the EU. The product category can be chosen from a list that has over 20 000 different options, so it is useful to know the code (TARIC code /32/) beforehand. The safe use instructions can be included as a PDF-file but are not necessary to be included. /35/

The concern element and its concentration are required as well. The option of concentration becomes visible after choosing the element of concern. Even though knowing the real rate of concentration of the concern element has been stressed by ECHA, the available options of the concentration vary between > 0.1 % w/w and ≤ 100 % w/w (Figure 7). Therefore, it does not matter if the concentration level is known in detail. Of course, ECHA encourages the notifiers to give out as detailed information as possible. In Figure 8, the information requirements are listed in an efficient form by ECHA. /35/

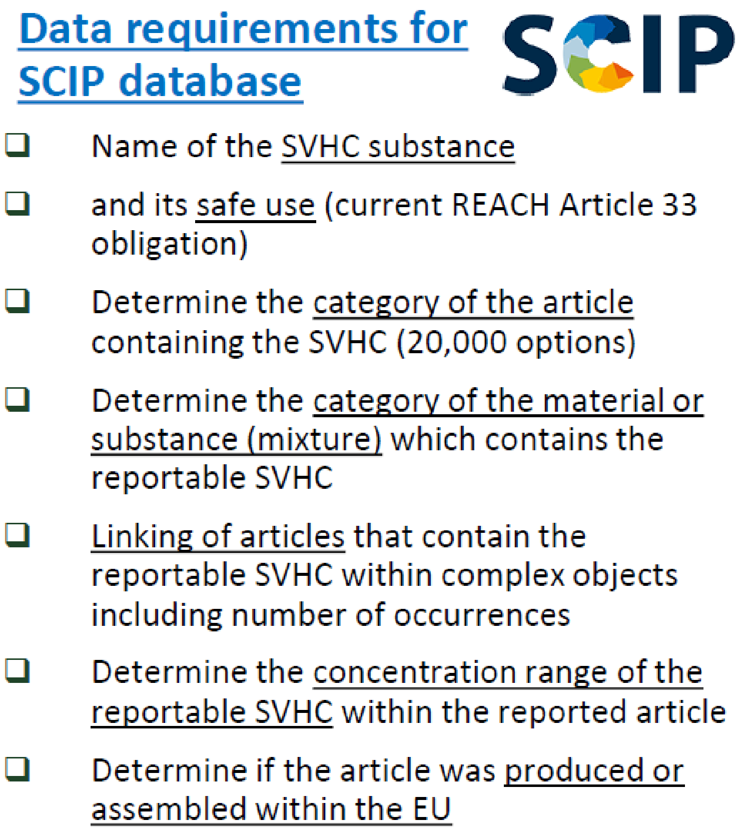


Figure 8. Requirement list of data for the SCIP database. /28/

Figure 9. The tree of hierarchy. /35/

Figure 9 describes the tree of hierarchy. After filling in and saving the notification form, the tree becomes visible on the left side of the screen. In this tree, the product can be seen on a very detailed level. In order to build a tree of hierarchy, one ought to notify all the articles that contain the concern element that are within the product. From these articles (TR 20 that contains lead in Figure 9) the end user product can be built (Component A). The tree can include several levels of articles (in addition to TR 20) that may include several concerning chemicals, and all those together form the final product. Of course, the product that is built in the database is not perfect or final because only those articles that contain the concern element need to be notified. For example, the tree of hierarchy may only include one article with one concern element, such as in Figure 9, but the actual final product may include dozens of articles. /28, 35/

In terms of arguing about the legitimate confidentiality, the notifying company does not have to use a very detailed name of the article or the complex object but can use a name as simple as possible as long as the article or the complex object can be identified by the waste treatment operators. In addition, since the whole product is not visible in the tree of hierarchy, copying someone's product by looking for details from SCIP is close to impossible. /28, 35/

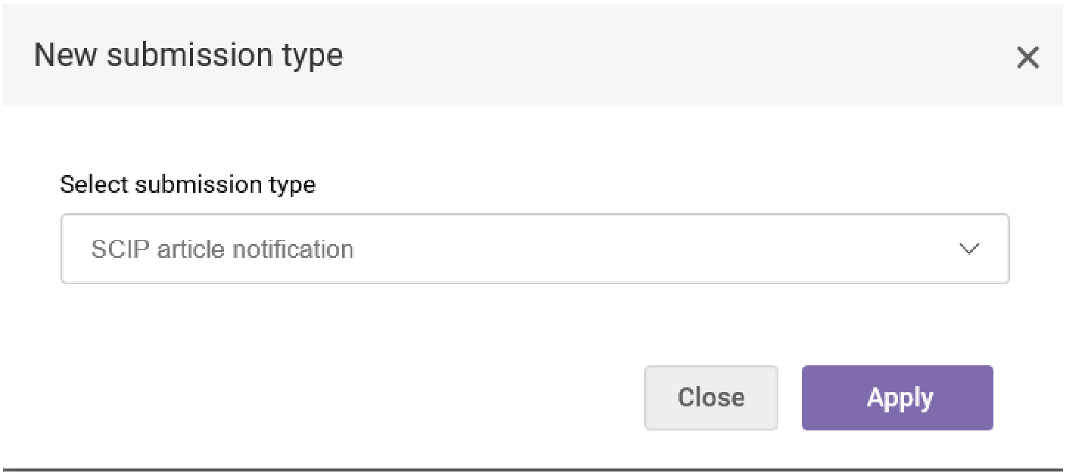


Figure 10. Submitting the SCIP article dossier notification. /35/

After filling in all the required data, the notification can be verified. The software gives an option to check if the notification has enough information and if that information has been given out correctly. After successful validation, the notification can be submitted into the database (Figure 10).

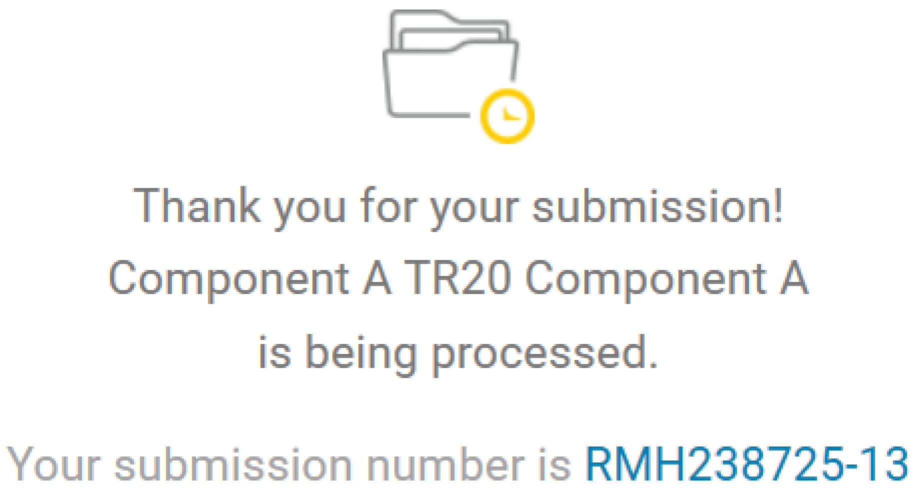


Figure 11. The view after successful notification submission and submission number. /35/

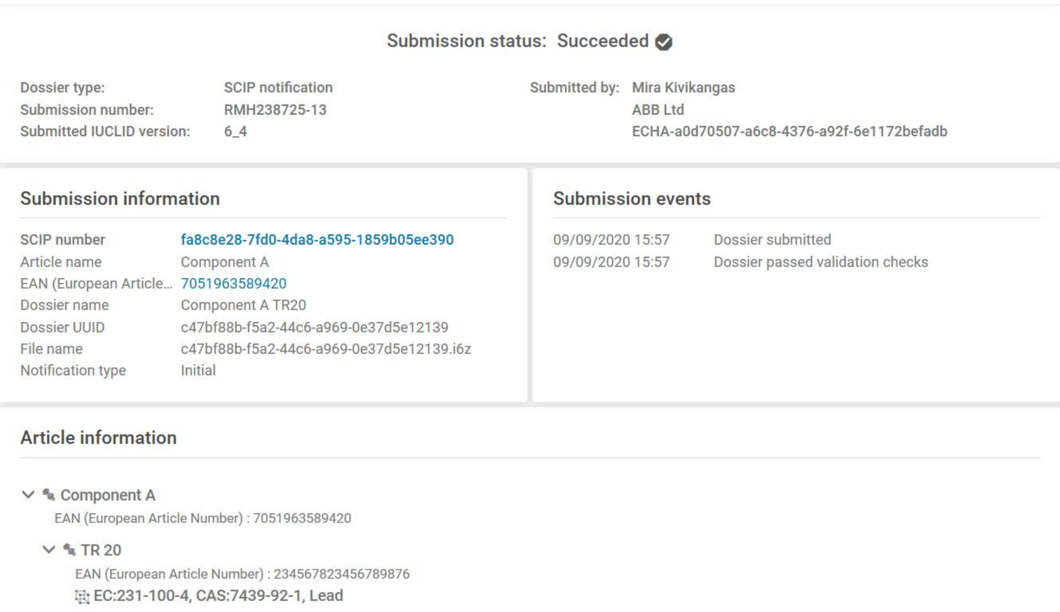


Figure 12. The information provided about the successfully imported dossier. /35/

After a successful submission, the database gives out a submission number (Figure 11) and some further information about the dossier (Figure 12). The database gives out a submission identification number that can be used or referenced by others, when they are searching for this certain dossier from the database or if they are using it in their other submissions. This number is not freely available but needs to be provided by the owner of the code to the one that may need it. It is possible for other companies to use this reference number. For example, if part of a product is manufactured in a different factory in a different location, the second factory that manufactures the rest of the product can use the SCIP number as a reference. This means that the first factory notifies the articles and the part of the product that they manufacture, and the second factory does the same with their manufactured product and articles. With this method SCIP dossier duplicates can be avoided in the database. In addition, it is much simpler for companies to notify only their own products since they are most familiar with them. /35/

5.2.1 Conclusion: a Brief Walk-through of Making a SCIP Notification

1. Start with the article that contains the concern element (SVHC Candidate List substance), and knowing the details of the product
2. The name and the main identifier of the product/article (e.g. EAN code)
3. Fill in the required information
    a. Product category and production in or out of the EU
    b. Concern element
    c. Concentration range of the concern element
4. Save the notification after filling in all the data
5. Validate the notification to check if everything is good to go
6. Create dossier
7. Submit the dossier into the SCIP database
8. Build the final product from the article notifications that have been created and saved into the database

5.3 The Role of the Third-party’s Software Tool

The third-party company has piloted a SCIP module for the software tool. The final version of the module becomes available by the end of October 2020. That is when the companies can start making ‘real’ SCIP notifications and the demo phase ends. The need for this module arises from the difficulty of notifying hundreds of different components, articles, and products if one uses only the online version of SCIP on ECHA cloud. ABB ELDS also faces this problem, and the third-party company's SCIP module brings a significant help to this process. /27/

ABB ELDS manufactures dozens of different products that consist of hundreds of different circuit board modules, which are made of thousands of different electrical and mechanical components. Even though only non-compliant articles and complex objects are required to be notified, there are still hundreds of components and modules subject to the notification obligation. In addition, the different product variables need to be notified as well. Instead of filling out a notification manually for each article/product, part of the information is collected straight from the manufacturers/suppliers through a form that can be converted into a SCIP dossier, and these notifications can then be imported into the database as a bulk. /27/

The third-party company is responsible for collecting compliance data of articles. In comparison with the working principle of ECHA's cloud version of the SCIP, ABB ELDS only needs to provide the basic information about the product, which includes identification description, the article category (TARIC code), safe use instructions, and whether the production takes place in the EU. The SCIP module of the third-party software tool carries out the rest of the needed information for a successful SCIP notification. The third-party company collects data from supplier, which includes the SVHC substance on an article level and the concentration rate, article, and material categories (Figure 13). The SCIP module of the third-party software tool enables companies to edit and review SCIP data on BOM level, which is one of the main differences in comparison with ECHA cloud version of the database. It also means that the full bill of material is visible as a list for a complex object of interest, which makes the notifying of needed articles significantly easier and faster. The complex object does not have to be built separately article by article, such as on the ECHA online cloud version of SCIP. The SCIP module creates a dossier automatically for each non-compliant article once all the required data are collected. Then finally, the dossiers are ready to be imported into the database. /27/

In brief, part of the information collection for the notification is outsourced to the third-party company (Figure 13). The SCIP module is used to gather and combine the collected data, formatting the data to IUCLID file format, and to produce notification files that can be imported into the SCIP database as a bulk. This makes filling the obligation of notifying non-compliant articles and products easier and faster. Using the SCIP module provided by the third-party company, the notifier (ABB ELDS) does not have to use as much time and effort as they would end up using in the ECHA cloud. In the SCIP module, the company is also able to return to the notification files and make adjustments and updates if needed straight into the file, without having to create a completely new dossier from scratch. /27/

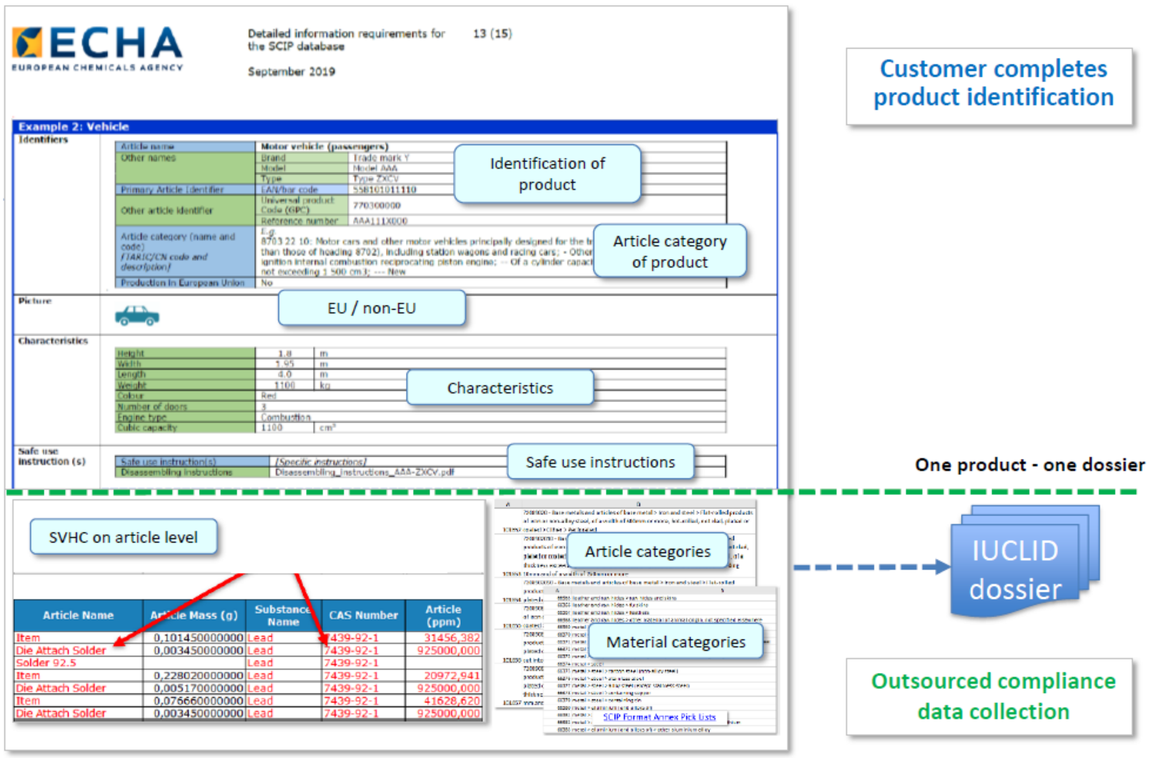


Figure 13. Tables explaining the third-party company's SCIP module working principle and customer's and software tool provider's responsibilities. /27/

6 IMPLEMENTING THE SCIP DATABASE INTO PRACTICE AT ABB ELDS

A flowchart is a tool to visualise the process flow. The flowchart shows the causal connections between different parts within the process. In this instance, the flowchart (Appendix 3) visualises the journey of a new component that is planned to be added to the production chain of a product. The information about the component flows through different departments within ABB ELDS. The process starts with hardware design engineers mapping the requirements for the component needed. Then a suitable component is being chosen, which then continues its journey to global component librarians, who check if there already is a component for that required purpose. If the need for a new component is accepted, it goes to material compliance department, where the compliance data of the component will be acquired. The material compliance team's process has already been explained above. /33/

The process of accepting a component into ABB ELDS' global component library requires plenty of planning, research, design, and development. In the following section, an attempt will be made to explain and visualise the insertion of the SCIP database into the component library process. There are two possible solutions for adding the third-party company's SCIP module into the flow chart, and the next chapter will introduce the two possible options. The pictures are simplified versions of the phase where the new component arrives to the material compliance team to be researched and are based on the original flow chart. Some boxes may have been left out of the picture due to their irrelevancy. For full flow chart, see Appendix 3.

6.1 Suggested Changes in Flowchart

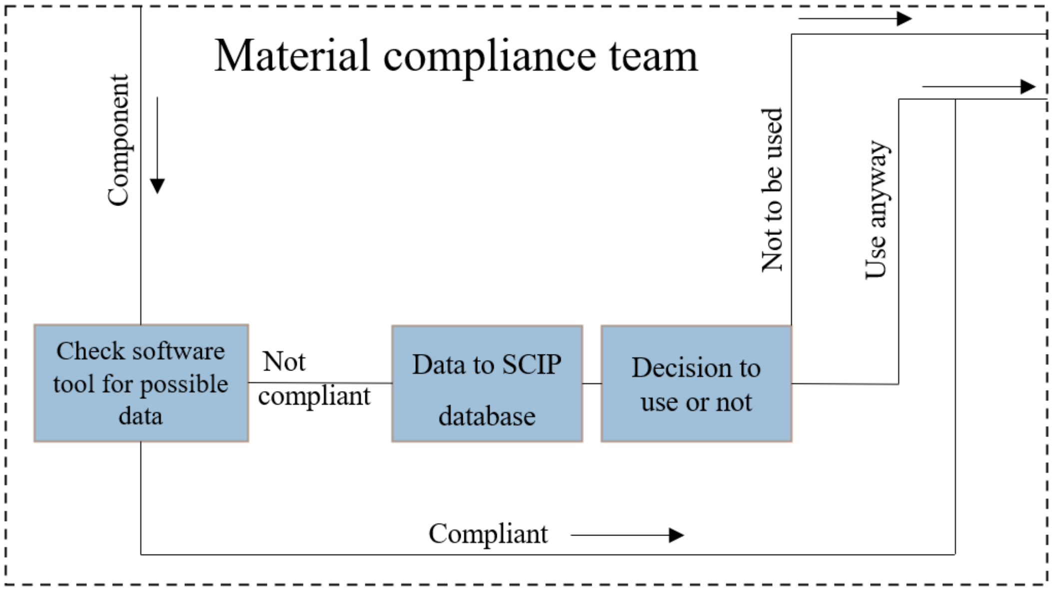


Figure 14. Option one for the software tool's SCIP database module in the flow chart.

In terms of planning and designing new components for products, the importance of material compliance comes rather late in the process. Figure 14 presents the planning and design processes of a component when it has arrived at material compliance engineers. After pre-approval of the component, material compliance team receives the details of the component from the hardware design engineers and global librarians. The information about the component is then sent to the third-party company for material compliance data gathering. The data may or may not be complete, so the missing information is then gathered through the 'normal' process or through escalation, and the compliance statuses are checked. If everything is well with the component and there are enough data available, and the component is compliant with the REACH SVHC rule, it may continue its journey to be accepted and eventually used in a product.

In terms of the SCIP database, only non-compliant (REACH SVHC) components are notified and brought into the database. Therefore, adding the process of notifying non-compliant components into the SCIP database makes sense if it is added into the flow chart when it is clear the part is not compliant (see Figure 14 and added SCIP database box). The component may end up being used in a product regardless of being non-compliant with REACH SVHC, but this depends on how crucial the component is, and on the unique properties of the chemical(s) used in the part (such as lead). Non-compliant components are still being used because the technology is not yet advanced enough to produce lead-free components efficiently. However, during this stage of doing research on the compliance data of the part, there has not yet been a made decision on the flow chart concerning whether the part will be brought to use, so there is a possibility of making a SCIP notification for nothing.

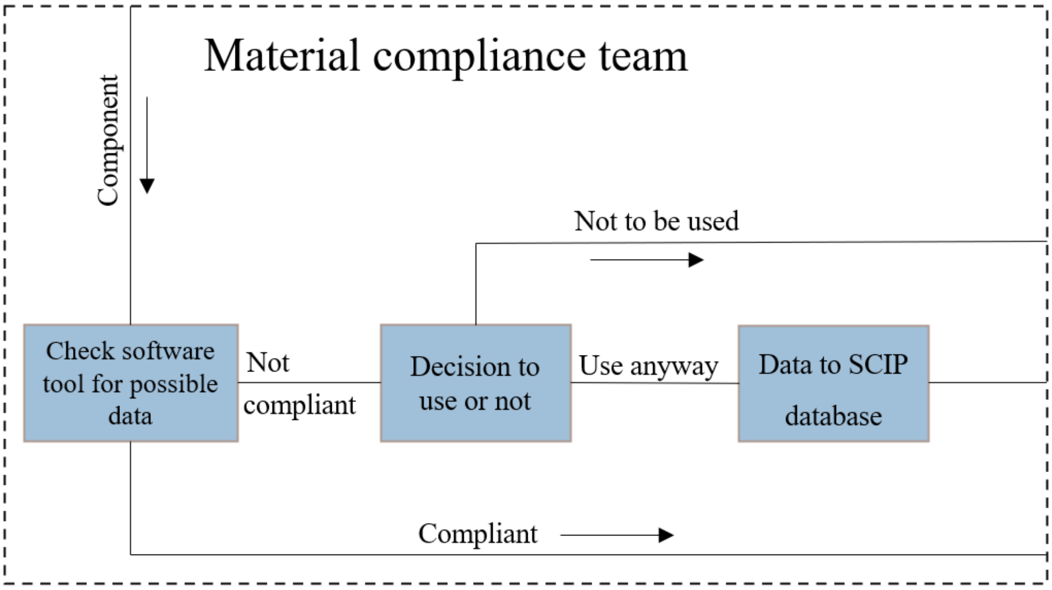


Figure 15. Option two for the software tool's SCIP database module in the flow chart.

In Figure 15, there is a second option for the SCIP database notification phase added to the flow chart. This option has the SCIP database notifying phase added to where the component has been decided to be taken into use regardless of being non-compliant. As the process has been explained above, the second option is significantly more viable, since the non-compliant component will be notified only after the decision about its use has been made. Hence, no unnecessary work will be carried out; it not sensible to notify non-compliant components that will not be used in the production phase of the product. Therefore, the option two is more practical and it supports the objective of the EU's Waste Framework Directive at ABB ELDS more efficiently.

This section and these two plans are only considered to work within the material compliance planning section in the flow chart (for reference see Appendix 3.) The flow chart is from 2018, so it would be more efficient to update the whole chart in order to take the questions concerning the environment into consideration in a more wholesome way throughout the process of planning new components for products. For instance, if the process of material compliance was to be added into more of the beginning of the process, plenty of time and hours would be saved; if the goal was to only consider REACH compliant components to be used, the material compliance team would not have to tackle with as many compliance data collection processes.

7 DISCUSSION AND CONCLUSION

We are surrounded by chemicals in our everyday items. Chemicals are in places we would not think they would be. They exist in large numbers, and some are very dangerous to our health. ECHA’s SCIP database provides a solution for the issue of knowing the amount and the location of those dangerous chemicals within products. This makes waste treatment easier and safer, supports green manufacturing, and increases the transparency and eventually profits companies in the end. However, the SCIP database is not an issueless obligation for industries and manufacturers but requires plenty of time and resources.

7.1 Points on Circular Economy

Circular economy is a way of reducing, reusing, and recycling goods and materials. In terms of dangerous chemicals, there are two points that argue both for and against circular economy. First, reusing and recycling are excellent ways of not bringing hazardous chemicals more into the cycle of consuming. The lower the concentrations and the number of different chemicals can be held, the safer it is for the end user to enjoy the product until the product meets its life cycle’s end and is forwarded to the waste treatment managers. Knowing the locations and amounts of those said chemicals makes the waste treatment easier.

Reducing the number and the amount of dangerous chemicals does not happen automatically or only out of good will. There are laws and directives that regulate the use of those chemicals, and without those regulations, it would not be profitable for companies and industries to try and reduce the number of those chemicals. More often, many of the dangerous chemicals have gone through less thorough research and development, considering they have very harmful properties. The less time is spent on researching and developing a chemical, the cheaper it is for a company to use the chemical. The alternatives may require years of research and development in order to become as efficient or useful in terms of its properties; more money lost in the process. It would also seem that the number of dangerous chemicals is going up, but this is not the case. The illusion of the larger number of hazardous chemicals comes from the growing REACH SVHC Candidate list. The chemicals have always been there, only now they are being noticed and reported according to the REACH SVHC regulation. In addition, the number of harmful chemicals in industrial use is going down. /36/

The point that argues against circular economy arises from the fact that goods and materials circulate in the cycle of consuming. This means the same dangerous chemicals remain in the circle, thus staying longer in use than perhaps is healthy. It is somewhat paradoxical from the circular economy point of view, how using and cycling the same materials is being supported but at the same time, we want to get rid of dangerous chemicals from our everyday items. Where are they supposed to go if the linear economy model and its dumping philosophy should not be supported? Getting rid of the chemicals would mean introducing new goods and materials into the cycle. Of course, this would then mean the newer and safer alternatives are to replace the hazardous chemicals, not to co-exist with them. Hence, the number of chemicals would remain the same, in theory at least. Developing new alternatives may take several years until they are ready to be taken into use, so leaving the dangerous chemicals outside the circle cannot happen just like that; manufacturing new articles cannot stop or delay from economical point of view. /36/

7.2 Issues regarding the SCIP Database

SCIP database seems to be a rather straightforward tool but there are some difficulties regarding the distribution of information by ECHA, and the timescale of the notifying obligation. Several complains have been made about the timescale and lack of proper information about the responsibilities of industries. A letter was sent to the President of the European Commission, which calls for decisive action in order to solve issues regarding implementation of the SCIP database. The letter was signed by 40 different, very significant industries of the European Economy. There has been a request to postpone the start of the SCIP database notification obligation at least by 12 months. The signatories of the letter also require studies made about the feasibility, usefulness, proportionality, and impact of the database, and depending on the outcome of the studies, adapt the SCIP database accordingly. /37/

ECHA had planned the finalization of the database development by January 2020 but they failed. This delay has prevented companies to develop, test, and adapt their own systems to meet the January 2021 deadline of notification. There are significant concerns regarding the workability and the value of the SCIP database. The concern has been repeated in the last two years without being resolved by the European Commission or ECHA. For companies that have not systematically collected compliance data or have not even implemented a compliance data collection system, the issues regarding the proportionality of SCIP is massive. In order to meet the deadline of January 2021 and having the ability to notify articles successfully, a steady system for compliance data collection is crucial. One of the reasons for companies being behind the schedule is that they may not even have an implemented data collection system, so they must start from the very beginning. This, once again, requires plenty of resources and time, which some companies may not have any more if they have not yet implemented a compliance data system. /37/

ECHA had responded to the letter sent to the European Commission by stating that they have no indication to postpone the deadline of 5 January 2021 and keep encouraging companies to continue their preparations /38/. ABB ELDS is a great example of how long-term collection of material compliance data pays off; ABB ELDS has the needed software that fills the requirements and knowing experts who have experience in compliance data collection. When the basic infrastructure and resources are there, ABB ELDS is fully prepared to meet the notification obligation in January 2021.

The SCIP database is a very ambitious project, therefore a challenge. It measures the capacity and implementation abilities of companies, in addition to companies' willingness to participate in circular economy. SCIP is a great example of unifying the ways of EU nations to handle waste and attitudes against green manufacturing. Of course, there are some problems concerning the areal effects of the SCIP database; it only concerns EU producers and manufacturers, and the EU has already gotten smaller in terms of the number of its member countries. It is not one of the goals of this thesis to argue about the stability of the EU, but it may be that if directives make companies' life harder within the EU, why not leave? /41/

Issues regarding suppliers' and manufacturers' unresponsiveness and/or reluctance to provide compliance data will become a problem in terms of the SCIP database. Most of the suppliers and manufacturers are in Asia, and the EU laws do not apply to them per se. However, if their goal is to work with and sell their products to EU, the products need to be suitable for EU manufacturers and industries. Therefore, compliance with REACH SVHC is very important. Even though the products are not compliant, the Asian suppliers and manufacturers need to be cooperative so that their products can be used in the EU. This means that the suppliers and manufacturers need to be willing to declare what chemical and how much of it is included in the product and the amount of the chemical in case the product is non-compliant. There have been instances at ABB ELDS when a supplier had declared their products REACH compliant, but it turned out from the FMD of the product that the product did in fact include hazardous chemical, which proved the component non-compliant. In these instances, it would be appropriate to consider whether it is worth keeping these types of suppliers and manufacturers on the AVL. It is worth being critical with the compliance data provided by suppliers and companies.

When the supplier is unresponsive, it may take up to months to get the requested data. This may become an issue when the article data is imported into the SCIP database. If the compliance data collection process takes time and importing data into the software tool is slow, it is even slower to create successful notifications to SCIP. Since the SCIP database notification form requires a minimum amount of data, not being able to provide the data may result in failed notifications and no data can be imported into SCIP. If everything does go smoothly with the data collecting and importing, suppliers and manufacturers being cooperative, the basic process of requesting, waiting, approving, and importing of the compliance data takes time. The software tool provider imports the data into the software tool once a month, so nothing really is done that fast. Luckily, ABB ELDS has been collecting the compliance data for several years and has a vast compliance data library on components already on hand.

The first year of notification obligation is going to be full of work. Regardless of the SCIP module of the software tool and the help it brings, ABB ELDS' material compliance team still need to provide plenty of data for the SCIP notification. Thankfully, after all the non-compliant components and modules have been imported into the SCIP database, the dossiers require updating only when something changes:

- component becomes compliant
- component is no longer in use (a new dossier of a complex object is imported into SCIP without this said component)
- REACH SVHC Candidate list updates → new non-compliant articles arise from the component library.

In some cases, the manufacturer makes changes in the component composition and sometimes this may mean the hazardous substance is left out and the component becomes compliant; it can be changed to the SCIP notification and the dossier can be updated. Sometimes components also become obsolete, so the component can be left out from a notification and dossier can be updated. Most regularly, the changes come from the REACH SVHC Candidate list updates. This brings new substances to the list and this may bring new components to the non-compliancy list from the component library, and they need to be imported to the SCIP database. After importing of all non-compliant components into the database, only maintenance of the dossiers is required. Of course, when completely new products are designed and new, non-compliant components introduced into the library, brand new dossiers need to be created for them.

In addition to the basic time-consuming measures of importing and updating data into SCIP, ABB ELDS is faced with another issue. Some of the products at ABB ELDS are customizable by the customer. This means that for a certain product family there are no 'basic packages' but the customer can choose between variables; and there are many of them. In terms of importing the data into the SCIP database, this may be problematic because no product is the same, and the dossier needs to be created on a product level as well. However, ECHA's lack of providing information on product level notifying may turn in ABB ELDS' favour. They have not cleared out how the product level information should be notified, so ABB ELDS might as well include all the modules and module components under the same product family's code. There is no need to make a new dossier of every single one of sold products; it would not be viable either in terms of time, or resources. This method would be useful to apply to all ABB ELDS' products. It is more useful to notify products on a more general level. For example, a safety relay consists of four possible different modules that all have non-compliant components. The relay may consist of ten different modules. Instead of notifying all possible combinations of those ten modules, all modules are notified under the general name of the said safety relay. Since there are labels on the side of the relay stating which sort of modules the relay consists of, the waste treatment manager would know how to handle them accordingly. All the modules have been imported into the SCIP database after all.

7.3 Conclusion

ABB ELDS' material documentation follows the IEC 63000:2018 standard and the SCIP database supports the goal of transparent documenting and will result in major positive contributions for the environment. Implementing the SCIP database into the process does not cause any major changes to the documentation of the products. The SCIP database does support the circular economy but there are some problems in terms of circulating hazardous chemicals in the cycle of consuming. The goal after all is to substitute these chemicals with safer alternatives. The SCIP database is an interesting new obligation for companies. Regardless of the delays from ECHA's side, the basic understanding and structure have been provided and companies are encouraged to use them. The European Chemicals Agency's new SCIP database under the Waste Framework Directive will change the compliance data collection for all EU producers, manufacturers, and importers. It is mandatory for all companies that are bound by EU legislations and will cause plenty of difficulties for companies but with right implementation practices and enough research and resources, the obligation is possible to be met.

The implementation of the SCIP database into the global component library system requires further planning and research. There were two possible solutions for the location of the SCIP database in the flowchart and the second option meets the notifying obligation most efficiently. It may not be useful to have the material compliance so late in the process but implementing the whole phase and especially the SCIP database phase more to the beginning of the process saves time if the initial planning can be made with compliant components from the beginning. However, it is not yet possible to use only compliant components since there are some chemicals that are crucial in the working principle of some components, such as lead. This is an interesting topic for further examining and should be carried soon for the sake of ABB ELDS' material compliance team's workload.

Regardless of the seemingly laborious task ahead of companies, ABB ELDS is fully prepared for the notification obligation and the SCIP database. There are still some questions left because of the lack of information by ECHA but ABB ELDS has made the most of the available data and resources. Thorough research has been made, software infrastructure is ready and set, and compliance data have been collected almost for all components. Everything is ready for January 2021.

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APPENDICES

Appendix 1. List of REACH SVHC Candidate List that includes 209 chemical groups.

Name of the substance group	EY number	CAS number
Dibutylbis(pentane-2,4-dionato-O,O')tin	245-152-0	22673-19-4
Butyl 4-hydroxybenzoate	202-318-7	94-26-8
2-methylimidazole	211-765-7	693-98-1
1-vinylimidazole	214-012-0	1072-63-5
Perfluorobutane sulfonic acid (PFBS) and its salts	-	-
Diisohexyl phthalate	276-090-2	71850-09-4
2-methyl-1-(4-methylthiophenyl)-2-morpholinopropan-1-one	400-600-6	71868-10-5
2-benzyl-2-dimethylamino-4'-morpholinobutyrophenone	404-360-3	119313-12-1
Tris(4-nonylphenyl, branched and linear) phosphite (TNPP) with ≥ 0.1% w/w of 4-nonylphenol, branched and linear (4-NP)	-	-
4-tert-butylphenol	202-679-0	98-54-4
2-methoxyethyl acetate	203-772-9	110-49-6
2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propionic acid, its salts and its acyl halides	-	-
Pyrene	204-927-3	129-00-0
Phenanthrene	201-581-5	85-01-8
Fluoranthene	205-912-4	206-44-0
Benzo[k]fluoranthene	205-916-6	207-08-9
2,2-bis(4'-hydroxyphenyl)-4-methylpentane	401-720-1	6807-17-6
1,7,7-trimethyl-3-(phenylmethylene)bicyclo[2.2.1]heptan-2-one	239-139-9	15087-24-8
Terphenyl, hydrogenated	262-967-7	61788-32-7
Octamethylcyclotetrasiloxane	209-136-7	556-67-2
Lead	231-100-4	7439-92-1

Ethylenediamine	203-468-6	107-15-3
Dodecamethylcyclohexasiloxane	208-762-8	540-97-6
Disodium octaborate	234-541-0	12008-41-2
Dicyclohexyl phthalate	201-545-9	84-61-7
Decamethylcyclopentasiloxane	208-764-9	541-02-6
Benzo[ghi]perylene	205-883-8	191-24-2
Benzene-1,2,4-tricarboxylic acid 1,2 anhydride	209-008-0	552-30-7
Reaction products of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and 4-heptylphenol, branched and linear (RP-HP)	-	-
Chrysene	205-923-4	218-01-9
Cadmium nitrate	233-710-6	10325-94-7
Cadmium hydroxide	244-168-5	21041-95-2
Cadmium carbonate	208-168-9	513-78-0
Benz[a]anthracene	200-280-6	56-55-3
1,6,7,8,9,14,15,16,17,17,18,18-Dodecachloropentacyclo[12.2.1.16,9.02,13.05,10]octadeca-7,15-diene (“Dechlorane Plus”™)	-	-
Perfluorohexane-1-sulphonic acid and its salts	-	-
p-(1,1-dimethylpropyl)phenol	201-280-9	80-46-6
Nonadecafluorodecanoic acid (PFDA) and its sodium and ammonium salts	-	-
4-heptylphenol, branched and linear	-	-
4,4'-isopropylidenediphenol	201-245-8	80-05-7
Benzo[def]chrysene (Benzo[a]pyrene)	200-028-5	50-32-8
Perfluorononan-1-oic-acid and its sodium and ammonium salts	-	-
Nitrobenzene	202-716-0	98-95-3
2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV-350)	253-037-1	36437-37-3
2,4-di-tert-butyl-6-(5-chlorobenzotriazol-2-yl)phenol (UV-327)	223-383-8	3864-99-1
1,3-propanesultone	214-317-9	1120-71-4

5-sec-butyl-2-(2,4-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [1], 5-sec-butyl-2-(4,6-dimethylcyclohex-3-en-1-yl)-5-methyl-1,3-dioxane [2]	-	-
1,2-benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters	-	-
Reaction mass of 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate and 2-ethylhexyl 10-ethyl-4-[[2-[(2-ethylhexyl)oxy]-2-oxoethyl]thio]-4-octyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (reaction mass of DOTE and MOTE)	-	-
Cadmium sulphate	233-331-6	10124-36-4, 31119-53-6
Cadmium fluoride	232-222-0	7790-79-6
2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE)	239-622-4	15571-58-1
2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	223-346-6	3846-71-7
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	247-384-8	25973-55-1
Sodium peroxometaborate	231-556-4	7632-04-4
Sodium perborate, perboric acid, sodium salt	-	-
Cadmium chloride	233-296-7	10108-64-2
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	271-093-5	68515-50-4
Trixylyl phosphate	246-677-8	25155-23-1
Lead di(acetate)	206-104-4	301-04-2
Imidazolidine-2-thione (2-imidazoline-2-thiol)	202-506-9	96-45-7
Disodium 4-amino-3-[[4'-[(2,4-diaminophenyl)azo][1,1'-biphenyl]-4-yl]azo] -5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38)	217-710-3	1937-37-7
Disodium 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28)	209-358-4	573-58-0
Dihexyl phthalate	201-559-5	84-75-3
Cadmium sulphide	215-147-8	1306-23-6
Pentadecafluorooctanoic acid (PFOA)	206-397-9	335-67-1
Dipentyl phthalate (DPP)	205-017-9	131-18-0
Cadmium oxide	215-146-2	1306-19-0

Cadmium	231-152-8	7440-43-9
Ammonium pentadecafluorooctanoate (APFO)	223-320-4	3825-26-1
4-Nonylphenol, branched and linear, ethoxylated	-	-
Trilead dioxide phosphonate	235-252-2	12141-20-7
Trilead bis(carbonate) dihydroxide	215-290-6	1319-46-6
Tricosafluorododecanoic acid	206-203-2	307-55-1
Tetralead trioxide sulphate	235-380-9	12202-17-4
Tetraethyllead	201-075-4	78-00-2
Sulfurous acid, lead salt, dibasic	263-467-1	62229-08-7
Silicic acid, lead salt	234-363-3	11120-22-2
Silicic acid (H2Si2O5), barium salt (1:1), lead-doped	272-271-5	68784-75-8
Pyrochlore, antimony lead yellow	232-382-1	8012-00-8
Pentalead tetraoxide sulphate	235-067-7	12065-90-6
Pentacosafluorotridecanoic acid	276-745-2	72629-94-8
Orange lead (lead tetroxide)	215-235-6	1314-41-6
o-toluidine	202-429-0	95-53-4
o-aminoazotoluene	202-591-2	97-56-3
n-pentyl-isopentylphthalate	933-378-9	776297-69-9
N-methylacetamide	201-182-6	79-16-3
N,N-dimethylformamide	200-679-5	68-12-2
Methyloxirane (Propylene oxide)	200-879-2	75-56-9
Methoxyacetic acid	210-894-6	625-45-6
Lead titanium zirconium oxide	235-727-4	12626-81-2
Lead titanium trioxide	235-038-9	12060-00-3
Lead oxide sulfate	234-853-7	12036-76-9
Lead monoxide (lead oxide)	215-267-0	1317-36-8
Lead dinitrate	233-245-9	10099-74-8

Lead cyanamidate	244-073-9	20837-86-9
Lead bis(tetrafluoroborate)	237-486-0	13814-96-5
Hexahydromethylphthalic anhydride	-	-
Heptacosafluorotetradecanoic acid	206-803-4	376-06-7
Henicosafluoroundecanoic acid	218-165-4	2058-94-8
Furan	203-727-3	110-00-9
Fatty acids, C16-18, lead salts	292-966-7	91031-62-8
Dioxobis(stearato)trilead	235-702-8	12578-12-0
Dinoseb (6-sec-butyl-2,4-dinitrophenol)	201-861-7	88-85-7
Dimethyl sulphate	201-058-1	77-78-1
Diisopentyl phthalate	210-088-4	605-50-5
Diethyl sulphate	200-589-6	64-67-5
Dibutyltin dichloride (DBTC)	211-670-0	683-18-1
Diazene-1,2-dicarboxamide (C,C'-azodi(formamide)) (ADCA)	204-650-8	123-77-3
Cyclohexane-1,2-dicarboxylic anhydride	-	-
Bis(pentabromophenyl) ether (decabromodiphenyl ether) (DecaBDE)	214-604-9	1163-19-5
Biphenyl-4-ylamine	202-177-1	92-67-1
Acetic acid, lead salt, basic	257-175-3	51404-69-4
[Phthalato(2-)]dioxotrilead	273-688-5	69011-06-9
6-methoxy-m-toluidine (p-cresidine)	204-419-1	120-71-8
4-Nonylphenol, branched and linear	-	-
4-methyl-m-phenylenediamine (toluene-2,4-diamine)	202-453-1	95-80-7
4-aminoazobenzene	200-453-6	60-09-3
4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated	-	-
4,4'-oxydianiline and its salts	-	-
4,4'-methylenedi-o-toluidine	212-658-8	838-88-0
3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	421-150-7	143860-04-2
1-bromopropane (n-propyl bromide)	203-445-0	106-94-5

1,2-diethoxyethane	211-076-1	629-14-1
1,2-Benzenedicarboxylic acid, dipentyl ester, branched and linear	284-032-2	84777-06-0
α,α-Bis[4-(dimethylamino)phenyl]-4 (phenylamino)naphthalene-1-methanol (C.I. Solvent Blue 4)	229-851-8	6786-83-0
N,N,N',N'-tetramethyl-4,4'-methylenedianiline (Michler's base)	202-959-2	101-61-1
Lead(II) bis(methanesulfonate)	401-750-5	17570-76-2
Formamide	200-842-0	75-12-7
Diboron trioxide	215-125-8	1303-86-2
[4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Blue 26)	219-943-6	2580-56-5
[4-[4,4'-bis(dimethylamino) benzhydrylidene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride (C.I. Basic Violet 3)	208-953-6	548-62-9
4,4'-bis(dimethylamino)benzophenone (Michler's ketone)	202-027-5	90-94-8
4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol	209-218-2	561-41-1
1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione (β-TGIC)	423-400-0	59653-74-6
1,3,5-Tris(oxiran-2-ylmethyl)-1,3,5-triazinane-2,4,6-trione (TGIC)	219-514-3	2451-62-9
1,2-bis(2-methoxyethoxy)ethane (TEGDME; triglyme)	203-977-3	112-49-2
1, 2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME)	203-794-9	110-71-4
Zirconia Aluminosilicate Refractory Ceramic Fibres	-	-
Trilead diarsenate	222-979-5	3687-31-8
Potassium hydroxyoctaoxodizincatedichromate	234-329-8	11103-86-9
Phenolphthalein	201-004-7	77-09-8
Pentazinc chromate octahydroxide	256-418-0	49663-84-5
N,N-dimethylacetamide	204-826-4	127-19-5
Lead styphnate	239-290-0	15245-44-0
Lead dipicrate	229-335-2	6477-64-1
Lead diazide, Lead azide	236-542-1	13424-46-9

Formaldehyde, oligomeric reaction products with aniline	500-036-1	25214-70-4
Dichromium tris(chromate)	246-356-2	24613-89-6
Calcium arsenate	231-904-5	7778-44-1
Bis(2-methoxyethyl) phthalate	204-212-6	117-82-8
Bis(2-methoxyethyl) ether	203-924-4	111-96-6
Arsenic acid	231-901-9	7778-39-4
Aluminosilicate Refractory Ceramic Fibres	-	-
4-(1,1,3,3-tetramethylbutyl)phenol	205-426-2	140-66-9
2-Methoxyaniline, o-Anisidine	201-963-1	90-04-0
2,2'-dichloro-4,4'-methylenedianiline	202-918-9	101-14-4
1,2-dichloroethane	203-458-1	107-06-2
Strontium chromate	232-142-6	7789-06-2
Hydrazine	206-114-9	302-01-2, 7803-57-8
2-ethoxyethyl acetate	203-839-2	111-15-9
1-Methyl-2-pyrrolidone (NMP)	212-828-1	872-50-4
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	271-084-6	68515-42-4
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	276-158-1	71888-89-6
1,2,3-trichloropropane	202-486-1	96-18-4
Cobalt(II) sulphate	233-334-2	10124-43-3
Cobalt(II) dinitrate	233-402-1	10141-05-6
Cobalt(II) diacetate	200-755-8	71-48-7
Cobalt(II) carbonate	208-169-4	513-79-1
Chromium trioxide	215-607-8	1333-82-0
Acids generated from chromium trioxide and their oligomers	-	-
2-methoxyethanol	203-713-7	109-86-4
2-ethoxyethanol	203-804-1	110-80-5

Trichloroethylene	201-167-4	79-01-6
Tetraboron disodium heptaoxide, hydrate	235-541-3	12267-73-1
Sodium chromate	231-889-5	7775-11-3
Potassium dichromate	231-906-6	7778-50-9
Potassium chromate	232-140-5	7789-00-6
Disodium tetraborate, anhydrous	215-540-4	12179-04-3, 1303-96-4, 1330-43-4
Boric acid	-	-
Ammonium dichromate	232-143-1	7789-09-5
Acrylamide	201-173-7	79-06-1
Tris(2-chloroethyl) phosphate	204-118-5	115-96-8
Pitch, coal tar, high-temp.	266-028-2	65996-93-2
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	215-693-7	1344-37-2
Lead chromate molybdate sulphate red (C.I. Pigment Red 104)	235-759-9	12656-85-8
Lead chromate	231-846-0	7758-97-6
Diisobutyl phthalate	201-553-2	84-69-5
Anthracene oil, anthracene-low	292-604-8	90640-82-7
Anthracene oil, anthracene paste, distn. lights	295-278-5	91995-17-4
Anthracene oil, anthracene paste, anthracene fraction	295-275-9	91995-15-2
Anthracene oil, anthracene paste	292-603-2	90640-81-6
Anthracene oil	292-602-7	90640-80-5
2,4-dinitrotoluene	204-450-0	121-14-2
Triethyl arsenate	427-700-2	15606-95-8
Sodium dichromate	234-190-3	10588-01-9, 7789-12-0
Lead hydrogen arsenate	232-064-2	7784-40-9
Hexabromocyclododecane (HBCDD)	-	-
Dibutyl phthalate (DBP)	201-557-4	84-74-2
Diarsenic trioxide	215-481-4	1327-53-3

Diarsenic pentaoxide	215-116-9	1303-28-2
Cobalt dichloride	231-589-4	7646-79-9
Bis(tributyltin) oxide (TBTO)	200-268-0	56-35-9
Bis (2-ethylhexyl)phthalate (DEHP)	204-211-0	117-81-7
Benzyl butyl phthalate (BBP)	201-622-7	85-68-7
Anthracene	204-371-1	120-12-7
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	287-476-5	85535-84-8
5-tert-butyl-2,4,6-trinitro-m-xylene (Musk xylene)	201-329-4	81-15-2
4,4'- Diaminodiphenylmethane (MDA)	202-974-4	101-77-9

Appendix 2. An example of a full material declaration of a component.

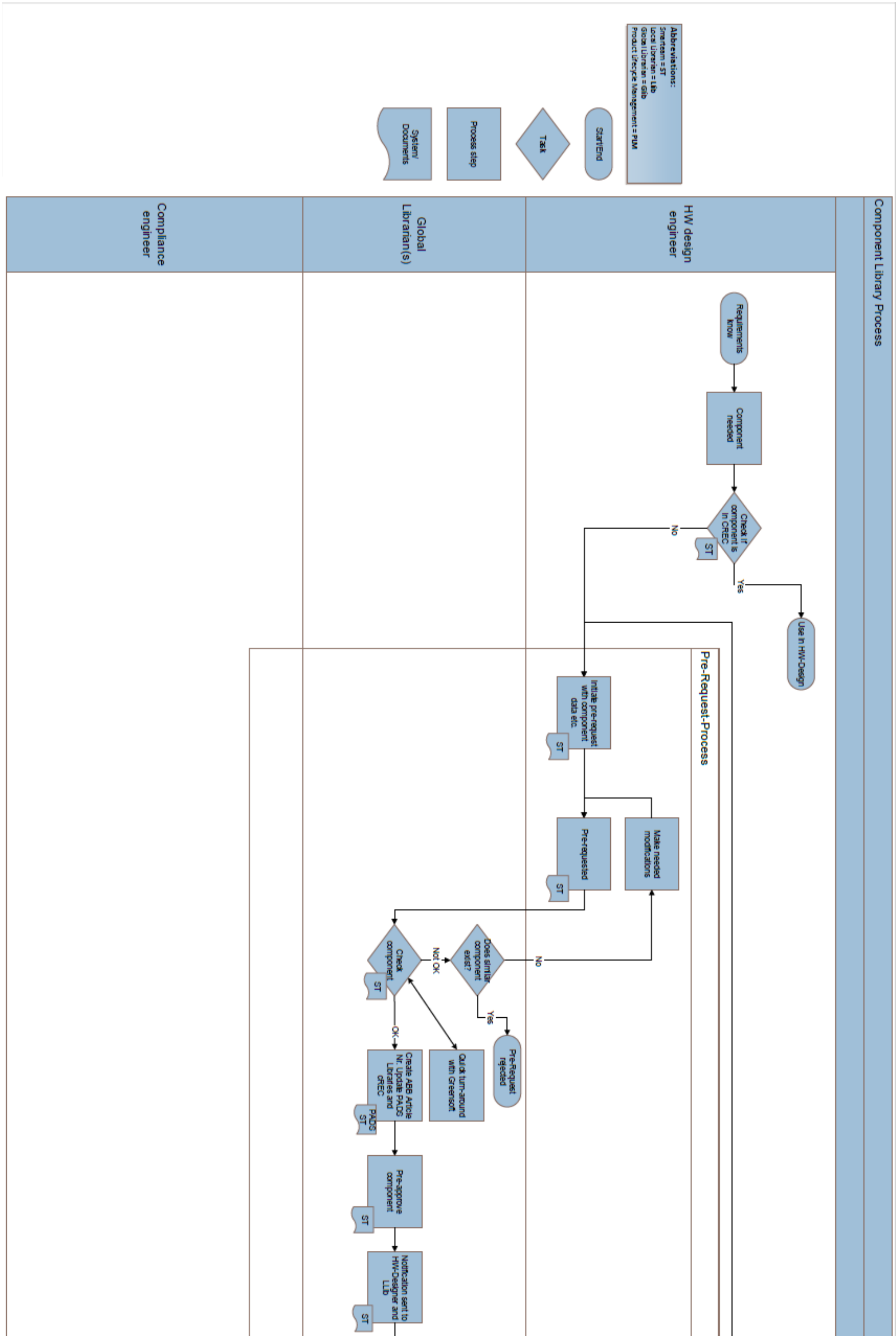
Subdiscrete Category	Subdiscrete	Subdiscrete Type	Subdiscrete Weight (g)	Subdiscrete Wt% of Discrete	Constituent	CAS #	Constituent Wt% (of the Subdiscrete)	Mass(g)	Mass(mg)
Bond Wire	Gold	Mixed 7	0,000092	0,1					
					GOLD	7440-57-5	99	0,00009108	0,09108
					palladium	7440-05-3	1	0,00000092	0,00092
Die	Micron	Cu/Al/Ta	0,0075532	8,21					
					aluminium	7429-90-5	0,2	0,000015106	0,0151064
					copper	7440-50-8	0,05	0,00000378	0,0037766
					SILICON	7440-21-3	99,7	0,00753054	7,5305404
					tantalum	7440-25-7	0,05	0,000003777	0,0037766
Die Attach	Film	Standard	0,0013156	1,43					

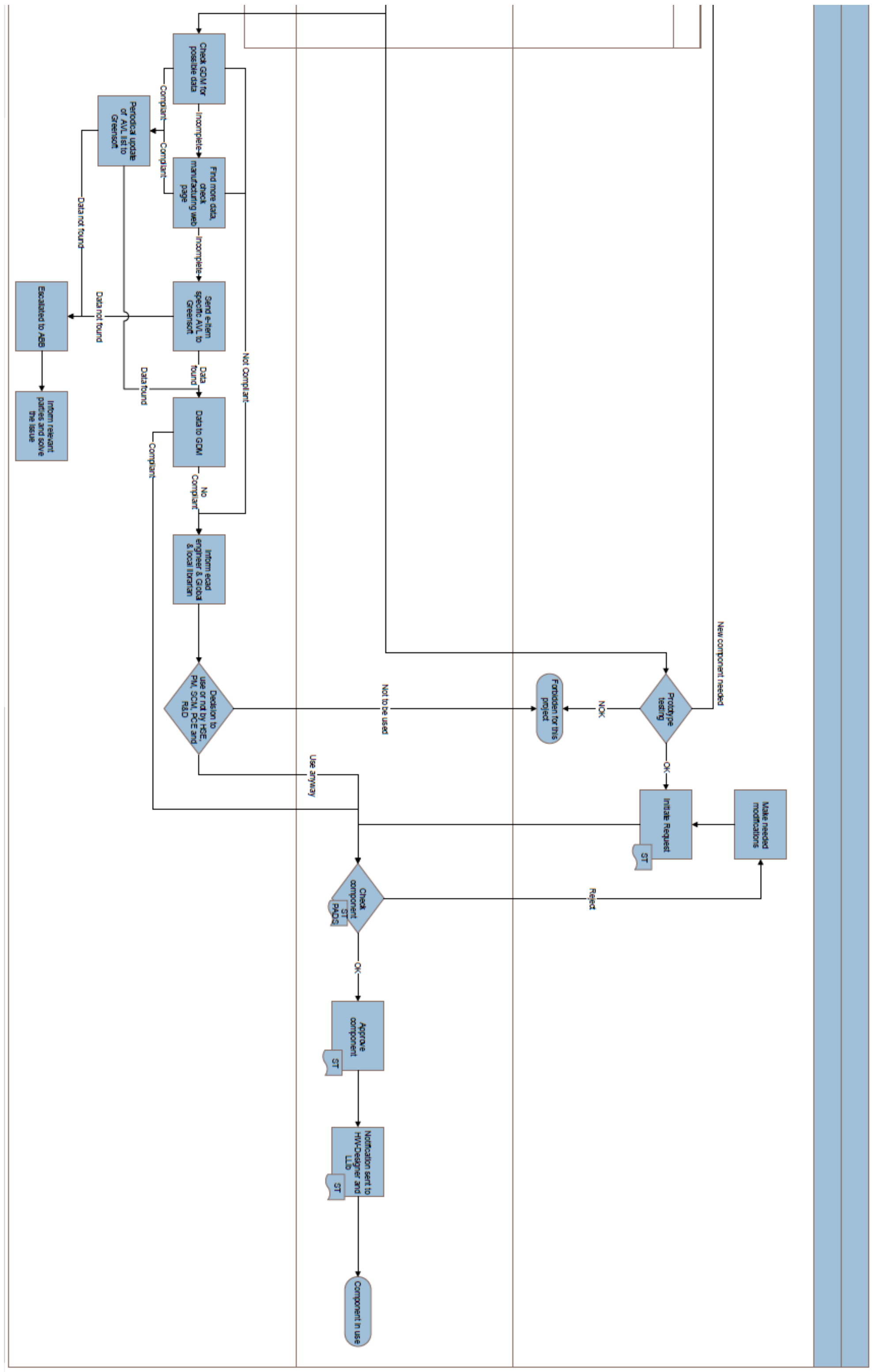
					Formaldehyde, polymer with (chloromethyl)oxirane and 2-methylphenol	29690-82-2	80	0,00105248	1,05248
					Silane, dichlorodimethyl-, reaction products with silica	68611-44-9	20	0,00026312	0,26312
Encapsulant	Epoxy Mold Compound	Green	0,0592848	64,44					
					4,4'-Dihydroxy-3,3',5,5'-tetramethyldiphenylmethane diglycidyl ether	93705-66-9	8	0,00474278	4,742784
					ALUMINIUM HYDROXIDE	21645-51-2	3	0,00177854	1,778544
					Benzaldehyde, hydroxy-, polymer with phenol	106466-55-1	5	0,00296424	2,96424
					CARBON BLACK	1333-86-4	1	0,00059285	0,592848
					SILICA, VITREOUS	60676-86-0	83	0,04920638	49,206384
Internal Plating	LCC Pad Plating	Nickel Gold	0,0002024	0,22					
					GOLD	7440-57-5	10	0,00002024	0,02024
					nickel	7440-02-0	90	0,00018216	0,18216
Interposer Core	BT Substrate	Green	0,0077004	8,37					
					1,1'-(methylenedi-p-phenylene)bismaleimide	13676-54-5	11,5	0,00088555	0,885546
					bisphenol A	80-05-7	0,6	0,0000462	0,04620024

					Cyanic acid, (1-methylethylidene)di-4,1-phenylene ester, homopolymer	25722-66-1	8,5	0,00065453	0,654534
					Formaldehyde, polymer with (chloromethyl)oxirane and 2-methylphenol	29690-82-2	9,3	0,00071614	0,7161372
					FORMALDEHYDE, POLYMER WITH 2-(CHLOROMETHYL)OXIRANE AND PHENOL	9003-36-5	9	0,00069304	0,693036
					GLASS, OXIDE, CHEMICALS	65997-17-3	52,9	0,00407351	4,0735116
					magnesium silicate	13776-74-4	1	0,00007700	0,077004
					SILICON DIOXIDE	7631-86-9	7,2	0,00055443	0,5544288
Interposer Solder Mask	Ink	Epoxy	0,0039008	4,24					
					Oxirane, 2,2'-[[[(oxiranylmethoxy)phenyl]methylene]bis[[(1,1-dimethylethyl)methylphenylene]oxymethylene]]bis-	129915-35-1	99,5	0,003881296	3,881296
					polychloro copper phthalocyanine	1328-53-6	0,5	0,000019504	0,019504
Interposer Surface Finish	Surface Finish	Gold	0,0000092	0,01					
					GOLD	7440-57-5	100	0,0000092	0,0092

Interposer Surface Finish 2	Surface Finish	Nickel	0,0000368	0,04					
					nickel	7440-02-0	100	0,0000368	0,0368
Interposer Surface Finish 3	Surface Finish	Copper	0,0014536	1,58					
					copper	7440-50-8	100	0,0014536	1,4536
Solder	Balls	SAC 305	0,0104512	11,36					
					copper	7440-50-8	0,5	0,00005226	0,052256
					SILVER	7440-22-4	3	0,00031354	0,313536
					TIN	7440-31-5	96,5	0,010085408	10,085408
					Total Weight			0,092	92

Appendix 3. The component library process flow chart




Make needed modifications
New component needed
Prototype testing
OK
Initiate Request
ST
NOK
Reject
Forbidden for this project
Not to be used
Use anyway
Check component
ST
PADS
OK
Approve component
ST
Notification sent to HW-Designer and LLib
ST
Component in use
Not Compliant
Check GDM for possible data
Incomplete
Find more data, check manufacturing web page
Incomplete
Send e-item specific AVL to Greensoft
Data found
Data to GDM
No Compliant
Inform ecad engineer & Global & local librarian
Decision to use or not by HSE, PM, SCM, PCE and R&D
Compliant
Compliant
Compliant
Periodical update of AVL list to Greensoft
Data found
Data not found
Data not found
Escalated to ABB
Inform relevant parties and solve the issue