



CREATION OF THE EVALUATION CRITERIA FOR THE ENVIRONMENTAL ASPECTS

Case Neste Oyj Kilpilahti Site

Lappeenranta–Lahti University of Technology LUT

Master's Programme in Circular Economy

2025

Sara Lahtinen

Examiners: Associate Professor Jarkko Levänen

Postdoctoral Researcher Laura Kainiemi

Supervisors: Timo Rautiainen, M.Sc. (Tech.)

Hanna Huttunen, M.Sc. (Econ.)

Minna Ruokolainen, M.Sc. (Environmental Sciences/Chemist)

ABSTRACT

Lappeenranta–Lahti University of Technology LUT

LUT School of Energy Systems

Environmental Technology

Sara Lahtinen

Creation of The Evaluation Criteria for the Environmental Aspects

Case Neste Oyj Kilpilahti Site

Master's thesis of Environmental Technology

2025

79 pages, 11 figures, 2 tables and 6 appendices

Examiners: Associate Professor Jarkko Levänen, Postdoctoral Researcher Laura Kainiemi

Supervisors: Timo Rautiainen M.Sc. (Tech.), Hanna Huttunen M.Sc. (Econ.), Minna Ruokolainen M.Sc. (Environmental Sciences/Chemist)

Keywords: ISO 14001, IED2.0, Environmental Management System, evaluation of environmental aspects, significance of environmental aspects

This master's thesis has been implemented as scientific research for Neste Corporation. The aim of the thesis was to investigate how the environmental impact evaluation criteria could contribute to achieving the environmental goals set by Neste's management, and to examine how the new requirements of the EU's Industrial Emissions Directive (IED) 2.0 affect Neste's Environmental Management System (EMS) and its updating. The purpose was to create a set of criteria for evaluating the impacts of environmental aspects, which would help determine the significance of the aspects and, through this, forward the corrective action proposals defined for significant aspects to the company's management.

The new requirements of IED 2.0 guide companies in EU member states, among other things, to update their EMS to be public and to improve the company's sustainable development. The requirements of the ISO 14001 standard granted to Neste have also been considered when creating the criteria, so that the company can improve the compliance of its operations. The criteria consist of five different evaluable criteria and five evaluation levels, which can be used to score environmental aspects according to their significance.

The criteria were piloted by using identified environmental aspects of the wastewater plant at Neste's Porvoo refinery. Based on the results of the pilot, it can be stated that the aspects identified as significant by the criteria can contribute to the transparency of Neste's EMS and the achievement of environmental objectives.

TIIVISTELMÄ

Lappeenrannan–Lahden teknillinen yliopisto LUT

LUT Energiajärjestelmien Tiedekunta

Ympäristötekniikka

Sara Lahtinen

Ympäristönäkökohtien arviointikriteeristön luominen

Tapaus Neste Oyj Kilpilahden toimipiste

Ympäristötekniikan diplomityö

2025

79 sivua, 11 kuvaa, 2 taulukkoa ja 6 liitettä

Tarkastajat: Professori Jarkko Levänen, tutkijatohtori Laura Kainiemi

Ohjaajat: Timo Rautiainen M.Sc. (Tech.), Hanna Huttunen M.Sc. (Econ.), Minna Ruokolainen M.Sc. (Ympäristötieteet/Kemisti)

Avainsanat: ISO 14001, IED 2.0, ympäristönhallintajärjestelmä, ympäristönäkökohtien arviointi, ympäristönäkökohtien merkittävyys

Tämän diplomityö on toteutettu tieteellisenä tutkimuksena Neste Oyj:lle. Työn tavoitteena oli selvittää miten ympäristönäkökohtien vaikutusten arviointikriteeristöllä voitaisiin edistää Nesteen johdon asettamien ympäristötavoitteiden saavuttamista sekä tutkia miten EU:n asettaman teollisuuspäästödirektiivi 2.0:n (IED) uudet vaatimukset vaikuttavat Nesteen ympäristönhallintajärjestelmään ja sen päivittämiseen. Tarkoituksena oli laatia ympäristönäkökohtien vaikutusten arviointiin tarkoitettava kriteeristö, jonka avulla näkökohtien merkittävyys voitaisiin määritellä ja sen kautta viedä merkittävälle näkökohdille määritellyt korjaavat toimenpide-ehdotukset eteenpäin yrityksen johdolle.

IED 2.0:n uudet vaatimukset ohjaavat EU:n jäsenmaiden yrityksiä mm. päivittämään ympäristönhallintajärjestelmänsä julkiseksi sekä parantamaan yrityksen kestävä kehitystä. Nesteelle myönnetyn ISO 14001 standardin vaatimukset on myös huomioitu kriteeristöä luodessa, jotta yritys pystyisi parantamaan toimintansa vaatimustenmukaisuutta. Kriteeristö koostuu viidestä eri arvioitavasta kriteeristä sekä viidestä arviointitasosta, joiden avulla ympäristönäkökohdat voidaan pisteyttää merkittävyyden mukaan.

Kriteeristön pilotointi toteutettiin Nesteen Porvoon jalostamon jätevesilaitoksen toiminnan tunnistetuilla ympäristönäkökohdilla. Pilotoinnin tulosten perusteella voidaan todeta, että kriteeristön avulla merkittäviksi näkökohdiksi tunnistettujen näkökohtien avulla voidaan edistää Nesteen ympäristönhallintajärjestelmän läpinäkyvyyttä sekä ympäristötavoitteiden saavuttamista.

ACKNOWLEDGEMENTS

My two years of studies at LUT have now come to an end. Just a few years ago, the thought of holding a Master of Science in Environmental Engineering degree felt like a distant dream, and that's why I am truly grateful and proud of this achievement. Although combining work and studies was at times really demanding, it taught me a tremendous amount as a person. During my studies, I gained vast new insights into the circular economy and the management of our environment, but I also learned a lot about myself and my own resources.

I sincerely want to thank Neste's entire environment team, especially Hanna and Timo. Thank you for making the completion of this work possible and for taking the time to guide and teach me even during major changes – you are true professionals! A big thank you also to my quality team for their support and empathy during my studies.

These past two years have held a lot, both in my professional and personal life. That's why I am grateful to everyone who was part of the journey during these times. Warm thanks to my loved ones and friends who kept encouraging me even on the worst days. I especially want to thank my spouse, Manu, my safe harbour, for believing in me and giving me strength when my endurance was at its limits. Thank you for being there for me when I needed it most.

Now it's time to return to everyday life and start planning the next steps in my career. As they say at Neste: The only way is forward!

21 May 2025, Porvoo Finland

Sara

SYMBOLS AND ABBREVIATIONS

Abbreviations

ASR	Asian Sustainability Rating
BAT	Best Available Technology
BS	British Standard
CDP	Carbon Disclosure Project
CPAA	Certified Public Accountants Association
CSCP	Certified Supply Chain Professional
CSRD	Corporate Sustainability Reporting Directive
ESRD	European sustainability Reporting Standard
DNV	Det Norske Veritas
DJSI	Dow Jones Sustainability Index
EAP	Environmental Action Programme
ECCP	European Climate Change Programme
EEA	European Environment Agency
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
ESG	Environmental, Social and Governance
ESRD	European Sustainability Reporting Standard
GHG	Greenhouse Gas
IED	Industrial and Livestock Rearing Emissions Directive
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization

JRC	Joint Research Center
LCA	Life-Cycle Assessment
PDCA	Plan-Do-Check-Act –method
PMP	Project Management Professional
R&D	Research and Development
SCCM	Stichting Coördinatle Certificatie Managementsystemen, <i>eng. Foundation of coordination of ccertification systems for the environment, healthy and safe working</i>
SDG	Sustainable Development Goals
SEA	Significant Environmental Aspect
SRT	Sustainability Reporting Tool
TQEM	Total Quality Environmental Management
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Table of contents

Abstract

Acknowledgements

Symbols and abbreviations

1	Introduction	8
2	Environmental Management	10
2.1	Development of operations - PDCA	10
2.2	Environmental Management System	11
2.3	History of EU's Environmental Management.....	14
2.4	Current EU requirements	16
2.4.1	IED.....	18
2.4.2	CSRD	19
2.5	Sustainability Reporting Tools.....	21
2.5.1	EMAS	22
2.5.2	ISO 14001	24
2.6	Management of Environmental Aspects	26
3	Environmental Management in Neste	29
3.1	Neste as a corporation	29
3.1.1	History	30
3.1.2	Company Strategy.....	31
3.2	Evaluation of Environmental Aspects in Neste	33
3.2.1	Environmental Aspects in Neste.....	34
4	Research methods	37
4.1	Used methods	37
4.1.1	Research development	37
4.1.2	Literature review	38
4.1.3	Interviews.....	38
4.2	Piloting	39
5	Findings and Results.....	41
5.1	The Evaluation Criteria	41

5.1.1	Scoring Criteria.....	41
5.1.2	Calculation Method.....	45
5.2	Piloting The New Criteria	49
5.3	Key Results	51
5.4	Output Evaluation	52
5.5	Follow-up Actions and Recommendations for the Future	53
6	Discussion.....	55
7	Conclusions	59
8	Summary.....	62
	References.....	65

Appendices

Appendix 1. Identification template of environmental aspects

Appendix 2. Instructions for the Evaluation and Scoring of the Environmental Aspects - tool

Appendix 3. The Evaluation Criteria of the environmental aspects

Appendix 4. Scoring Tool for evaluating environmental aspects

Appendix 5. Scoring Explanations for environmental aspects scoring results

Appendix 6. Automated list of Significant Aspects

1 Introduction

The European Union has set a goal of being carbon neutral by 2050. Industry and livestock have been identified as the largest sources of emissions, but they also play an important role in ensuring livelihoods through the production of food and goods. The different operators in the industries cause emissions into the environment and thus also pose a risk to people's health. Animal rearing and food production produces up to 46% of all the industrial and livestock emissions. Heavy industry and manufacturing produce 27%, while waste industries produce 20%. The remaining 7% is from energy industries and from other sources. (European Commission, 2025g)

To control and prevent the emissions from industry and livestock, the EU created the Industrial Emissions Directive (IED) in 2010. While the EU was setting new environmental targets, changes were also made to the IED and a new version, IED 2.0, was created and put into force in 2024. (European Commission, 2025d) The new requirements and regulations guides companies to be more efficient and environment friendly in their operations by utilizing the Best Available Technologies (BAT technologies). The requirements require companies to generate an Environmental Management System (EMS) and it must be implemented in and audited by 1st of July in 2027 (EUR-Lex, 2024).

With the new directive, operators and companies within the EU are obligated to update their actions to meet the new requirements. Finnish company Neste, which has commissioned this thesis, is obligated to comply with the directive's requirements as well. With the latest updates, Neste has begun taking steps to revise and update its environmental management system and to reduce emissions from its own operations. Revising and updating an environmental management system is a major process that requires a lot of work and resources. In terms of efficiency and quality, the work needs to be divided into smaller entities. This thesis covers only one part of the whole process.

The purpose of this thesis is to research the updated requirements of the environmental management systems and create an evaluation criteria based on the requirements. The criteria will be used to assess the size and significance of the impacts of Neste's different environmental aspects. The criteria will be used as a tool to identify the most critical environmental aspects, which should be focused on monitoring and developing first at the

Neste's Porvoo Kilpilahti refinery. The aim of this thesis is to create a criteria that broadly considers the nature of different aspects. The Porvoo refinery is a massive entity that includes numerous smaller units, departments and stakeholders, and therefore the aptitude and flexibility of the criteria are of paramount importance.

This thesis will answer the questions of how the environmental impact evaluation criteria contribute to achieving the environmental objectives set by Neste's management and how the new requirements of the IED 2.0 affect to Neste's environmental management system. The thesis also considers closely the requirements of the ISO 14001 standard in relation to the environmental management system.

The thesis will be implemented by using two different research methods. The background information of the requirements needed for the criteria will be obtained through literature review. The actual creation of the criteria will be implemented as research development.

The report is divided into two parts, background literature and the development of the criteria. The report begins with an introduction to environmental management and its systems, after which the new EU requirements are discussed. The second part of the report focuses on Neste as a company and its needs and special considerations in environmental management systems. The report concludes with a presentation showcasing the development of the criteria and its piloting.

2 Environmental Management

Over the past couple of decades, companies all over the world have started to develop their operations and policies to be more sustainable and less harmful to our environment. To develop the operations, it is indispensable to understand the company's operations thoroughly and its impacts on the environment, including its stakeholders. Environmental impacts and their identification are large entities, and they require the right tools and methods to be managed effectively and with high quality.

2.1 Development of operations - PDCA

To maximize the profitability and quality of organization and companies it is crucial to develop the operations continuously. Development must be carried out systematically and regularly so that the organization's operations remain constantly up-to-date and meets the latest requirements of guidelines and regulations. To make the development easier there have been created a Plan-Do-Check-Act (PDCA) -method to help organizations to develop their actions and operations step by step. The PDCA -method is a famous model to use in the continual development of different processes. (Johnson, C. N., 2016)

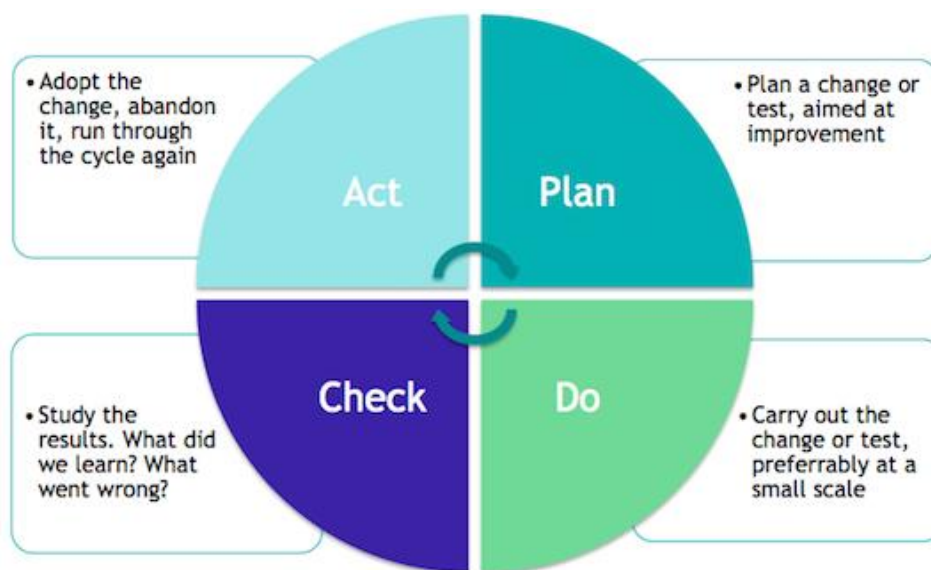


Figure 1 Plan-Do-Check-Act -process (ICT Institute, 2017)

In figure 1 have been explained the PDCA cycle more closely. The method consists of four different steps: plan, do, check, act. The steps guide to identify the opportunities and possible challenges and to plan the coming actions, test the planned actions in practice, analyze the results caused by the actions made and implement the possible corrective actions. (Johnson, C. N., 2016)

The first step, "Plan", is to make a plan for improvement for the coming changes or test. Plan prepares for the future and identifies potential problems. In the next step, "Do", the change or test is implemented according to the plan. In the third step, "Check", the results and lessons learned are collected and evaluated from the test. In the final step, "Act," any necessary corrective actions are assessed and selected. After that the cycle starts over by planning the implementation of the corrective actions. (ICT Institute, 2017) This method should also be used to improve environmental management and is therefore mentioned in this thesis.

2.2 Environmental Management System

To ensure the functionality and effectiveness of environmental management, the entire organization and its operating levels need to be considered. To develop environmental management, organizations have created Environmental Management Systems (EMS) which aim to bring together different parts of the management and integrate environmental managements into organizations operations. The systems help organizations to ensure its continuous improvement in environmental protection and the prevention of environmental incidents. (Welford, R., 2016) With EMSs it is possible to monitor the sustainability of companies. With an effective EMS it is possible to monitor the sustainability of the company, its management and the environmental aspects of its operations. It also can increase the brand value and the attractiveness of the company in the markets. According to Robert Sroufe, incorporating EMS into a company's operations can impact a company's operational capability and performance. (Sroufe, R., 2003)

The EMS enable data to be collected and documented appropriately so that it is easily accessible and manageable. To be efficient, the system needs active and continuous monitoring, so that there is always a readiness and knowledge to identify and implement possible changes and corrections to organizations' operations in environmental performance.

(Sroufe, R., 2003) There are various standards that can be used to support the development and creation of an EMS, and their requirements can be used to create an efficient and compliant system. The most popular standards used are British standard (BS) 7750, Eco-Management and Audit Scheme (EMAS) and ISO 14001. The standard support the development of an EMS and enables the auditing of the system against the requirements and the certification of the organization. (Schaltegger, S., Burritt, R., 2017)

There are several different kinds of methods that can be utilized in environmental management. The most typical methods and tools are Life-Cycle Assessment (LCA), environmental accounting, environmental auditing, environmental reporting, total quality environmental management (TQEM) and Eco-control. (Schaltegger, S., Burritt, R., 2017)

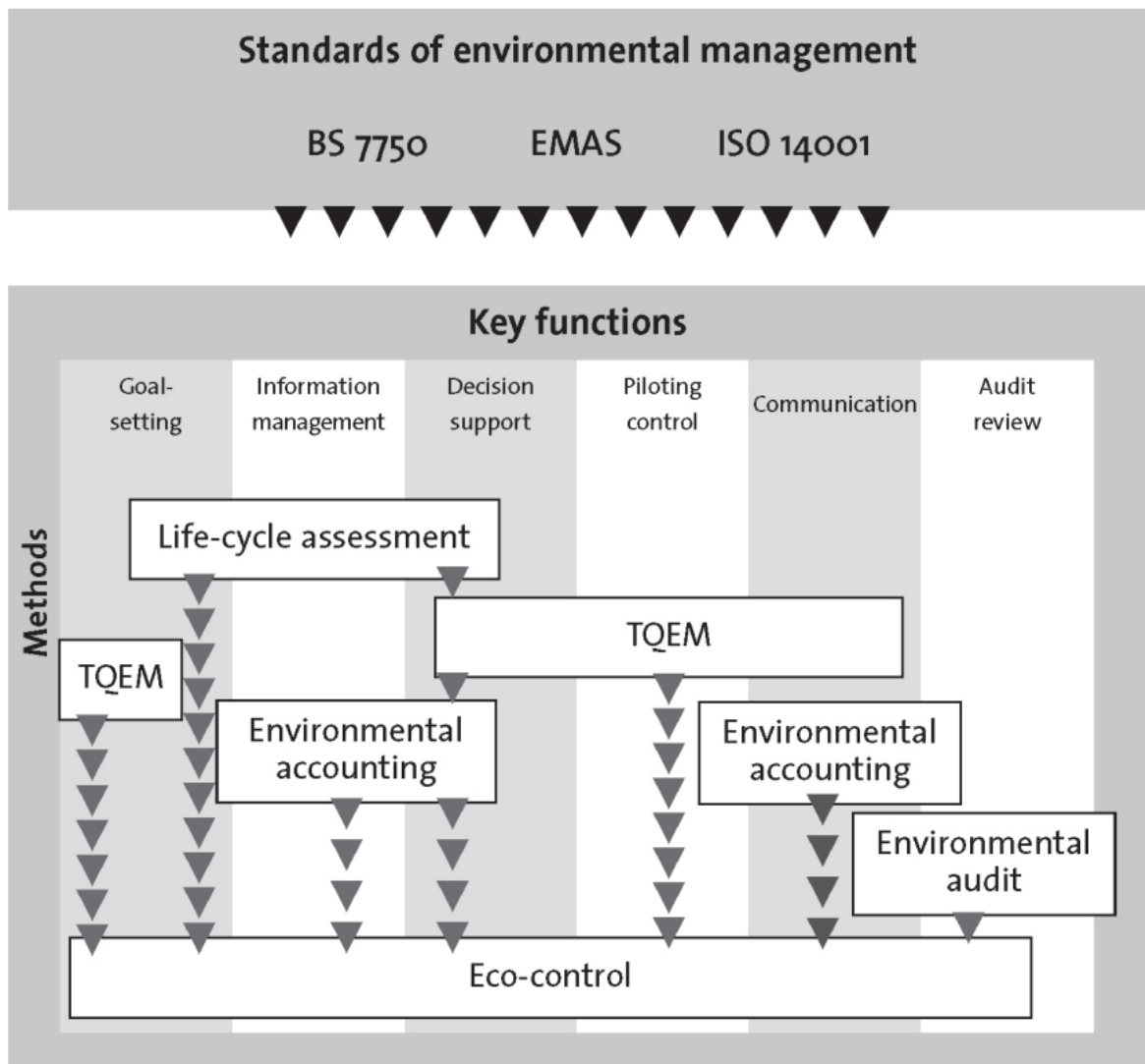


Figure 2 Environmental management tools and functions in corporations (Schaltegger, S., Burritt, R., 2017)

In figure 2 there are presented the tools and functions used in environmental management of corporations. The presented methods work in different functions of organizations. TQEM is a method that is suitable in goal setting, decision support and piloting control. It can be used to ensure the high-quality progress of operations and its continuous development. The LCA method can also be used in goal setting and in decision support. It is based on life-cycle data management and assessment in the environmental management process. The use of environmental accounting supports information management, decision support and communication. This one is the most traditional method of information management in organizations. The environmental audit method naturally supports the organization's audit

review. This is often implemented in the form of a checklist which can be used to determine the organization's compliance level. (Schaltegger, S., Burritt, R., 2017)

The previously mentioned Eco-control, which is not shown in Figure 1, is a method for organizational management that is divided into three different approaches: financially oriented eco-control, ecologically oriented eco-control and economically-ecologically oriented eco-control. Financially oriented eco-control allows for the analysis and control of the economic impacts of the environment on the organization, while ecologically oriented eco-control allows for the control of how the organization and its operations affect the environment. As its name suggests, the third approach, economically-ecologically eco-control, considers both previously presented perspectives. (Schaltegger, S., Burritt, R., 2017)

2.3 History of EU's Environmental Management

Environmental issues have already been a topic of concern for decades. Concern about environmental problems and the seriousness of their consequences arose in the early 1970s. The United Nations Conference on the Environment in Stockholm in 1972 started the planning of environmental policy, and later that year the European Council of Heads of State and Government declared for the first time the need for official environmental policy. (Luise, G., 2024) The first environmental regulations created by the EU came into force in 1973, when the European Commission's first Environmental Action Program EAP came into force. At the time, the main points of the program were reducing and preventing environmental damage, increasing ecology, and rationalizing the use of natural resources. The objectives were considered ambitious and optimistic, but their promotion continued in the following second environmental program, which came into force in 1977. In the second program the focus was especially emphasized on nature conservation. (Hey, C., 2007)

After the 1970s, the objectives of the environmental programs were more moderate due to the global recession and therefore focused more on the functioning of the internal market and environmental policy together. The objects focused more on emission reduction and their target values. The first references about sustainable development were also taken in the 1980s (Hey, C., 2007) and its official definition was published internationally in 1987 (Luise, G., 2024). Following the 1986 Chernobyl nuclear accident, environmental policy was reviewed and revised in the form of the Single European Act, published later in 1986. Since

then, environmental policy has been included in the objectives set by the European Commission to ensure a healthy environment and well-being for people, and the smart, sustainable use of resources. (Luise, G., 2024) At the end of the decade, in 1987, the fourth EAP took a major step forward with environmental protection, by giving it a full chapter of its own in the Treaty establishing the European Commission and by adding it to the overall EAP process as one of the main parts. (Hey, C., 2007)

The most innovative reforms of the fifth EAP were related to the definition of sustainable development goals in line with the Brundtland Report definitions and structural changes to the Treaty to encourage the use of public transport, improve energy efficiency and prevent waste. The program also mentioned economic tools that could encourage voluntary positive environmental actions, for example through tax breaks. However, the new targets were not received by member states as well as the Commission hoped, and this resulted a revision of the program's agenda. As a result of the reassessment, to allow flexibility and leeway for the member states, the new objectives focused on procedural requirements, framework directives, voluntary agreements and self-regulatory information and management tools (Hey, C., 2007).

In 1990 creation of the European Environment Agency (EEA) in accordance Regulation 1210 was started. The purpose of the agency is to collect, analyse and process information on environmental issues from EU member states as well as Iceland, Liechtenstein, Norway, Switzerland and Turkey. However, the EEA has no power for decision-making or obligation to monitor the implementation of environmental policy in all the member states. (Luise, G., 2024) It was officially commissioned in 1994. (European Union, 2025a) Later on in the late 1990s, several new environmental regulations and guidelines were introduced. At the time, the Ambient Air Quality Directive (96/62) (EUR-Lex, 1996b) and the Integrated Pollution Prevention Directive (IPPC, 1996/61) (EUR-Lex, 1996a) along with others came into force. Some of the new statutes conflicted with each other, but those have since been re-evaluated and updated. (Hey, C., 2007)

The development of environmental legislation and the creation of new regulations has accelerated since the beginning of the 2000 century. In 2001, with the Treaty of Nice, the European Council adopted a sustainable development strategy that included the environmental dimension alongside the economic and social dimensions. Four years later, in 2005, the EU published the Kyoto Protocol and the European Climate Change Programme

(ECCP). (Luise, G., 2024) These aimed to control and decrease greenhouse gas emissions in member states by average 5% between 2008 and 2012 compared to 1990 levels (United Nations, 2025), and to set caps on carbon dioxide emissions from industrial companies (EUR-Lex, 2005).

The required emission limit values have been updated several times over the years, and new strict targets have been set for EU member states. The EU is currently implementing its eighth environmental program, which entered into force in 2022 and will be in use until 2030. The current main point is to focus on achieving climate neutrality, accelerating the transition to use clean and efficient energy, and to achieve the circular and well-being economy. (European Parliament, 2022a) To achieve these goals, the EU has already drawn up The European Green Deal in 2019 (European Commission, 2025e) which will enable the implementation of environmental neutrality. (Luise, G., 2024)

2.4 Current EU requirements

The European Union and the regulations that have been defined for its member countries play a major role in promoting sustainable development and in the fight against climate change. EU is currently implementing its eighth Environmental Action Programme. The current programme aims to accelerate the transition of our operations towards climate neutral operations, clean and efficient energy and economy which is advancing and implementing the circularity and well-being. (European Parliament, 2022a) The programme includes a roadmap, European Green Deal, where the goals are set to reduce emissions in European Union's area by 55% by 2030 and achieving carbon and climate neutrality by 2050 (European Parliament, 2022b). In practice this means that the same amount of carbon dioxide emission is produced, the same amount of carbon is sequestered. To achieve a sustainable balance, all greenhouse gases generated from different operations need to be monitored and sequestered in carbon sinks. (European Parliament, 2019) The climate neutrality, alongside carbon neutrality, includes all the gases that have a negative effect on the climate such as nitrous oxide and methane among the others. (United Nations, 2021)

The EU needs to act quickly to achieve climate neutrality before the defined deadline, especially in the sectors that cause the most emissions and environmental impacts. Most of the pollution in Europe is caused by industrial production processes and therefore a directive

has been created for its operations to reduce emissions and guide the companies and actors in a more sustainable direction. With the Industrial and Livestock Rearing Emissions directive it is possible to prevent and control the emissions of livestock farming and industry. (European Commission, 2025d)

To correct the direction of the industry to a more sustainable direction with various directives and guidelines, it is also necessary to update the industry sector's strategy in a way that the directives and strategy supports each other, and the result is equal with clear goals and identified boundaries. The EU's new industrial strategy is aimed at supporting small and medium sized companies in their transformation journey towards carbon and climate neutral operations. (European Parliament, 2020)

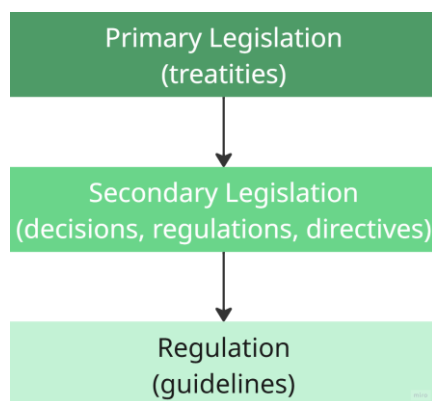


Figure 3 Hierarchy of EU regulations (European Commission, 2025f)

Figure 3 above shows the hierarchy of EU legislation and the composition of its acts. The starting point for legislation is primary legislation, which consists of various treaties that have been jointly agreed by the EU Member States and to which they are all committed. (European Commission, 2025f) Such agreements include the Treaty of Lisbon, Treaty of Nice and Treaty of Amsterdam. (European Union, 2025b) Secondary legislation is derived from primary law and supports any gaps in primary law with detailed regulations. Secondary legislation covers various statutes such as decisions, directives and recommendations. Regulations are also included in secondary legislation and are directly applicable in each EU member state upon entry into force. Such regulations include, for example, the IED. (European Commission, 2025f)

2.4.1 IED

The European Commission has created a directive to control and minimize the emissions and environmental impacts from the EU's industry and livestock sectors (European Commission, 2025d). These sectors have been identified as the EU's largest polluting sectors and therefore their activities must be addressed in detail. The first Industrial Emissions Directive was published and put into force in 2010. The new version, IED 2.0, was published in early 2024 and has been created to replace the old version. (European Commission, 2025d)

Based on the hierarchy of laws presented in Figure 1 of the previous section 2.3, it can be stated that while the IED is a directive, it is not in itself prescriptive, but it must be implemented nationally by enacting its requirements into legislation by amending and updating the state's own existing environmental law. (European Commission, 2025d) In Finland, IED has been implemented by the Environmental Protection Act. (Valtioneuvosto, 2011)

Article 14a of the IED defines the regulations regarding the environmental management systems of industrial and livestock organizations. IED 2.0 has defined its 6 key goals:

1. enhancing the use of new innovative technologies in reducing emissions,
2. further tightening the existing restrictions and limit values of emissions,
3. improving the accessibility of environmental data by simplifying the permitting procedures,
4. developing more effective tools to improve the circular economy and resource efficiency and to reduce the use of chemicals that cause harm to the environment,
5. improving the reduction of the unregulated emissions,
6. improving awareness and understanding of the rights of the public.

(European Commission, 2025d)

According to IED 2.0 requirements, organizations are obliged to create an environmental policy and ensure its availability to the public and to use BAT techniques in their operations

to ensure the most efficient and the most up-to-date operations. The techniques can be identified by using the Sevilla -process, which enables the European Commission's Joint Centre (JRC) to create permit requirements. The requirements concern the resource efficiency of operators, in terms of energy, water and materials. The requirements also include implementing Article 8 of the Energy Management System directive 2012/27/EU or participating in energy audits, producing a list of all hazardous substances used in the organization's operations, defining measures to achieve environmental goals and creating a transformation plan in accordance with Article 27d of the IED. (European Commission, 2025d)

The new requirements will be put into use in the stages by 2030. The European Commission will define and approve by 31st December 2025, an implementing act of the information that companies are required to publish. (European Commission, 2025g) The Commission has started the definition of Best Available Technologies (BAT) in 2024, which must be implemented in industrial companies' operations over a four-year period, starting from 2028. Also, the implementation and auditing of the new EMS system must be completed by July 1st, 2027, excluding the organizations specified in Article 3(4) of Directive (EU) 2024/1785 of the European Parliament and of the Council. (European Commission, 2025d)

2.4.2 CSRD

The EU currently requires large-scale companies (with over 1000 employees) (European Commission, 2025b) to report on their impacts and risks on the environment, society and governance (ESG) (Martinčević, I., Primorac, D., Dorić, B., 2024). Assessing and reporting on the sustainability of companies was previously challenging and inefficient, which is why, in 2023, the EU put the Corporate Sustainability Reporting Directive (CSRD) into force to make it easier for stakeholders to evaluate a company's non-financial performance. (EUR-Lex, 2014) The purpose of the directive is to bring transparency to companies' operations and improve the management of sustainability-related risks. (Martinčević, I., Primorac, D., Dorić, B., 2024) This directive also replaces the Non-Financial Reporting Directive (NFRD) (2014/95/EU) which was created in 2014. (EUR-Lex, 2014) Those companies that are defined as subject to the CSRD are also obliged to report on their activities in accordance with the European Sustainability Reporting Standard (ESRD). (European Commission,

2025b) The implementation of both directives by the member states has been achieved by integrating the directive into each country's own legislation (Martinčević, I., Primorac, D., Dorić, B., 2024).

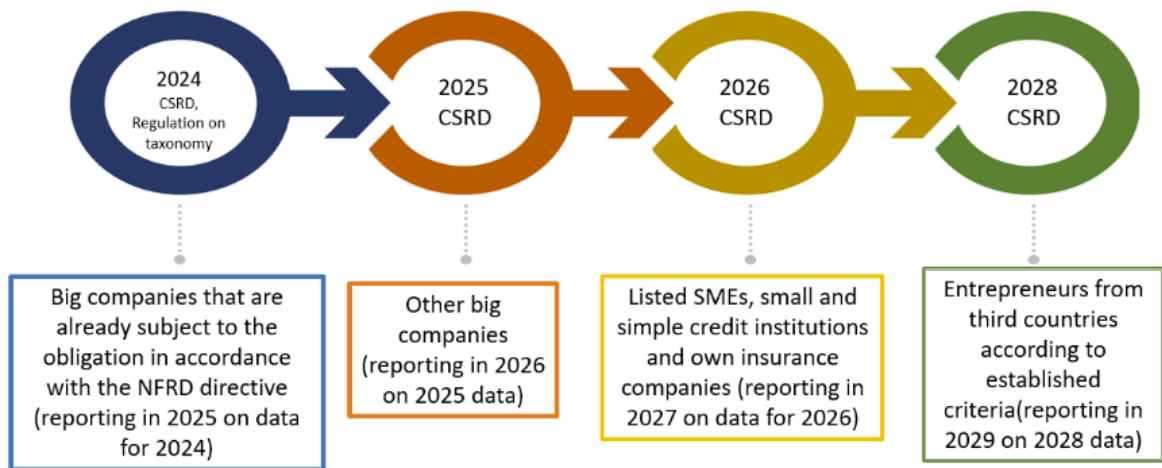


Figure 4 Implementation of the CSRD phase by phase (Martinčević, I., Primorac, D., Dorić, B., 2024)

Figure 4 above shows the phased implementation of CSRD between 2024 and 2028. In the first phase, all companies with more than 1,000 employees that have previously used NFRD switched to CSRD during 2024. Other large companies that have not used the previous directive will implement in the CSRD in their operations during 2025. In 2026, all the listed Small and Medium-sized enterprises (SMEs) and own insurance companies will be reporting in accordance with the directive. Final implementation phase is in 2028, and it applies to the companies which have subcompanies in the EU. Reporting is implemented in each phase by reporting the previous year's data. (Martinčević, I., Primorac, D., Dorić, B., 2024) According to a proposal adopted by the European Commission in February 2025, only companies with a potentially significant negative impact on the environment and people will be required to report on their activities. This also aims to ensure that reporting requirements from large companies do not undermine the value of smaller companies in the value chain. (European Commission, 2025b)

2.5 Sustainability Reporting Tools

According to Siew 2015, one of the biggest competitive advantages for companies in the markets is the transparency of their operations. Nowadays customers and consumers pay attention especially to the companies' sustainability and environmental impacts and how openly they share information about their operations. Sustainability reporting tools enable the assessment of the sustainability of companies' operations and their comparison with each other. (Siew, R. Y. J., 2015)

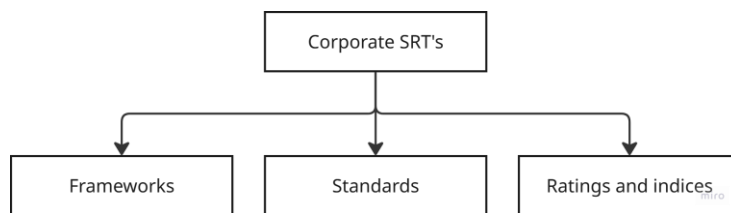


Figure 5 Corporate Sustainability Reporting Tools (Siew, R. Y. J., 2015)

As shown in figure 5 above, the sustainability reporting tools can be divided into three simple categories. The first category, frameworks, describes, at a general level, the sustainability reporting requirements for companies and includes several principles and protocols. The second category is standards, which provide more specific instructions and objectives with the objects that have been identified as the best practices. There are a huge number of standards, but the most well-known of them are, for example, the ISO14001 and EMAS. (Siew, R. Y. J., 2015)

The third category, ratings and indices, includes different rating tools, which aim to measure a company's ESG performance. It includes e.g. Asian Sustainability Rating (ASR) and Dow Jones Sustainability Index (DJSI). (Siew, R. Y. J., 2015)

According to a study conducted by Lozando in 2019, the simultaneous use and utilization of different SRTs should be carefully studied to maximize the effectiveness of reporting and the tools. The benefits of the tools can easily suffer if an organization has too few or too many of them in use at the same time. Reporting may remain too vague and inaccurate if too few different tools are used. By getting acquainted with the different tools and their contents

in advance the coverage of all areas and the required accuracy can be ensured. There can also be too many tools in use at the same time, which can cause overlaps in the use of tools and reduce the efficiency of resource use. When implementing different tools, the needs of the organization must be considered to get the full benefit from sustainability reporting. When choosing a tool, the sector and country in which the organization operates, the organization's role and responsibilities as part of sustainability, the role and impact of stakeholders on the organization's sustainability, and its supply chain must be considered. (Lozano, R., 2019)

2.5.1 EMAS

Eco-Management and Audit Scheme is a regulation and guideline for sustainable development originally created by the European Commission in 1993 (EUR-Lex, 2023). It is also one of the most important elements of the European Green Deal. EMAS is a voluntary tool that enables organizations in various sectors to improve their environmental performance and to develop their operations towards a circular economy. With the tool, organizations can set their own unprompted goals to decrease the identified environmental impacts, create and evaluate the effectiveness of the environmental management system, and increase transparency about its operations and environmental performance to the public and its stakeholders. (European Commission, 2025a)

EMAS differs from other environmental tools with its comprehensiveness and sophistication. It monitors accurately the compliance of the laws, uses core indicators in evaluating actions, and involves the organizations' personnel extensively. According to environmental auditors, EMAS is considered a more efficient tool for verifying requirements than the ISO 14001 standard. (European Commission, 2025c)

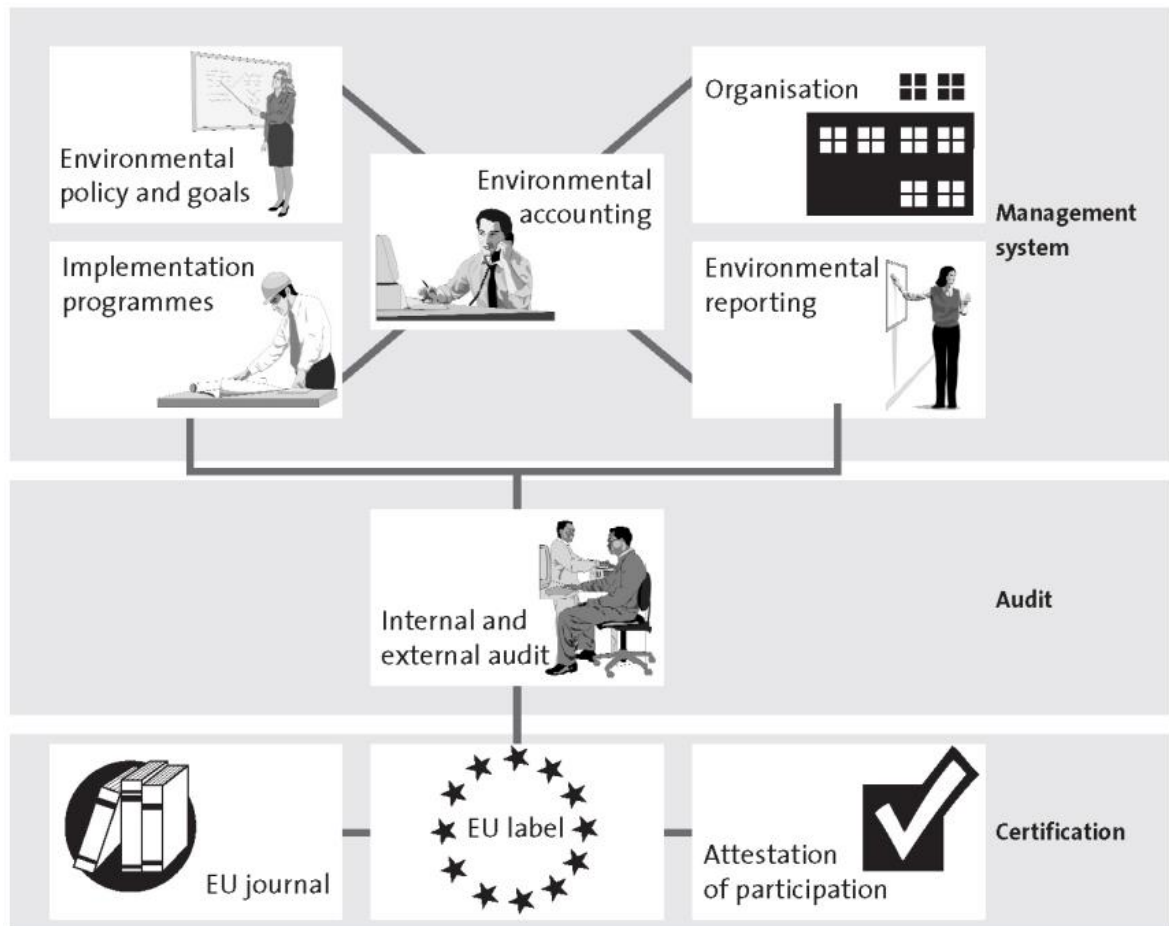


Figure 6 The key elements of EMAS process (Schaltegger, S., Burritt, R., 2017)

Figure 6 above presents the key elements of the EMAS process and the progression of the process from environmental accounting to organizations certification. Environmental accounting consists of the organization's own environmental policy and goals, implementation programs and a management system that includes environmental reporting. Environmental Management System and implementation programs with the environmental policy and goals serve as the organization's auditable objects and are used to assess the organization's compliance with the EMS requirements. If the organization meets the requirements and passes internal and external audits, it is granted the EMAS certificate. (Schaltegger, S., Burritt, R., 2017)

2.5.2 ISO 14001

Organizations often obtain certifications to support their operations. There are several different kinds of certification systems for organizations such as ISO Certifications (International Organization for Standardization, 2025b), Certified Public Accountants Association (CPAA) (Certified Public Accountants Association, 2025), Certified Supply Chain Professional (CSCP) (Association for Supply Chain Management, 2025) and Project Management Professional (Project Management Institute, 2025) -certificates.

There are a huge variety of standards for corporate operations that companies can be certified to after successfully passing the audits. Some of the commonly used ISO -standards are:

- ISO 14001:2015 Environmental management systems (Finnish Standards Association SFS, 2024a)
- ISO 19001:2024 Quality management systems (Finnish Standards Association SFS, 2024b)
- ISO / IEC 27001:2024 Information security management systems (Finnish Standards Association SFS, 2024c)
- ISO 45001:2018 Occupational health and safety management systems (Finnish Standards Association SFS, 2024d)

(International Organization for Standardization, 2025c)

This thesis focuses on the ISO 14001 Environmental management system standard, as it describes the compliance of an EMS. The standard differs from others by focusing on the environmental management and requirements and the transparency of the EMS. ISO 14001 is a standard, created in 1996 by International Organization for Standardization (ISO), for companies' environmental management systems, where all the requirements have been defined for meeting the standard. (Finnish Standards Association SFS, 2025a) The guidelines defined in the standard, guides companies to continuously develop their environmental activities. The standard and its certification can be considered a competitive advantage in today's business market. A well-known standard gives a company an environmentally conscious image and thus attracts customers to use its services. (Finnish

Standards Association SFS, 2015) Alongside this standard, a supporting standard ISO 14004 Environmental management system; general guidelines on implementation. has also been created to provide practical guidance to organizations on creating, implementing, maintaining and developing the EMS. (Finnish Standards Association SFS, 2016)

The ISO 14001 has been developed to improve companies' environmental awareness and increase the understanding of the impacts of their own operations on the environment. By implementing the requirements of the standard, companies are able to develop their operations in, for example, resource efficiency, waste management and costs. (Finnish Standards Association SFS, 2015) The standard has been updated several times over the years. The current version, ISO 14001:2015, came into force in 2015 and replaces the SFS-EN ISO 14001:2004, SFS-EN ISO 14001/AC:2009, SFS-EN ISO 14001/AC: en:2009 and SFS-EN ISO 14001: en:2004 standards. (Finnish Standards Association SFS, 2015)

The key elements of the ISO 14001 standard focus on organizational leadership and its commitment, continuous improvement, definition of the responsibilities and authorities, and documentation. The standard requires commitment from company's management, defining environmental management resources, establishment of environmental policy and objectives, and regular reviews of the EMS results. Continuous improvement aims to develop the level of environmental performance and setting and monitoring of the new goals. The purpose of defining responsibilities and authorities by top management is to ensure the necessary resources to operate and maintain the environmental management system. The standard also requires systematic documentation of all phases and sections of the EMS, so that the required information is available to the public and stakeholders. (Finnish Standards Association SFS, 2015)

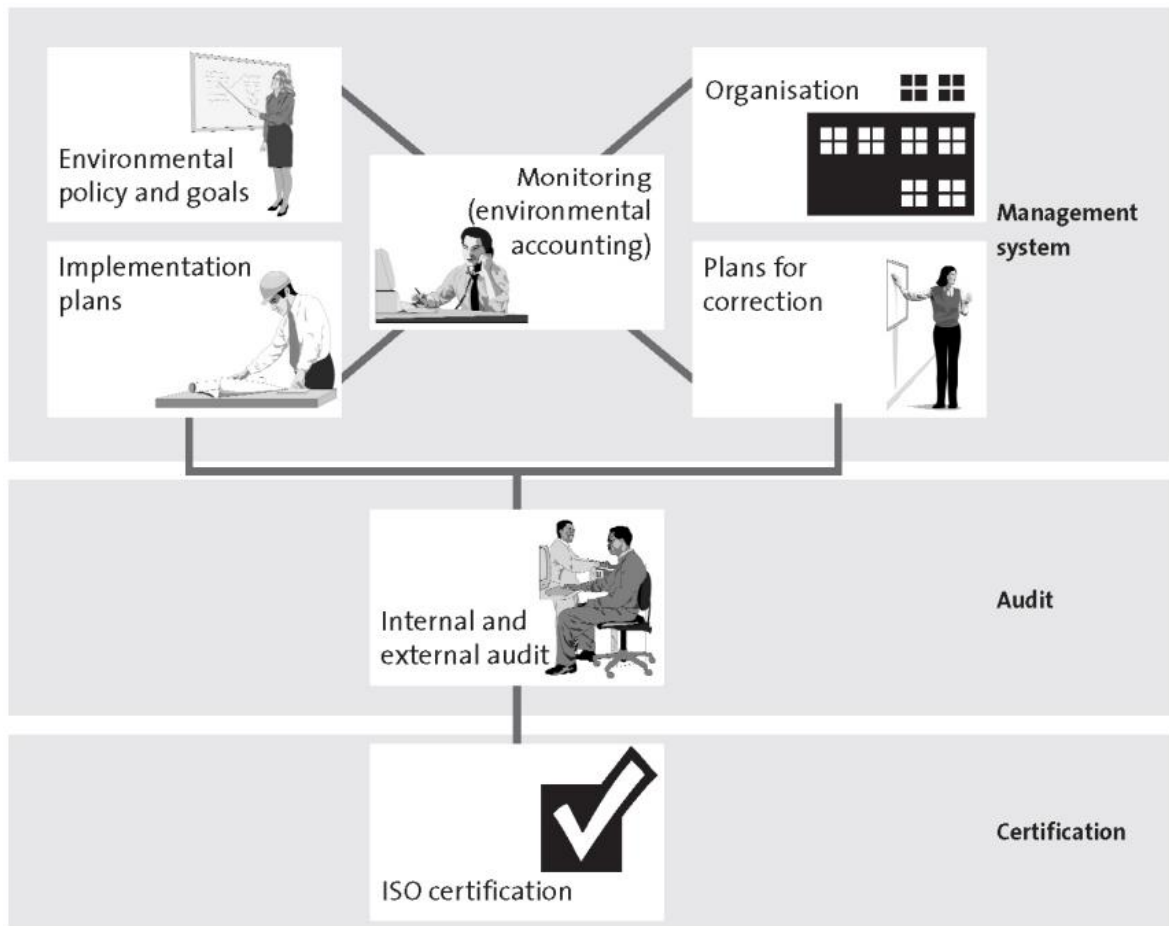


Figure 7 The key elements of ISO 14001 process (Schaltegger, S., Burritt, R., 2017)

Figure 7 illustrates the ISO 14001 certification process for organizations. The process starts from monitoring environmental accounting, which consists of the organization's environmental policy and objectives, implementation plans, and a management system that includes corrective action plans. Environmental Management System and implementation plans with the environmental policy and goals serve as the organization's auditable objects and are used to assess the organization's compliance with the EMS requirements. If the organization meets the requirements and passes internal and external audits, it is granted the ISO 14001 certificate. (Schaltegger, S., Burritt, R., 2017)

2.6 Management of Environmental Aspects

For an organization's environmental management to be effective and comprehensive it must consider the environmental aspects and impacts of the organization's operations. (Finnish

Standards Association SFS, 2024a) To get the maximum benefits from identifying environmental aspects it requires careful planning and precise systematicity.

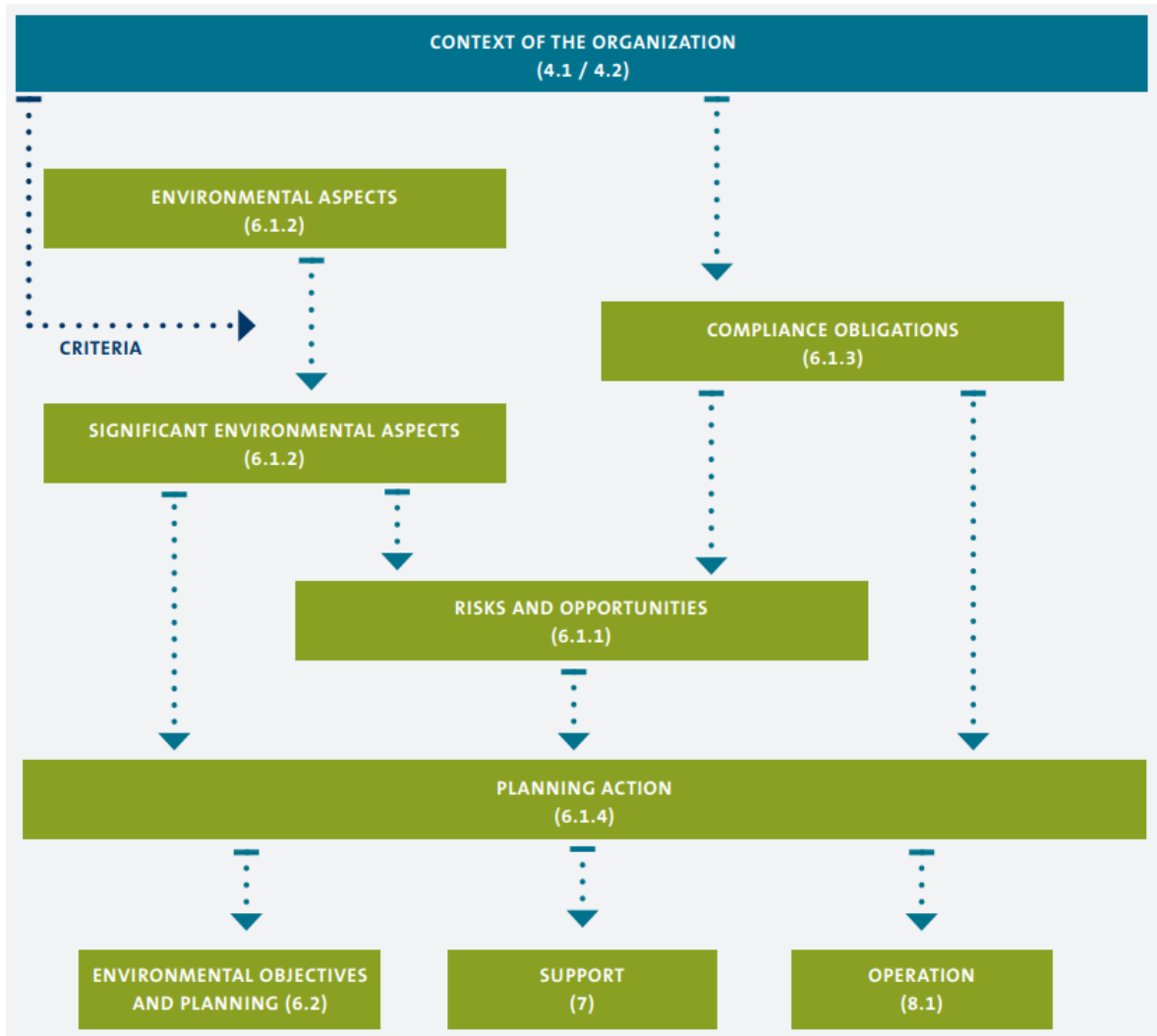


Figure 8 Elements of the implementation of the actions for environmental aspect (SCCM, 2019)

According to figure 8 of the chart prepared by SCCM Foundation (Foundation of coordination of certification management systems for environment, healthy and safe working) related to the context analysis of the organizations, it is stated how the environmental aspects of a company's operations should be addressed and how their development should be implemented. By conducting a context analysis (4.1/4.2), a company can identify all its functions and possible sub-departments that it uses to operate. Analysis is an essential tool in identifying environmental aspects comprehensively from all the

departments of the company without leaving any of them unexamined. It also enables the company to identify the laws and regulations regarding its operations with which it has compliance obligations (6.1.3). (SCCM, 2019)

As described in the SCCM's chart, the next step (6.1.2) is to identify the environmental aspects of identified departments in the context analysis. (SCCM, 2019) Depending on the size of the company there can be a huge number of aspects, making it necessary to separate the most significant aspects from the others. Also, according to the requirements of the ISO 14001 standard, companies are obliged to identify aspects of their operations that have significant environmental impacts. An environmental aspect is defined as "an element of organization's activities or products or services that interacts or can interact with the environment" (Finnish Standards Association SFS, 2015). A significant environmental aspect is an aspect that causes at least one significant environmental impact and has been determined to be significant based on the organization's criteria. (Finnish Standards Association SFS, 2015) For the separation of the aspects, the company needs to create a criteria based on which the significance of the aspects is defined. The need for creation of the criteria is the primary reason for this thesis.

After defining the significance of the environmental aspects, a risk and opportunity assessment (6.1.1) needs to be carried out for the significant aspects. This allows for more detailed assessment of the potential risks arising from the aspects and their probabilities by using risk analysis. In this step, the company's compliance obligations need to be also considered, for example, the likelihood of exceeding the limit values of the environmental permits. After this step, the corrective actions can be planned for the most critical environmental aspects. Action planning (6.1.4) includes environmental objectives (6.2), supporting actions (7) and their usage (8.1) for the environmental aspects. (SCCM, 2019)

3 Environmental Management in Neste

Neste is known around the world for its renewable fuels. It is also one of the largest industrial companies in Finland and therefore an influential environmental actor. (Neste Oyj, 2025j) Large-scale companies require a massive number of resources to operate and that is why their operations should be continuously reviewed and developed. Neste's operations have been in state of transformation in recent years (Neste Oyj, 2025i) with the new renewable fuel innovations and therefore identifying their partly changed environmental aspects and the extent of their impacts are currently needed. From a scientific research perspective, a large international company like Neste is very interesting, especially in line with current trends from an environmental and sustainability perspective. By studying the environmental management and environmental aspects of large, influential companies and business entities, a lot can be learned about the use of environmental functions and the need for improvement, and thus new, more effective tools for environmental management can be created in other companies, both large and small. Neste's operations extend widely across the fuel production and distribution chains (Neste Oyj, 2025j), which also means extensive and diverse solutions for managing environmental impacts. By creating new tools that streamline and improve Neste's operations, it can also help companies in other sectors on a broader scale. And since Neste's refinery operations extend to other parts of Europe and even Asia (Neste Oyj, 2025j), Neste's new environmental management tools can also provide solutions on a global level for the environment.

3.1 Neste as a corporation

Neste Oyj is a Finnish corporation, which is known worldwide as an advanced fuel manufacturer. The company produces renewable fuels, which numerous cooperative partners and individuals use every day for various needs. Neste has been recognized as a pioneer in the development of sustainable fuels and renewable raw material solutions for the use of various polymer and chemical industries. (Neste Oyj, 2025j)

Neste started its operations in 1948, after which its operations have developed and taken huge strides towards more sustainable fuels. (Neste Oyj, 2025j) In 2024, Neste's personnel

consisted of almost 5,800 employees worldwide in nearly 20 different countries and the company's net revenue in the same year was 20,6 million euros. (Neste Oyj, 2025a) The headquarters of the company is located in Keilaranta, Espoo, Finland but the refineries are in Porvoo Kilpilahti, Netherlands and Singapore. The company's gas station chain of almost 1,000 stations operates in Finland and all Baltic countries. (Neste Oyj, 2025j)

3.1.1 History

There were no domestic oil production or fuel industry in Finland before Neste was founded in 1948. The journey from a small local actor to the world's leading producer of renewable fuels had begun. In the 1950s and 1960s, the company expanded its operations and established oil refineries in Naantali (in 1957) and Porvoo (in 1965). Over the next decades, Neste stabilized its position on the markets and became the largest company in Finland. It also continued to expand its retail service station brand outside Finland, including all the Baltic countries and the Northwestern parts of Russia. In the 1990s, Neste was listed on the Helsinki Stock Exchange and began investing in the production of renewable diesel. The NEXBTL technology was patented in 1996 which served as an accelerator for stepping away from fossil raw materials and fuels. The production of this new innovation started in Porvoo 2007 and in the other refineries in the early 2010s. (Neste Oyj Belgium, 2025)

During its transformation journey, the company has merged with Imatran Voima to Fortum, which lasted for about 12 years. After this Neste has changed its name from Neste Oil to Neste, reflecting that the company's operations are no longer focused on oil refining but on other renewable fuels and on the development of oil-substituting products. (Neste Oyj Belgium, 2025)

Over the years, Neste's operations have expanded globally to Rotterdam and Singapore. The Singapore refinery, with excellent global connections, started its operations in 2010, as the company's first major investment in Asia. The operations focuses on renewable diesel production and has an annual capacity of 2.6 million tons. The refinery also produces 1 million tons of Sustainable Aviation Fuel (SAF) annually. (Neste Oyj, 2025h)

As a Europe's largest refinery producing renewable fuels, the refinery of Rotterdam began its operations a year after Singapore, in 2011. Refinery offers great opportunities for

collaboration with other companies for its location. It produces up to 2.7 million tons of renewable diesel and 1.2 million tons of SAF per year. (Neste Oyj, 2025g)

Neste's Porvoo refinery has been continuously growing and nowadays its capacity is 12 million tons per year. The production results over 100 end products that are sold to customers worldwide. The company's aim is to make the Porvoo production plant Europe's most sustainable refinery. (Neste Oyj, 2025e)

3.1.2 Company Strategy

The aim of Neste's actions is to ensure the well-being of our planet for future generations. This leads the company to create solutions to reduce carbon emissions and to develop new solutions to support sustainable development and the circular economy. By utilizing the BATs and creating new innovations, Neste wants to be able to prevent the harm caused by climate change to our planet. (Neste Oyj, 2025f)

Neste's vision is to lead the consumers and service providers as well as the fuel industry towards a more sustainable world. The company wants to improve the world together with other stakeholders and therefore engages in numerous collaborations with international universities and research institutions. (Neste Oyj, 2025d)

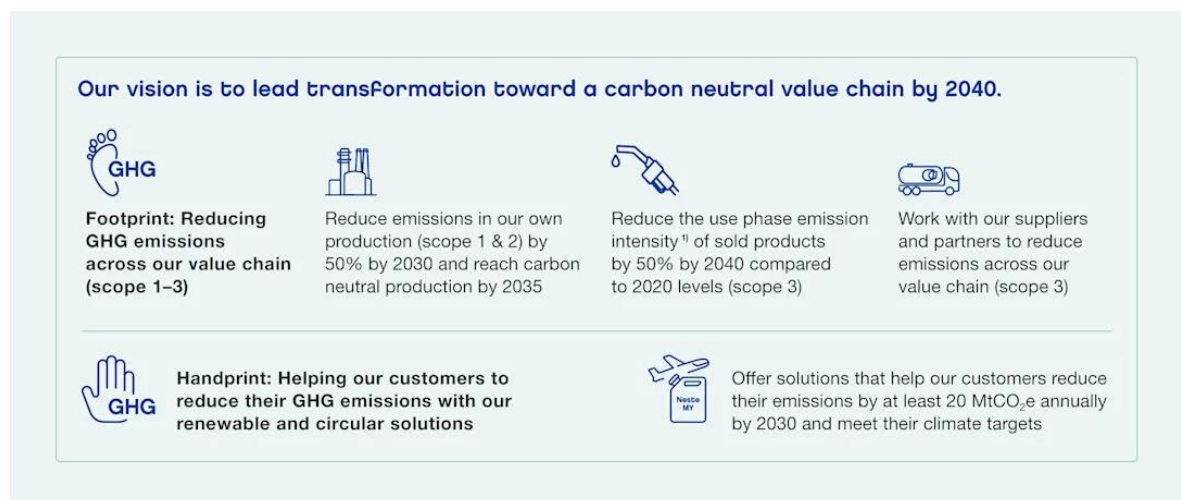


Figure 9 Neste's vision for 2040. (Neste Oyj, 2025c)

Figure 9 describes Neste's vision to achieve a carbon-neutral value chain by 2040. The figure includes a GHG footprint and handprint for the company, which can be used to assess the negative, but also positive impacts on environment and emissions of the company. The footprint is based on three scopes which need to be improved to develop the operations to be more sustainable. These three scopes are explained in more detail in the next chapter. The handprint, on the other hand, aims to capture the company's positive impact by offering sustainable solutions to the customers who want to reduce their own emissions. (Neste Oyj, 2025f)

Neste has announced its commitment to supporting its partners and customers in reducing greenhouse gas (GHG) emissions by tens of millions of tons. So far, reductions of up to 50 million tons have been achieved, and the next goal is to reduce 20 million tons of CO₂e each year by 2030. (Neste Oyj, 2025j) The company has prepared three different scopes with which the company aims to achieve the target to be a carbon neutral corporation by 2035. Scopes consists of focusing on the direct emissions (Scope 1), indirect emissions caused by the purchased energy (Scope 2) and other indirect emissions caused by the value chain (Scope 3). (Neste Oyj, 2025c)

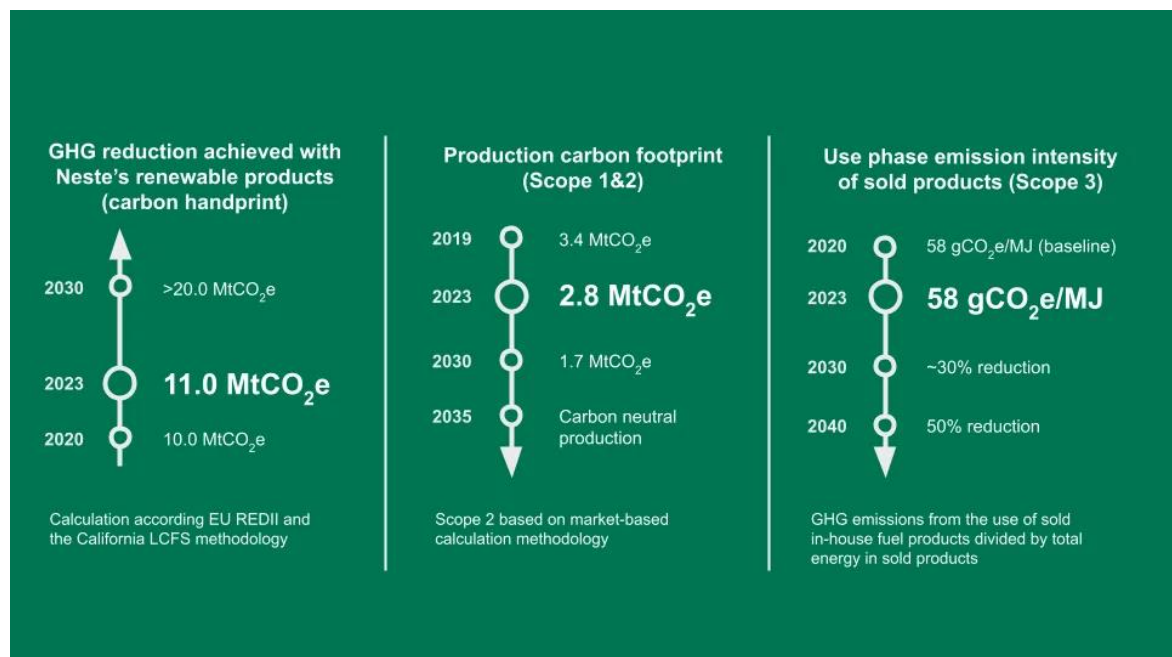


Figure 10 Neste's progress of reducing GHG emissions. (Neste Oyj, 2025a)

Figure 10 above represents the roadmap of Neste's carbon neutrality target and the current situation towards achieving it with the scopes. It has achieved a GHG reduction of 11.0 MtCO₂e by 2023 with its renewable products. The amount of emissions from production containing scope 1 and 2 in 2023 was 2.8 MtCO₂e, which is even 0.6 MtCO₂e less than in 2019. The baseline for the emission intensity of the sold products in the use phase of the product was 58g CO₂e/MJ in 2023 and it is planned to decrease by 30% by 2030 and 50% by 2040. (Neste Oyj, 2025c)

3.2 Evaluation of Environmental Aspects in Neste

Neste started its first environmental monitoring measures in the middle of 1960s with seawater quality monitoring. Later in the 1970s and 1980s, the company started monitoring also air quality and noise, as well as studying ecosystem bioindicators. Neste's environmental department was established in 1969 and it has continued its operations since then. The company created its first group environmental policy in 1984 and published its first group environmental policy report eight years later in 1992. (Neste Oyj, 2025b)

Neste's environmental management and improvement on sustainable development consist of various mandatory and voluntary certifications, regulations, reporting frameworks and global goals and principles, such as Corporate Sustainability Reporting directive (CSRD), European Sustainability Reporting Standards (ESRD), Responsible Care, Sustainable Development Goals (SDG) and several ISO -certificates. Neste also has numerous Environmental, Social and Governance (ESG) ratings and designations, such as S&P Dow Jones Indicates, Global 100 and Carbon Disclosure Project (CDP). At Neste, ISO standards are unit-specific and do not cover all the operations of the company. The company received its first ISO 14001 certification in 1998 for the Oil Products -unit, and it has been audited regularly since then. The company received its first S&P Dow Jones Indicates and Global 100 recognition in 2007. (Neste Oyj, 2025b)

Neste has created internal policies and principles for its operations, which define the company's objectives and guidelines to meet legal and EU requirements. For example, Neste's Environmental Management Principle and Sustainability Policy describes the purpose of the guidelines, the company's responsibilities, minimum requirements and

frameworks, monitoring methods and reporting, and operational development. The guidelines are updated regularly and are available to all Neste employees. (Neste Oyj, 2019)

Environmental management is continuously developing the company's operations. It requires active monitoring and improvement of environmental actions. There are various tools that help actors keep their operations up to date in a changing environment. Like many other companies, also Neste uses the PDCA method in developing its operations. Currently, Neste's operations with its EMS are in PDCA cycle in step four, act. The company has previously created and used its own system and now the functionality and comprehensiveness of the system has been reassessed, and the corrective actions are needed to be implemented. As Neste proceeds in developing its operations towards increased sustainability, it must pay increasing attention to the environmental impacts, both positive and negative, of its operations. (Neste Oyj, 2025j)

Neste's EMS system and the ISO 14001 certificate were last audited in November 2024 by Det Norske Veritas (DNV). The audit revealed some development needs to the EMS and its compliance with the ISO 14001 standards requirements. According to the DNV's audit report, the development needs were considering the ISO 14001 requirement regarding insufficient identification of the environmental aspects. (DNV, 2024)

As a result of the audit, the company's EMS is now being updated and the need to implement an evaluation criteria for the impacts of the environmental aspects has been identified. The criteria is planned to be used to assess the criticality and significance of the impacts of different aspects and thus identify the aspects that need immediate corrective actions.

3.2.1 Environmental Aspects in Neste

In line with ISO 14001 standard and with the EU's new IED requirements, Neste has started to update its EMS system in 2024. The company's environment team has a plan to implement the update and achieve consistency in the system. The plan consists of nine different steps:

1. Identification of the operational environment and stakeholders
2. Identification of the environmental aspects
3. Identification of the significant environmental aspects

4. Identification of the environmental impacts of the significant environmental aspects
5. Definition of the environmental objectives for the significant aspects and impacts
6. Preparation of an environmental programme with measures, responsible persons and timetable
7. Review by the company management
8. Internal audit
9. External audit

(Neste's Environment Team, 2025)

This thesis focuses on steps “2. Identification of the environmental aspects” and “3. Identification of the significant environmental aspects”. Other steps 4-9 will be implemented in Neste after the completion of this thesis during the years 2025-2027. A full-scale context analysis has not yet been conducted for Neste, but the departments and functions have been identified at a high level (step 1. Identification of the operational environment and stakeholders in the Neste's implementation plan). There are plans for more detailed analysis in the future.

When comparing the SCCM chart, represented in figure 8, and the implementation plan of the Neste's environment team, there is notable consistency in the progression of the steps. The main elements of SCCM can be clearly noticed and those have been specified in Neste's plan. The steps to be implemented in this work correspond to steps 6.1.2 Environmental aspects and Significant environmental aspects of the SCCM chart.

In accordance with the second step of the environment team's plan, the team has created an identification template of environmental aspects that helps identify the environmental aspects and their impacts in different functions. Neste's Kilpilahti refinery is a large entity containing a huge number of different functions and departments. To identify environmental aspects efficiently and comprehensively from different perspectives, the Neste environment team has organized workshops separately with the representatives of the different departments of the refinery. Identifying of the aspects is an arduous process that requires resources and time. The workshops for identifying aspects have started in February 2025

and are expected to continue until next fall. The total number of the workshops to be organized will be approximately 15.

In the workshop department representatives together with the environment team review the department's operations, environmental aspects and impacts. The identification template of environmental aspects (Appendix 1.) used in the workshops consists of four parts: function, type, nature and scope of the aspect. Functions refer to the phases and activities of the refinery's operations, such as those related to raw materials (procurement, logistics and storage), products (production, distribution, usage), waste management (wastewater treatment, recycling), and the maintenance of refinery operations (maintenance, R&D, rescue services, land usage and construction).

Aspects are classified by type according to how the aspect appears itself, for example a raw material, chemical, waste, air or water emission, odor, noise or light pollution or other matter related to the refinery's operations. In the third column "nature of the aspect", defines the impact of the aspect as positive or negative. The last evaluation column defines the scope of the aspect as local, regional or global.

4 Research methods

The implementation and system update of the new EU EMS guidelines in companies is a long process and is therefore carried out in separate parts. This thesis focuses on only one part of the updating and does not evaluate other parts of the implementation. The parts of the implementation differ from each other and therefore their specific needs must be considered and the research methods used in each part must be selected accordingly. A comprehensive implementation of the update requires many different methods, and they can be used in different ways for different purposes. By utilizing the right methods, the best results can be achieved from implementation and research in the most efficient way.

4.1 Used methods

The research methods used in this thesis consist of research development, literature review, interviews and piloting. These methods were selected at the beginning of the thesis, during the planning phase. By utilizing all these methods together, it has been possible to ensure the comprehensiveness of the groundwork and input data, as well as the functionality of the final criteria and tool for the evaluation and scoring of the environmental aspects. Based on the successful outcome of the work and the results obtained, the choices of investigation methods can be considered successful.

4.1.1 Research development

Research development as a research method is often used in the creation of new innovations. (Gravemeijer, K., 1998) This method was chosen as one of the research methods for this thesis because the aim of the thesis was to create a new evaluation criteria for environmental aspects of Neste's Kilpilahti Site. The purpose of the criteria being created was to promote the development of Neste's EMS towards meeting the new requirements of IED 2.0 and ISO 14001 standard.

This method combines a theoretical part and a practical part, in which the actual end product of the thesis was prepared. The development work and the preparation of the criteria were

based on a preliminary literature review, based on which the structure and theoretical part of the work began to take shape. In the actual practical part, the criteria for evaluating the environmental aspects and a scoring tool for the significance of the aspects were created.

4.1.2 Literature review

When developing a new tool, it is desirable to start planning by utilizing existing materials and background documentation on the topic. To maximize the benefit and efficiency of the tool, it should be designed to be consistent with the organization's other tools and methods, so that the use of the tool is more natural for the users and does not require extensive training or learning new skills. However, it should be noted that the criteria created in this thesis and its usage requires a broad understanding of environmental issues and their impacts so that the results obtained can be considered realistic.

In this thesis the various internal company tools and materials are considered comprehensively across the Neste departments before the development of the criteria has been started. The criteria has been based on, among other materials, the dual materiality analysis table prepared by Neste's sustainability team and on the main strategic objectives of the Performance Plan 2025 prepared by the Safety Finland team. (Neste Safety Finland, 2024) One of the most important used source of research literature in the development of the criteria was David Ayers' article *Environmental Aspects & Impacts; A system for identifying priorities and setting goals*. According to his studies, to the criteria developed for evaluating environmental aspects and their impacts, a company has a lot of freedom to adapt it to its own needs and desires. Different companies focus on different goals, one wants to aim for the highest possible financial return, while another wants to achieve the most sustainable and environmentally neutral business possible. Depending on the company's goals, the evaluation of aspects can emphasize those themes that are most important to the company. (Ayers, D., 2010)

4.1.3 Interviews

Neste employees have a huge amount of knowledge and expertise, and therefore this work aimed to utilize that knowledge through interviews. The interviews were organized at the

beginning of the work with various experts of Neste. The purpose of the interviews was to collect information from different key roles and to create a basis for understanding the environmental management topic. The interviewees consisted of various experts such as Head of Environmental Safety, Environmental Manager, Senior Environmental Specialist and Environmental Permitting Manager.

The interviews guided the plans of the thesis in the right direction and provided ideas for the needs of the criteria and evaluation tool to be created. The aim of preparing the criteria and tool was to make them as comprehensive as possible but user-friendly. For this reason, the expectations and wishes of the future users of the tools were also discussed in the interviews, so that they would meet their needs as well as possible.

4.2 Piloting

When developing a new tool, it is important to test the tool in practice before it is released. This allows potential problems to be identified in advance and the tool's functions to be modified to be more efficient. Piloting of the criteria created in this thesis was started immediately after the criterion and the base scoring were defined, so that the starting points for the calculation formula and the scoring resolution of environmental aspects could be resolved.

The piloting allowed to evaluate the criteria and scoring tool and its scaling to the correct ratio. The piloting were utilized to identified environmental aspects of the Neste's Kilpilahti refinery's wastewater treatment plant. From the identified aspects, the 7 most significant aspects were selected together with the wastewater treatment plant representatives based on the current information, which served as the aspects to be evaluated in the piloting. The treatment plant representatives were asked to select the top 5 aspects per representative and by combining them, the final number of aspects became 7, when the aspects mentioned twice were combined.

The pilot included different phases, during which the suitability of the criteria, the scoring of the evaluation levels and the functionality of the scoring tool's calculation formula could be verified. The piloting allowed the evaluation levels of the criteria to be adapted to the aspects and to specify practical examples created to support the evaluation, which make it

easier for the user of the scoring tool to choose the most suitable evaluation level. Without comprehensive testing, the criteria and scoring tool or the results from them could not be considered relevant or realistic.

5 Findings and Results

With the EU's new stricter EMS requirements and new guidelines, Neste, Oyj, among other companies, has begun updating its own EMS. Along the update, the company's environment team recognized the need for environmental evaluation criteria and evaluation tool, and thus also need for this master's thesis. Therefore, the purpose of this work is to create a set of criteria and a tool that will enable Neste's environment team to evaluate the significance of various environmental aspects and their impacts and, based on the results obtained, present an action plan with corrective actions to the company's management to manage the environmental impacts of the Porvoo refinery. This chapter presents the use and content of the environmental evaluation criteria and tool, as well as the results obtained from them.

5.1 The Evaluation Criteria

The purpose of the set of criteria created in this thesis is not only to evaluate the significance of the environmental aspects but also to provide comprehensive justification for the evaluation. After the aspects are evaluated, the criteria can be used to present and explain to the company's management why and what kind of corrective actions should be implemented for the significant environmental aspects.

5.1.1 Scoring Criteria

According to David Ayers, the purposes of using criteria and their goals can differ greatly between different companies, and therefore the criteria itself can also differ between different companies. (Ayers, D., 2010) As a result, it is worth noting that the environmental impact evaluations carried out by different companies are not necessarily consistent and therefore they should not be directly compared with each other.

In assessing the impacts of environmental aspects, Neste wants to emphasize the environmental neutrality of its operations and aim to reduce its carbon footprint. Neste's Safety Finland team has prepared a Performance Plan for 2025, where one of the main goals is to ensure that legal compliance obligations are met. (Neste Safety Finland, 2024) This

goal will be noted as one of the criteria to be assessed in the assessment criteria to be developed and will be given special emphasis in the calculation of the assessment.

The criteria for evaluating the significance of the impacts of environmental aspects (Appendix 3.) consist of five evaluation levels and five different evaluation criteria. For each criterion, scoring levels from 1 to 5 have been defined, from which the level that best corresponds to the impact of the environmental aspect is selected. All scoring levels are scaled to the environment and scale of Neste's Kilpilahti refinery. The five evaluation criteria of the criteria are:

- scale of impact,
- scope of impact,
- stakeholder concern and negative publicity,
- irremediability and
- compliance.

All criteria have been chosen with reason and consideration.

The first criteria, Scale of impact, was selected because it allows for an evaluation of the overall consequences of the environmental aspect on the environment. This criterion has also been considered in the double materiality scoring table prepared by Neste's sustainability team and is therefore also used in this evaluation. The first and lowest scoring level of the scale of impact, "Negligible", should be selected when the consequences will not cause substantial damage or disruption, and they are local with only a few days duration. The impact of the aspect could cause temporary damage or emissions inside and/or outside the site boundaries. The second scoring level "Low" should be selected when the adverse effects can be contained and managed effectively with proactive measures and the impact of the aspect is local and might last for a few weeks. The impact does not cause any permit limit exceedance but might cause minor or limited environmental impact inside and/or outside of the site boundaries. At the third scoring level "Moderate" consequences require a coordinated response and substantial efforts to manage. The effects may cause locally lasting effects, environmental permit limit exceedance and environmental damage inside and/or

outside of the site boundaries. In the fourth level “High” impacts are significant and have a large geographical impact. The impacts result in serious environmental permit exceedance and the corrective measures both inside and outside of the site are necessary. The final level “Extremely grave” results in a crisis level scenario with fundamental effects and large geographic effect for multiple years. The effects result in serious and permanent environmental effects both inside and outside the site boundaries.

The next criterion, scope of impact, indicates the geographical extent of the impact. This criterion is also considered as one of the factors in the double materiality scoring table. The first and lowest scoring level of the impact, “Isolated”, is selected when the scope of the impact is isolated and potentially affects a small number of people and isolated are of the surrounding environment. Example area of this scope is refinery. The second scoring level “Local” should be chosen for the impact of an environmental aspect, whose impact is local, affecting outside the refinery and potentially affecting groups of people and local environment. Example areas of this scope are sea areas and cities nearby, such as Porvoo and Sipoo. The third scoring level “Regional” is selected when the impact is regional, and it is potentially affecting a large number of people and regional environment. Example area of this scope is a province, such as Uusimaa. The fourth scoring level, “National”, is selected when the impact is national, and it is potentially affecting all the citizens of the nation and nations environment. Example area of this scope is a whole country, in this case Finland. The fifth and final scoring level for the scope of impact criteria is “International”, which is selected when the impact is widespread, and it has an international reach. Example areas of this scope are several countries.

The third criterion to be scored, stakeholder concern and negative publicity, describes the contacts made by the refinery’s stakeholders or the media regarding the impacts of the environmental aspect. This criterion was selected for the criteria in accordance with ISO 14001 and IED 2.0 requirements. The first level, “Never”, is selected when there are no contacts at all regarding the impacts of the aspect. The next level, “Rare”, is selected when there are small number of casual contacts, about 1-5 per year. In the third level, “Occasional” there should be occasional contacts from stakeholders or local media on the same topic over 5 times per year. At the fourth level “National publicity”, the effects of the aspect have caused notable attention through national media. At the fifth and final level, “International publicity” media attention has made major headlines in global media.

The fourth criterion to be evaluated is irremediability, which describes the irremediability of the impacts of the aspect. This criterion is also considered as one of the factors in the double materiality scoring table. The first level “Easily remediable” should be selected when the impact can be easily remedied with minimal efforts, e.g. through slight adjustments in Neste's sites, operations or supplier engagements. The second evaluation level "Can be remedied" should be selected when the impact can be remedied, but it requires notable efforts and time, and changes in Neste's sites, operations or supplier engagements. There might also be a need to involve external stakeholders. In the third level "Partially remediable" the impact is partially remediable but leaves lasting results, potentially needing long-term strategic shifts in Neste's sites, operations and involving external stakeholder(s). In the fourth level “Largely irremediable” the impact is largely irremediable and requires complex, long-term initiatives to mitigate. Several external stakeholders need to be involved. In the fifth level "Irremediable" the impact is completely irremediable and irreversible.

The fifth and final criterion to be evaluated is compliance, which describes the laws and regulations set for the impacts of environmental aspects that must be followed in the company's operations. This was selected as one of the criteria to be evaluated according to the company's goals of the Performance Plan 2025 prepared by the Neste's Safety Finland team. The first evaluation level of the criterion, “No requirements”, means that no legal goals or restrictions have been defined for the impacts of the aspect. The second evaluation level, “Internal goal or company policy”, should be selected when there has been set company's own policies and desired goals. The third level, “Voluntary requirements”, describes the company's voluntary external goals, such as the requirements for meeting the ISO 14001 standard. In the fourth assessment level, “Requirement by law or permit”, the regulations come from, for example, environmental permits issued to the company or the requirements of the IED (Environmental Protection Act). The fifth and the final scoring level, “Administrative compulsion,” covers the most extreme cases, for example, where the environmental violations are so severe that the authorities have had to intervene, and the company is threatened with administrative compulsion to correct its operations.

Several evaluations and scorings of the significance of environmental aspects, such as in United States Environmental Protection Agency (US EPA) (United States Environmental Protection Agency, 2024) and David Ayers reports, the probability of the aspect's impact is evaluated. Probability is used to evaluate how often the environmental aspect and/or its

impact may occur. Evaluating probability is important, but in this work, it has been decided to completely exclude from the evaluation criteria, as it is not considered necessary at this point. If the impact of an aspect has the possibility of occurring at all, it is not necessary to determine its more precise probability in this evaluation, as the impact and its occurrence must be prepared for in any case by defining corrective and preventive actions. In this case, the magnitude of probability is therefore not seen to be important.

The risk evaluation of environmental aspects will be carried out primarily only for those environmental aspects which impacts are estimated to be significant. This way, by first focusing on other criteria that determine the significance of the aspect's impact, it is possible to place more emphasis on those criteria that yield results that are most useful for the company in terms of developing its operations. The purpose of the created criteria is not to act as a risk assessment tool and therefore probability has been separated from this evaluation criteria.

5.1.2 Calculation Method

Determination of the calculation method started by defining the desired benefit that could be achieved from the calculation. When evaluating the impact of environmental aspects, by using the criteria, each aspect receives its own score through scoring system which indicates the level of significance of the aspect and its impact. The basic calculation formula itself is simple, in which the scores for all evaluation criteria are added together. As previously stated, Neste wants to strengthen the compliance of its operations and therefore compliance needs to be highlighted from the other evaluation criterias when evaluating the impacts of environmental aspects. Accordingly, it has also been considered in the scoring formula.

Table 1 Scoring per each evaluation category.

	Scale of Impact	Scope of Impact	Stakeholder concern and Negative publicity	Irremediability	Compliance	Meeting the requirements?
1	1	1	1	1	2	1
2	5	5	5	5	10	1
3	10	10	10	10	20	1
4	15	15	15	15	30	1
5	20	20	20	20	40	1

The calculated scores of the impacts of environmental aspects are implemented according to table 1 above. Each evaluation criteria has its own points defined by evaluation level (1-5) as follows:

- Scoring level 1 – 1 point per evaluation criteria
- Scoring level 2 – 5 points per evaluation criteria
- Scoring level 3 – 10 points per evaluation criteria
- Scoring level 4 – 15 points per evaluation criteria
- Scoring level 5 – 20 points per evaluation criteria

As exception “compliance” score is doubled because the weighting in the calculation formula is focused on the environmental aspect’s compliance with the regulations. Scoring points of compliance are defined as follows:

- Scoring level 1 – 2 points
- Scoring level 2 – 10 points
- Scoring level 3 – 20 points
- Scoring level 4 – 30 points
- Scoring level 5 – 40 points

In addition to the five evaluation criteria, one additional column has been added to Table 1, which describes the fulfillment of the “compliance” requirement of the fifth evaluation criterion. This scoring multiplies the entire row by either a value of 1 or 2. If there is a requirement or obligation for the aspect and its impact that Neste's operations currently meet, the coefficient in the "meeting the requirements?" column is set to 1. In this case, the final score remains unchanged and does not rise to a level requiring actions. If Neste's operations do not meet the requirements and obligations set for the aspect and its requirements, the coefficient is set to 2. In this case, the total score is multiplied by 2 and the aspect score is raised to a higher level.

Table 2 Score results of the impacts of the environmental aspects.

Scoring	Significancy / actions needed
5 - 20	Not significant
21 - 45	No immediate need for corrective actions
46 - 70	Need for corrective actions
71 ≤	Highly significant, immediate corrective actions needed

Table 2 above presents the explanations of the criteria scoring with possible follow-up action needs. The scoring table is divided into four different sections. If the score of an aspect after the evaluation is 20 or less, the aspect and its impacts can be considered not significant. This means that the impacts of the aspect have almost no effect on the environment. When the aspect score is equal to or over 21 and equal to or under 45, the impacts of the aspect can be considered to cause mild environmental impacts, but for which there is no need to define immediate corrective actions. If an aspect score is equal to or over 46 and equal to or under 70, the impacts of the aspect may cause remarkable environmental impacts, and corrective measures should be planned. In the highest scoring category the rating must be equal to or over 71 which means that the impacts of the aspect cause significant environmental impacts and corrective actions must be defined immediately. The highest rated aspects will continue to be addressed in accordance with the SCCM action plan for risk and opportunity assessment.

Calculation formula used for scoring the impacts of environmental aspects:

Significancy score

$$\begin{aligned}
 &= (\text{Scale of impact} + \text{Scope of impact} \\
 &+ \text{Stakeholder concern and negative publicity} + \text{Irremediability} \\
 &+ (\text{Compliance} * 2)) * \text{Meeting the requirements}
 \end{aligned}$$

Example calculation 1 for the impact of environmental aspect X, which obtains the following values:

- Scale of impact: 1 - Negligible
- Scope of impact: 1 - Isolated

- Stakeholder concern and Negative publicity: 1 - Never
- Irremediability: 1 - Easily remediable
- Compliance: 2 – Internal goal or company policy
- Meeting the requirements: 2 - No

Total score: $(1 + 1 + 1 + 1 + (5 * 2)) * 2 = 28$

In this case, the aspect impact score falls within the yellow scoring range (21 - 45) of table 2 for "no immediate need for corrective actions".

Example calculation 2 for the impact of environmental aspect Y, which obtains the following values:

- Scale of impact: 1 - Negligible
- Scope of impact: 1 - Isolated
- Stakeholder concern and Negative publicity: 1 - Never
- Irremediability: 1 - Easily remediable
- Compliance: 3 – Voluntary requirements
- Meeting the requirements: 2 – No

Total score: $(1 + 1 + 1 + 1 + (15 * 2)) * 2 = 48$

In this case, the score of the impact of the environmental aspect reaches the orange scoring range (46 - 70) "Need for corrective actions". Based on these two examples, it can be stated that the significance of compliance with a requirement changes considerably based on whether the requirements and obligations are Neste's own internal policies or goals or whether they are requirements set by an external actor on Neste. Logically, meeting other stricter and more absolute requirements is of higher priority and should therefore receive higher values compared to Neste's internal policies.

If the impact of an aspect is particularly high and it receives an extremely high score in the evaluation, it is possible for it to even exceed the maximum score of 100 for the “Highly significance, immediate actions needed” level in table 2.

Example calculation 3 for the impact of environmental aspect Z, which obtains the following values:

- Scale of impact: 5 – Extremely grave
- Scope of impact: 5 – International
- Stakeholder concern and Negative publicity: 5 – International publicity
- Irremediability: 5 – Irremediable
- Compliance: 5 – Administrative compulsion
- Meeting the requirements: 2 - No

Total score: $(20 + 20 + 20 + 20 + (20 * 2)) * 2 = 240$

Example calculation 3 illustrates obtaining the highest possible score for the aspect. In this case, the aspect receives a total score of 240, which exceeds the maximum score of 100 for the highest category. The purpose of the total and final score is to enable the scoring of aspects with more than 100 points to be compared with each other so that they can also be ranked in order of importance if necessary.

5.2 Piloting The New Criteria

DNV's latest ISO 14001 audit of Neste's refinery (November 2024) identified development needs in the refinery's wastewater plant. The development needs concerned oil spills caused by heavy rains to the stream of Kartanonlahti which is part of the Porvoo region's waterways. (DNV, 2024) The operation of the wastewater plant is a very important function for the refinery's operations, as it is designed to treat oily wastewater from the Porvoo refinery and the Petrochemical plant of Borealis Polymers Oy (Neste Oyj, 2023). Due to the significance of the wastewater plant's operations, the identification of environmental aspects began there,

and therefore it was decided to select the impacts of the environmental aspects of the wastewater plant for testing and piloting the created evaluation criteria.

The piloting implemented in this thesis was started by using two different environmental aspects, heavy rain and conventional waste from wastewater plant operations. As previously stated in the DNV audit report, preventing oil spills caused by heavy rain is on the company's operational development list, heavy rain was selected to be utilized in the piloting to determine the high scoring level of the criteria. The lower level of criteria was defined by using conventional waste generated from wastewater plant operations -aspect because its environmental impact is not considered significant in relation to other refinery operations.

After scaling the upper and lower levels, the criteria were also tested with other aspects of the wastewater plant. Representatives of the wastewater plant were asked at the environmental aspect identification workshop to evaluate the top 5 aspects identified that are significant for their operations from their point of view. These aspects were related to water discharges from the wastewater treatment plant into the sea, VOC emissions, silicate sediment, wastewater treatment plant sludge, and waste heat released with the treated water discharged into the sea. Neste's environment team evaluated the top 5 aspects according to the criteria and based on their evaluations, necessary changes were made to the criteria and scoring, such as clarifications and rescaling of the criteria explanations.

During the piloting, there was an active discussion with the environment team about the usability of the criteria and its functionality with the environmental aspects of various Neste departments. Based on the team's comments, changes were made to the criteria regarding, among other things, the areas of scale of impact and the number and extent of stakeholder concern and negative publicity contacts.

There was also one major change made to the structure of the criteria during the pilot. The criteria was originally intended to be two-level, and the first level of the criteria was meant to roughly sort the aspects into those that required further evaluation and those that did not have an immediate need for further evaluation. The sorting was intended to be done using a simple sieve, where answering one question positively would automatically move the aspect to the next evaluation level. The questions at the first evaluation level were related to the impact of the aspect on regulatory requirements, irremediability and repetitive.

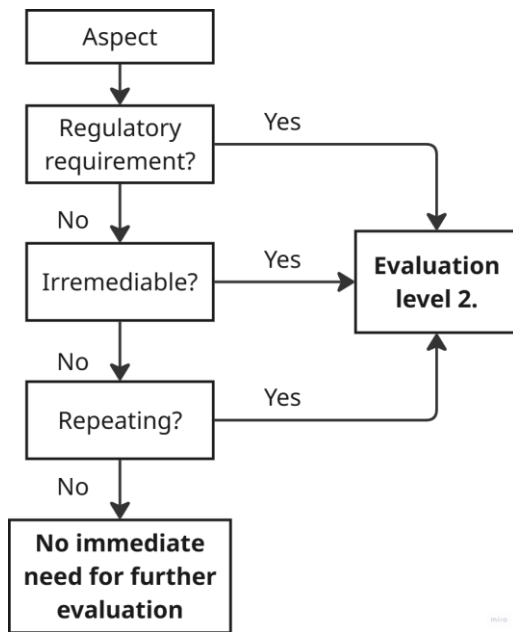


Figure 11 Level 1 of the criteria before piloting.

Figure 11 above shows the first level of the original two-part criteria before piloting. The first level was intended to reduce the number of aspects that went into the actual evaluation, i.e. level 2, which would have made the assessment of aspects more efficient and reduced the workload. However, this was decided to be abandoned during the piloting process, as the two-part criteria posed a risk that a significant aspect might accidentally pass through the first-level sieve. To mitigate the risk, it was decided to simplify the criteria to just one level, even if the efficiency of the evaluation would suffer. If any significant aspect would have slipped through the sieve, the damage it could have caused was seen too big in relation to the efficiency of the workload to be left unaddressed.

5.3 Key Results

The criteria and tool for evaluating the significance of the impacts of environmental aspects, designed and implemented in this thesis, enable the evaluation of the most critical environmental aspects of Neste's Porvoo refinery to be carried out easily and quickly. The criteria can therefore be said to make the definition and identification of Neste's most significant environmental aspects and their impacts easier, and to promote the achievement of the environmental goals set by the company's management. To enhance and increase the

consideration of the new environmental requirements in Neste's environmental management system, the criteria used in the evaluation have been created based on Neste's internal requirements, IED 2.0, and the requirements of the ISO 14001 standard.

The results obtained from piloting the criteria and the evaluation tool will strengthen the position of the impacts of significant aspects and serve as a basis for corrective measures to be presented to the company's management. With a successful evaluation of aspects and impacts, corrective measures can be focused on the right targets and thus improve Neste's compliance overall with the law and with the European Union's new regulations regarding the environmental management systems.

As a result of the evaluation of the environmental aspects of the wastewater plant used in the pilot, some of the aspects were classified based on the scoring into the "No immediate need for corrective actions" category and some into the "Need for corrective actions" category, as can be seen in Appendices 4-6. The evaluated aspects or their impacts have not been disclosed in more detail due to the sensitivity of the information.

The calculation formula developed for evaluating the impacts of environmental aspects emphasizes compliance and its improvement in line with Neste's own internal targets. Based on the testing of the criteria during the pilot and the testing of the wastewater treatment plant's impacts of the environmental aspect and their scoring, the emphasis on the "compliance" criterion can be considered successful. This can be determined by comparing the scores of different aspects with each other at different levels of "compliance" and its fulfillment.

5.4 Output Evaluation

When evaluating research results, it is important that potential pitfalls in the research are identified and their potential impact on the results is recognized in advance. The criteria used in the environmental impact evaluation tool in this work can be considered realistic and reliable, as the criterias are based on the requirements of the CSRD, IED 2.0 and ISO 14001 standard. The criteria's evaluation levels and their accuracy have also been designed and discussed together with experts from Neste's environment team.

The challenges that create uncertainty and possible factors that affect the reliability of the evaluation result identified in this work are the scoring tool user's own personal opinions and the level of understanding and knowledge regarding environmental issues. The criteria have been designed in such a way that each evaluation level of the criterion presents the clearest possible response, with examples, to the impacts of the environmental aspect. As stated earlier, the purpose of the criteria is to serve as a basis when further corrective measures are presented to the company's management, so it also somewhat prevents aspects and their impacts from being assessed on incorrect arguments.

Understanding the criteria and using the tool requires a deep understanding of Neste's refinery operations, environmental management, the impacts and sizes of environmental aspects and their risks. For this reason, the criteria and the scoring tool are not intended for use by all company employees, and therefore the version created in this work will only be available to Neste's environment team, whose experts have the required expertise.

The results obtained from the pilot can be considered relevant as they were consistent with the evaluations made by Neste's environment team before using the scoring tool at all. It can therefore be stated with strong justification that the results obtained from the criteria are realistic and correspond to their purpose. The tool's calculation formula's emphasis on "compliance" can also be considered successful, as the aspect evaluation score changes in proportion to the fulfilment of compliance requirements and the requirement of the obligation.

5.5 Follow-up Actions and Recommendations for the Future

The creation of this environmental impact evaluation criteria has been initiated while the update of Neste's EMS has been in progress and will continue for a couple of years after the completion of this thesis. As a result, there are some things that need to be considered with the criteria and evaluation tool in the future.

The identification of environmental aspects at Neste's Porvoo refinery began in spring 2025 in connection with the creation of the criteria. Therefore, there were not already identified environmental aspects in all different areas of the refinery when this thesis was started. The identification of aspects is still ongoing and will continue in different areas of the refinery

for several months after the completion of this thesis. That is why the criteria may need to be updated and modified later after the identification of all environmental aspects is completed. By updating the criteria later, the comprehensiveness of the criteria can be ensured so that it considers the needs of different aspects at the necessary level.

The criteria and evaluation tool are intended to be used also at other Neste sites, such as the Rotterdam and Singapore refineries. The conditions at these sites differ significantly from those at Neste's Porvoo refinery, so the criteria require a comprehensive review. However, the criteria to be evaluated must be kept the same when evaluating different items if the results are to be comparable with the results of other items. The largest changes and updates should be made to the evaluation levels of the criteria, as in this thesis they are designed to correspond only to the conditions and size of the Porvoo refinery.

The evaluation tool and its operating method are easily customizable as needed. If the tool is in the future wanted to be used with an emphasis on another criterion it is possible by easily modifying the tool's calculation formula. It may also be necessary to modify the scoring points in the calculation formula after the identifying of the environmental aspects is ready, if some aspects require, for example, a larger or smaller size class in terms of scoring.

Based on the results of this thesis, Neste will develop its internal NMS guidelines for identifying environmental aspects and evaluating their significance. The guidelines will describe the identification of aspects, and the tools and methods used in this process, including the workshops conducted during this work. The criteria and the scoring tool will also be included as attachments. The guidelines will be developed by Neste's environment team, and it will be archived and made available to all company employees.

6 Discussion

Sustainable and environmentally conscious business is trendy today but also an assumption in a changing world. Corporate operations are being monitored even more closely, and environmental awareness is constantly being increased both in and outside the corporate world. To make it easier to control corporate entities and their environmental impacts, the EU has set requirements for corporate operations in its member states to develop more environmentally conscious and transparent operations. As the world continues to change and evolve, the EU is also constantly updating its regulations and guidelines. With the latest IED 2.0 update, companies are required to monitor their environmental impacts more closely and to make their environmental activities and the EMS public in the form of an environmental policy. (European Commission, 2025d) The new update will also have an impact on the development of Neste's operations, including an update to EMS.

The new requirements of IED 2.0 guide Neste's EMS update to improve the availability and clarity of environmental data and to develop and create new tools to improve the sustainability of the company's operations. (European Commission, 2025d) Neste aims to improve the compliance of its operations, and therefore the ongoing EMS update has examined the requirements of the ISO 14001 standard in more detail. The requirements of the ISO standard guide the company to increase transparency in its environmental activities and to identify the environmental aspects of its operations more comprehensively and thoroughly. (International Organization for Standardization, 2015)

The evaluation criteria and the tool created in this work serve as part of achieving the company's environmental and compliance goals. Based on the results of the piloting of the criteria and the tool, it can be stated that they produce the desired type of data with the desired accuracy. The development and pilot of the criteria was a process that took several months and began at the very beginning of the work. The original intention of the final product of the work was to be a simple table from which the person using the criteria could manually calculate the environmental score of the criteria. The outline of the table was completed very quickly, after which the idea of a partially automated scoring tool, in addition to the criteria, emerged. By automating the scoring of the aspects by using a calculation tool, the amount of human calculation errors can be reduced, and the aspect evaluation process can be made

easier and faster. Automating the scoring can also increase the objectivity of the evaluation, making it more impartial.

The scoring tool was implemented entirely as a Google Sheet document and can also be converted to Microsoft Excel format if necessary to improve accessibility and usability. The calculation formula automated in the tool changed numerous times during the work. Neste's own internal spreadsheets were utilized in the design of the calculation formula, which were combined and modified to create the method used in this work. The intention was to make the calculation as simple as possible, making it easy to compare the results between each other. This can also ensure easy and smooth editing of the formula, if there is a need to utilize the tool, for example, by emphasizing different criteria. If changes are made to the criteria or scoring tool, the functionality of the calculation formula should always be reviewed in advance, as it may easily break down when changes are made. The weights included in the calculation formula must also be considered so that the calculation yields realistic results and does not distort the calculation.

Major practical changes were not avoided during the work. The original format of the criteria was designed to be two-part, as presented in section 4.2. The two-part criteria were intended to enhance the evaluation of aspects, as the first part of the criteria was intended to act as a sieve, according to the diagram prepared by the Hong Kong Environmental Protection Department, which determines whether an aspect is a Significant Environmental Aspect (SEA) or not significant, and thus selects only those environmental aspects that require further detailed assessment at the second level of the criteria. (Hong Kong Environmental Protection Department, 2013) The two-part criteria were used in the pilot with reasonably good results, but it was decided to abandon it. Although the results seemed good, it was concluded that the risk could not be taken that some truly significant aspect might accidentally get through the sieve. The workshops to identify environmental aspects of Neste's Porvoo refinery are still in progress at this stage of this thesis, which created uncertainty about what aspects might still be included in the evaluation and how their needs could be taken into account in the first stage of the criteria so that the wrong aspects do not get through with the wrong arguments.

When creating the criteria for the evaluation, it was decided to deviate from other similar evaluation criteria that other organizations have used. Almost without exception, in every other set of criteria encountered, such as David Ayers's criteria calculation formula (Ayers,

D., 2010), one of the criteria was the probability of the aspect's effect occurring. However, evaluating probability was not considered necessary in this case, because the evaluation of aspects wanted to be kept clearly separate from risk evaluation, which usually involves evaluating the probability of an event occurring. Its evaluation was not considered necessary either because if the aspect has even the slightest chance of being realized, the magnitude of the probability is no longer relevant at that point. The evaluation of probability was also seen as a potential risk in how the personal opinions or understanding of the person using the criteria could affect the scoring. People from different backgrounds may have different knowledge and skills, which may influence certain judgments in one way or another. Evaluating the probability of environmental aspects is important but its evaluation can be influenced by the person making the evaluation with his or hers own opinions and values. If the person in question feels that something is important to them and wants urgent corrective measures, they may assess the probability of the aspect as higher than it actually is. Of course, this also applies to other criteria and their evaluation. For this reason, it is important that the user of the criteria is able to justify the evaluation of their choice of aspects when evaluating them objectively. In order to obtain the most realistic and unbiased results from the criteria, it was decided to completely exclude probability evaluation from the criteria. This solution had no impact on the comparability or credibility of the scoring.

Instructions (Appendix 2.) for the use of criteria and evaluation tool were prepared that everyone who uses them understands its purpose and functions completely. The guidelines explain how and what the criteria consist of, how the evaluation tool and its scoring work in practice, and how and which environmental aspects are defined as significant. When scoring aspects using criteria, the correct evaluation level must be chosen using careful consideration so that the selected evaluation level can be clearly justified. When choosing between two evaluation levels, it is better to overestimate an aspect than to underestimate it, which in practice means that the higher evaluation level should be chosen instead of the lower evaluation level. This ensures that the aspect receives the necessary attention and can be subsequently removed from the significant aspects, if the aspect is re-evaluated and can be justified in being scored at lower criteria scoring level.

The criteria and evaluation tool created are designed to be used only for evaluating the environmental aspects of Neste's Porvoo refinery. However, the tool is intended to be used globally and can therefore also be applied as a basis for evaluating the environmental aspects

of Neste's other refineries and sites around the world, such as in Rotterdam and Singapore refineries. Because the criteria and their evaluation levels have been created to match the conditions and scale of the Porvoo refinery, they are not directly compatible with other sites and therefore require comprehensive re-evaluation and modification. In particular, the criterion "scope of impact" in the criteria must be re-evaluated and scaled on a site-by-site basis to suit the site's circumstances and scale, as the examples currently presented in the criterion's assessment levels are consistent with Finnish cities.

Although the criteria and scoring tool created so far can be considered ready for the environmental aspects of Neste's Porvoo refinery wastewater plant, it should be noticed that it has not been able to take into account the yet unidentified aspects and their needs from other Neste departments. Once the identification of aspects has been completed, the criteria and their evaluation levels should be re-evaluated with department-specific aspects and the necessary changes should be made, for example to the scope of the evaluation level of a criterion and to the examples given.

7 Conclusions

During Neste's EMS update, the company identified the need for an evaluation of the significance of environmental aspects. Neste's operations are diverse and therefore affect its environment in many ways. For a company's environmental management to be smoother and more comprehensive, it must identify the environmental impacts of its operations, both positive and negative. The environmental evaluation criteria designed and implemented in this thesis helps the company to identify the most significant environmental aspects of its operations and facilitate their further processing. This set of criteria can be considered a significant step in the update of Neste's EMS as it creates a strong foundation for monitoring the company's most significant aspects and improving their impact. The criteria can also be considered a management tool, as it helps to define the environmental aspects and targets on which a company should use its money and resources.

Since the regulations and guidelines drawn up by the EU apply to all its member states, it can be stated that the new requirements of IED 2.0 have direct impacts on companies operating in Finland, such as Neste. IED 2.0 guides companies and organizations to improve the sustainability of their operations with new innovative tools and to create a transparent and comprehensive EMS that is publicly available. (European Commission, 2025d) This regulation therefore forces Neste to update its own system and to take a deeper look at the environmental aspects and impacts of its operations. The identification of environmental aspects in Neste's various operations and the creation of criteria for evaluating the significance of aspects carried out in conjunction with this thesis implement the requirements of ISO 14001 and bring the company closer to meeting its compliance.

According to other studies already mentioned in this work, when creating criteria for evaluating environmental aspects, the organization or company using it must identify the topics and criteria that are essential to their operations and which criteria will determine the things that will benefit the company the most. The criteria and scoring tool created in this work differ from research studies modeled in literature, such as the criteria and scoring presented in D. Ayers' article. (Ayers, D., 2010) Differences can be seen in the criteria themselves, the lack of probability evaluation, and the formula for calculating scoring points. This leads to the conclusion that the possible environmental evaluation criteria and scoring

tools of different companies, as well as the results obtained from them, cannot be considered directly comparable to each other. If the needs of companies are similar and it is possible to evaluate their perspectives with the same tool, the results can be considered comparable. Even though the results of companies cannot be compared with each other, the evaluation and calculation methods and the results obtained from them can still be considered relevant and descriptive of the company's real situation, as in this master's thesis.

The final work can be considered a success due to the creation of a functional environmental evaluation tool and the smooth practical implementation in the piloting process. The criteria set has been created in accordance with Neste's needs, reflecting theories in research literature, and it can be stated that it works as desired thanks to the created evaluation tool and calculation formula. The real pressure test of the evaluation criteria in its full scope will be carried out later in 2025, after the completion of this thesis. The final piloting can only be done once the environmental aspects of all departments at Neste's Porvoo refinery have been identified. Before full-scale implementation, the criteria should be piloted once more, and any necessary changes are made to it so that the special features and needs of different aspects can be considered in the evaluation levels and scoring of the criteria. Piloting and implementation should be carried out by Neste's environment team, as so far only they have been found to have the required understanding and know-how to use the criteria and the aspect evaluation tool.

Once the tool has been piloted to its full required extent, Neste's environmental team will proceed with the most significant aspects and prepare corrective action proposals for them. The proposed actions should be presented to the company's management by using a set of criteria, justifying why these aspects should be addressed and with what priority. The company's management team is responsible for making decisions regarding the progress of corrective actions for environmental aspects and the next steps.

Improving the efficiency of environmental management tools and developing new innovations are prerequisites for improving the situation in our world. To develop the best and most effective solutions, companies should collaborate seamlessly and leverage resources and expertise across stakeholder boundaries. Although Neste is a listed company and business and good turnover are vital to the company's operations, companies should still be able to think about the best interests of the entire planet. If a company comes up with a good tool that can further improve the efficiency of environmental impact management, such

a solution should also be able to be sold publicly to other actors, so that the environmental impacts of all companies can be better managed and thus also mitigate climate change which has a huge impact on each of our lives.

Neste's operations are exceptional, especially on a Finnish scale because there is no directly competing company in the country that produces fuel for vehicles powered by internal combustion engines. For this reason, the tools it uses and develops are often only suitable for a similar environment. Although the tools used by companies are not necessarily directly compatible with others and it is not necessarily worth taking a direct model from them, it is still important that the environmental management tools developed are used transparently so that it is possible to draw inspiration and ideas from them. The more companies want and can help each other and utilize each other's experts, the more likely it is to create world-changing innovations that can solve the world's biggest challenges and conflicts.

8 Summary

We live in a world of constant change where we must consider the impact of our actions on the environment and our planet every day. To keep up with the change, we need to change our own practices in line with the changing world around us and be aware of our weakest points. Change affects us all, and that's why we need a common path to move towards a more sustainable world. An association like the European Union has a great influence on people on a large scale. Its mission is to unite us and create a common policy for its member states and their citizens, so that we can improve our actions and save our planet from the negative spiral of accelerating climate change and resource scarcity.

In August 2024, the EU published a new version of the Industrial and Livestock Rearing Emissions Directive (IED 2.0), the new requirements of which obliges industrial and livestock companies operating in EU member states to improve their Environmental Management Systems (EMS). (European Commission, 2025d) The ISO 14001 Environmental Management System -certification was first awarded to Neste in 1998 (Neste Oyj, 2025e). The ISO 14001 audit conducted by DNV in the summer of 2024 revealed the need to improve compliance with the standard and is therefore also part of this work. Updating the EMS is a large project and therefore it will be implemented in several different parts. Neste's environmental team recognized the need to identify and assess the environmental aspects of the refinery's operations, which gave the team a ready topic for master's thesis, and this work was decided to be executed.

According to the IED 2.0 requirements companies must increase transparency in their environmental management and develop new innovative tools to improve the sustainability of their business. (European Commission, 2025d) The requirements of the ISO 14001 standard are consistent with the requirements of the IED and require a certified company to, among other things, prepare a public environmental policy and identify the environmental aspects of its operations. (Finnish Standards Association SFS, 2015) To improve the fulfillment of these requirements, it was decided to create a set of criteria that would allow the identified environmental aspects and their impacts to be evaluated based on their significance.

Before the criteria were created, workshops to identify environmental aspects were held by Neste's environment team with representatives from different functions at the refinery. Workshops have been held throughout the thesis and will continue to be held after this work. Once the identification of environmental aspects was well underway, the actual planning and compilation of the criteria began.

The evaluated themes used in the criteria were selected based on Neste's needs and research literature. Five carefully considered themes were selected for the criteria and five criterion-specific evaluation levels were created for them. The environmental aspect assessor selects an evaluation level for each criterion that describes the actual situation for the aspect, and this level determines the score. Alongside the criteria a scoring tool has been created into which the points for the criteria of the aspect are entered and the tool outputs a final score describing the significance of the aspect. According to the final score, the aspect is classified into one of four categories: not significant no immediate need for corrective actions, need for corrective actions or highly significant, immediate need for corrective actions.

The criteria were piloted by using aspects of the wastewater treatment plant at Neste's Porvoo refinery. Several changes were made to the criteria during the pilot, including the format of the criteria, which was initially intended to be two parts. A two-part criteria would have made it possible to make the evaluation of aspects more efficient and faster by filtering out aspects that require further evaluation and those that do not. However, a potential risk was identified in which a significant aspect might have accidentally passed the first evaluation filter on incorrect grounds.

The criteria created in this thesis was designed for the aspects of a wastewater treatment plant, so it is necessary to re-evaluate them after the identification of all environmental aspects has been completed. The evaluation levels of the criteria and the practical examples presented in them should be re-evaluated if necessary. It is also possible to modify the scoring tool if, for example, new criteria are added to the criteria, or the weighting of the calculation need to be changed. The criteria is intended to be used later also in other Neste locations, such as Rotterdam and Singapore refineries. When using the criteria in different countries, it is necessary to re-evaluate the evaluation levels, as they are currently made suitable for the Porvoo environment and the Finnish scale.

The created criteria and scoring tool can be considered as a successful and functional entity. Based on testing conducted by Neste's environment team, the tool provides the relevant scorings and accurately considers the company's needs. The tool is designed to be easily modified, which ensures that the tool is effective and can be utilized for other purposes as well.

References

Association for Supply Chain Management. 2025. Certified Supply Chain Professional (CSPC). [e-publication]. [referred: 20.5.2025]. Available: <https://www.ascm.org/learning-development/certifications-credentials/cscp/overview/>.

Ayers, D. 2010. Environmental Aspects & Impacts; A system for identifying priorities and setting goals. Professional safety. P.26-31. [referred: 4.3.2025]. Available: <https://www.proquest.com/docview/200328397/fulltextPDF/B2ED5111F39244DAPQ/1?accountid=27292&sourcetype=Scholarly%20Journals>.

Certified Public Accountants Association. 2025. About CPAA. [e-publication]. [referred: 19.5.2025]. Available: <https://cpaa.co.uk/about-cpaa>.

DNV. 2024. Neste Oyj, oil products, Management system Certification ISO 14001:2015, ISO 9001:2015, ISO 45001:2018. Audit report. [referred: 15.3.2025].

EUR-Lex. 1996a. Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control. [e-publication]. [referred 18.5.2025]. Available: <https://eur-lex.europa.eu/eli/dir/1996/61/oj/eng>.

EUR-Lex. 1996b. Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management. [e-publication]. [referred 18.5.2025]. Available: <https://eur-lex.europa.eu/eli/dir/1996/62/oj>.

EUR-Lex. 2014. Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending. [e-publication]. [referred: 19.5.2025]. Available: <https://eur-lex.europa.eu/eli/dir/2014/95/oj/eng>.

EUR-Lex. 2023. Commission Decision (EU) 2023/2463 of 3 November 2023 on the publication of the user's guide setting out the steps needed to participate in the EU eco-management and audit scheme (EMAS) pursuant to Regulation (EC) No 1221/2009 of the European Parliament and of the Council (notified under document C (2023) 720). [e-publication]. [referred 18.5.2025]. Available: <https://eur-lex.europa.eu/eli/dec/2023/2463/oj/eng>.

EUR-Lex. 2024. Directive (EU) 2024/1785 of The European Parliament and of The Council. [e-publication]. [referred 3.3.2025]. Available: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32024L1785>.

European Commission. 2025a. About EMAS. [e-publication]. [referred: 20.1.2025]. Available: https://green-business.ec.europa.eu/emas/about-emas_en.

European Commission. 2025b. Corporate Sustainability Reporting. [e-publication]. [referred: 20.1.2025]. Available: https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.

European Commission. 2025c. EMAS, a premium environmental management tool for organisations. [e-publication]. [referred: 28.2.2025]. Available: https://green-business.ec.europa.eu/system/files/2023-07/EMAS%20presentation%20for%20organisations_2022.pdf.

European Commission. 2025d. Industrial and Livestock Rearing Emissions Directive (IED 2.0). [e-publication]. [referred: 20.1.2025]. Available: https://environment.ec.europa.eu/topics/industrial-emissions-and-safety/industrial-and-livestock-rearing-emissions-directive-ied-20_en.

European Commission. 2025e. The European Green Deal. [e-publication]. [referred: 18.5.2025]. Available: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

European Commission. 2025f. Types of EU law. [e-publication]. [referred: 14.4.2025]. Available: https://commission.europa.eu/law/law-making-process/types-eu-law_en.

European Commission. 2025g. Zero Pollution ambition by 2050. [e-publication]. [referred: 3.3.2025]. Available: <https://ec.europa.eu/environment/stories/industrial-emissions/>.

European Parliament. 2022a. EU Environmental Policy to 2030: a systemic change. [e-publication]. [referred: 20.1.2025]. Available: <https://www.europarl.europa.eu/topics/en/article/20210701STO07544/eu-environmental-policy-to-2030-a-systemic-change>.

European Parliament. 2022b. Published 2022, updated 2024. Green Deal: key to climate-neutral and sustainable EU. [e-publication]. [referred: 20.1.2025]. Available: <https://www.europarl.europa.eu/topics/en/article/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu#the-european-green-deal-goals-and-benefits-8>.

European Parliament. Published 2020, updated 2022. New EU industrial strategy: the challenges to tackle. [e-publication]. [referred: 25.1.2025]. Available: <https://www.europarl.europa.eu/topics/en/article/20201112STO91445/new-eu-industrial-strategy-the-challenges-to-tackle>.

European Parliament. Published 2019, updated 2023. What is carbon neutrality and how can it be achieved by 2050? [e-publication]. [referred: 20.1.2025]. Available: <https://www.europarl.europa.eu/topics/en/article/20190926STO62270/what-is-carbon-neutrality-and-how-can-it-be-achieved-by-2050>.

European Union. 2005. Launching the European Climate Change Programme (ECCP). [e-publication]. [referred 18.5.2025]. Available: <https://eur-lex.europa.eu/EN/legal-content/summary/launching-the-european-climate-change-programme-eccp.html?fromSummary=20>.

European Union. 2025a. European Environment Agency (EEA). [e-publication]. [referred: 18.5.2025]. Available: https://european-union.europa.eu/institutions-law-budget/institutions-and-bodies/search-all-eu-institutions-and-bodies/european-environment-agency-eea_en.

European Union. 2025b. Founding agreements. [e-publication]. [referred: 14.4.2025]. Available: https://european-union.europa.eu/principles-countries-history/principles-and-values/founding-agreements_en.

Finnish Standards Association SFS. 2015. Environmental management systems, Requirements with guidance for use (ISO14001:2015). SFS-EN ISO 14001. Standard. [e-publication]. [referred: 20.1.2025]. Available: file:///C:/Users/lahtisar/Downloads/1741100253100_6.pdf.

Gravemeijer, K. 1998. Developmental Research as a Research method. New ICMI Studeia Series, vol 4. Springer, Dordrecht. Pages: 277-278. [e-publication]. [referred: 21.5.2025]. Available: https://link.springer.com/chapter/10.1007/978-94-011-5470-3_18#citeas.

Hey, C. 2007. III. EU Environmental Policies: A short history of the policy strategies. EU Environmental Policy Handbook. Archive of European Integration. [referred: 16.2.2025]. Available: <https://aei.pitt.edu/98675/>.

Hong Kong Environmental Protection Department. 2013. EP-01 Identification of Environmental Aspects and Significance Evaluation. [e-publication]. [referred: 19.3.2025]. Available: https://www.epd.gov.hk/epd/misc/env_management_sme/eng/pdf/E_E/EP01.doc.

International Organization for Standardization. 2015. ISO 14001:2015. Environmental management system. Requirements with guidance for use. [e-publication]. [referred: 20.1.2025]. Available: <https://www.iso.org/standard/60857.html#:~:text=What%20is%20ISO%2014001%3F,contiuually%20improve%20their%20environmental%20performance>.

Finnish Standards Association SFS. 2016. SFS-EN ISO 14004:2016. Environmental management systems. General guidelines on implementation. [e-publication]. [referred: 20.5.2025]. Available: <https://online-sfs-fi.ezproxy.cc.lut.fi/fi/index/tuotteet/SFS/CENISO/ID2/1/405384.html.stx>.

Finnish Standards Association SFS. 2024a. SFS-EN ISO 14001:2015/A1:2024:en. Environmental management systems. Requirements with guidance for use. [e-publication]. [referred: 19.5.2025]. Available: <https://online-sfs-fi.ezproxy.cc.lut.fi/fi/index/tuotteet/SFS/CENISO/ID2/1/1330754.html.stx>.

Finnish Standards Association SFS. 2024b. SFS-EN ISO 9001:2015/A1:2024:en. Quality management systems. Requirements. [e-publication]. [referred: 19.5.2025]. Available: <https://online-sfs-fi.ezproxy.cc.lut.fi/fi/index/tuotteet/SFS/CENISO/ID2/9/1328070.html.stx>.

Finnish Standards Association SFS. 2024c. SFS-EN ISO/IEC 27001:2023/A1:2024:en. Information security, cybersecurity and privacy protection. Information security management systems. [e-publication]. [referred: 19.5.2025]. Available: <https://online-sfs-fi.ezproxy.cc.lut.fi/fi/index/tuotteet/SFS/CENISO/ID2/2/1328005.html.stx>.

Finnish Standards Association SFS. 2024d. SFS-EN ISO 45001:2023/A1:2024:en. Occupational health and safety systems. Requirements with guidance for use. [e-

publication]. [referred: 19.5.2025]. Available: <https://online-sfs-fi.ezproxy.cc.lut.fi/fi/index/tuotteet/SFS/CENISO/ID2/4/1330758.html.stx>.

ICT Institute. 2017. Information security and PDCA (Plan-Do-Check-Act). [e-publication]. [referred: 20.5.2025]. Available: <https://ictinstitute.nl/pdca-plan-do-check-act/>.

International Organization for Standardization. 2025a. About ISO. [e-publication]. [referred: 20.1.2025]. Available: <https://www.iso.org/about>.

International Organization for Standardization. 2025b. ISO: Global standards for trusted goods and services. [e-publication]. [referred: 19.5.2025]. Available: <https://www.iso.org/home.html>.

International Organization for Standardization. 2025c. [e-publication]. [referred: 19.5.2025]. Available: <https://www.iso.org/popular-standards.html>.

Johnson, C. N. 2016. The benefits of PDCA. American Society for Quality. [referred: 18.1.2025]. Available: <https://www.proquest.com/docview/1762043658/fulltextPDF/57178955D9374AD5PQ/1?accountid=27292&sourcetype=Magazines>.

Lozano, R. 2019. Analysing the use of tools, initiatives, and approaches to promote sustainability in corporations. University of Gävle. [e-publication]. [referred: 19.5.2025]. Available: <https://onlinelibrary-wiley-com.ezproxy.cc.lut.fi/doi/epdf/10.1002/csr.1860>.

Luise, G. 2024. The Historical-Institutional Evolution and the Political Dynamics of the European Union's Environmental Policy. *Perspective Politice*. Vol. XVII, no. 1-2. Pages 95-105. [e-publication]. [referred: 16.5.2025]. Available: https://www.ssoar.info/ssoar/bitstream/handle/document/98728/ssoar-perspol-2024-1-2-luise-The_Historical-Institutional_Evolution_and_the.pdf?sequence=1&isAllowed=y&lnkname=ssoar-perspol-2024-1-2-luise-The_Historical-Institutional_Evolution_and_the.pdf.

Martinčević, I., Primorac, D., Dorić, B. 2024. Corporate Sustainability Reporting Directive (CSRD): Obligations, Challenges and Requirements for Companies. *Enterprise Research Innovation*. Vol. 10, No. 1. Pages 317-327. [e-publication]. [referred: 19.5.2025]. Available: <https://hrcak.srce.hr/ojs/index.php/entrenova/article/view/33614/16751>.

Neste's Environment Team. 2025. Update of the ISO 14001 in Porvoo 2025. Internal material. [referred: 28.3.2025].

Neste Oyj. 2019. Environmental Management (Principle). Internal material. [referred: 20.2.2025].

Neste Oyj. 2023 Kilpilahden teollisuusalueen öljyntorjuntasuunnitelma. Internal material. [referred: 8.4.2025].

Neste Oyj. 2025a. Annual Report 2024. [e-publication]. [referred: 15.3.2025]. Available: https://www.neste.com/files/pdf/3kFaGuHcQk8hRDLS6tlvqF-Neste_Annual_Report_2024.pdf.

Neste Oyj. 2025b. Environmental Management System Porvoo. Internal material. [referred: 20.2.2025].

Neste Oyj. 2025c. Climate. [e-publication]. [referred: 16.2.2025]. Available: <https://www.neste.com/sustainability/climate>.

Neste Oyj. 2025d. Partnerships. [e-publication]. [referred: 20.5.2025]. Available: <https://www.neste.com/news-and-insights/partnerships>.

Neste Oyj. 2025e. Porvoo Refinery. [e-publication]. [referred: 2.1.2025]. Available: <https://www.neste.com/about-neste/how-we-operate/production/porvoo-refinery>.

Neste Oyj. 2025f. Purpose, Vision and Value. [e-publication]. [referred: 2.1.2025]. Available: <https://www.neste.com/about-neste/who-we-are/purpose-vision-and-values>.

Neste Oyj. 2025g. Rotterdam Refinery. [e-publication]. [referred: 2.1.2025]. Available: <https://www.neste.com/about-neste/how-we-operate/production/rotterdam-refinery>.

Neste Oyj. 2025h. Singapore Refinery. [e-publication]. [referred: 2.1.2025]. Available: <https://www.neste.com/about-neste/how-we-operate/production/singapore-refinery>.

Neste Oyj. 2025i. "The key to our success is our people" – The story of Neste's transformation. [e-publication]. [referred: 20.5.2025]. Available: <https://www.neste.com/news-and-insights/sustainability/neste-transformation-story>.

Neste Oyj. 2025j. Who We Are. [e-publication]. [referred: 2.1.2025]. Available: <https://www.neste.com/about-neste/who-we-are>.

Neste Oyj Belgium. 2025. Our Transformation Journey. [e-publication]. [referred: 2.1.2025]. Available: <https://www.neste.be/en/neste-in-belgium/who-we-are/strategy/transformation-journey>.

Neste Safety Finland Team. 2024. Performance Plan 2025. Confidential material.

Project Management Institute. 2025. Project Management Professional (PMP). [e-publication]. [referred: 20.5.2025]. Available: <https://www.pmi.org/certifications/project-management-pmp>.

SCCM. 2019. ISO 14001: Identifying and evaluating environmental aspects. [e-publication]. [referred: 19.3.2025]. Available: https://www.sccm.nl/sites/default/files/BM18-SCCM_ISO14001_environmental_aspects_EN_16apr19v3.pdf.

Schaltegger, S., Burritt, R. 2017. Contemporary Environmental Accounting: Issues, Concepts and Practice. Part 4: Integration. pages 356-408. [book]. [referred: 18.5.2025]. Available: <https://ebookcentral.proquest.com/lib/lut/reader.action?docID=1741620&ppg=356>.

Siew, R. Y. J. 2015. A Review of Corporate Sustainability Reporting Tools (SRTs). Journal of Environmental Management. [e-publication]. [referred: 8.1.2025]. Available: <https://www.sciencedirect.com/science/article/pii/S0301479715302620>.

Sroufe, R. 2003. Effects of Environmental Management Systems on Environmental Management Practices and Operations. Production and Operations Management; Muncie Vol. 12, P. 416-431. Available: <https://www.proquest.com/docview/228755265/fulltextPDF/DE9F805C7B204624PQ/1?accountid=27292&sourcetype=Scholarly%20Journals>.

United Nations. 2021. A Beginner's Guide to Climate Neutrality. [e-publication]. [referred: 20.1.2025]. Available: <https://unfccc.int/news/a-beginner-s-guide-to-climate-neutrality>.

United Nations. 2025. What is the Kyoto Protocol? [e-publication]. [referred 18.5.2025]. Available: https://unfccc.int/kyoto_protocol.

United States Environmental Protection Agency. 2024. Specialty-Batch Chemical Manufacturing Industry – EMS Implementation Guide. US EPA Archive Document.

Appendix D – 1-20. [referred: 7.4.2025]. Available:
https://archive.epa.gov/sectors/web/pdf/appendix_d.pdf.

Valtioneuvosto. 2011. Teollisuuden päästödirektiivin (IED) voimaansaattaminen ja muita ympäristönsuojelulain kehittämisajatuksia. [e-publication]. [referred: 13.5.2025]. Available:
<https://julkaisut.valtioneuvosto.fi/handle/10138/41377>.

Welford, R. 2016. Corporate Environmental Management 1, Systems and strategies. Book.
Referred 16.5.2025. Available:
<https://api.taylorfrancis.com/content/books/mono/download?identifierName=doi&identifierValue=10.4324/9781315825120&type=googlepdf>.

Appendix 2. Instructions for the Evaluation and Scoring of the Environmental Aspects -tool

Evaluation and Scoring of the Environmental Aspects									
Instructions									
<p>The criteria and evaluation table presented in this document are intended to serve as a tool for evaluating the impacts of environmental aspects of Neste's Porvoo refinery. This document consist from three main sections:</p>									
1. Evaluation Criteria									
<p>The evaluation criteria presents five categories (scale of impact, scope of impact, stakeholder concern and negative publicity, irremediability and compliance) and five scoring levels (1-5) for evaluating environmental aspects and their impacts. Explanations and examples have been provided for each criteria to support the evaluation of the aspects.</p>									
2. Scoring Tool									
<p>The scoring tool includes a table in which column B is filled with the environmental aspects to be scored. Column C is reserved for additional information on the aspect. Columns D-H record the aspect scores from 1 to 5 for each criteria based on the evaluation criteria from the first section of this document.</p> <p>Column I relates to the "compliance" -criteria of column H. If there is a requirement set for the aspect and the company meets them, select "yes" from the drop-down menu. If the company does not meet the regulations required to aspect, select "no".</p> <p>The "scoring explanations" table next to the scoring tool table shows which category the final score of the aspect belongs to. The maximum score of the aspects is defined as 100 points. However, the scoring table gives two different scores, the total score and the final score. In practice, aspects can receive more than 100 points, but the definition of exceeding it is not considered relevant, because in such a case all aspects that receive more than 70 points are classified as significant.</p> <p>The total score therefore indicates the actual score of the aspect, which makes it easier to evaluate the scores of significant aspects between each other. The final score is scaled according to the "scoring explanations" table and should therefore be used to determine the final scoring category.</p>									
3. List of Significant Aspects									
<p>The table of significant aspects is automated to collect all environmental aspects with a score above 45 from the "Scoring Tool" tab. Columns J- and K- show more detailed scores for each aspect.</p> <p>Aspects defined as significant require corrective actions, which must be defined by the company's management. Column L has space reserved for possible corrective action proposals.</p>									

Appendix 3. The Evaluation Criteria of the environmental aspects

Evaluation Criteria					
	Scale of impact	Scope of impact	Stakeholder concern and Negative publicity	Irremediability	Compliance (x2)
+					
1	<p>Negligible</p> <p>Will not cause substantial damage or disruption.</p> <p>Example of environmental consequences: Local effects, days. Temporary damage or emissions inside and/or outside the site boundaries.</p>	<p>Isolated</p> <p>The impact is isolated, potentially affecting a number of people and isolated area of the surrounding environment.</p> <p>Example area of the scope: Refinery.</p>	<p>Never</p> <p>0 contacts / year</p>	<p>Easily remediable</p> <p>The impact can be easily remedied with minimal efforts, e.g. through slight adjustments in Neste's sites, operations or supplier engagements.</p>	<p>No requirements</p>
2	<p>Low</p> <p>With proactive measures, the adverse effects can be contained and managed effectively.</p> <p>Example of environmental consequences: Local effects, weeks. No permit limit exceedance. Minor or limited environmental impact inside and/or outside of the site boundaries.</p>	<p>Local</p> <p>The impact is local, out side of the refinery, potentially affecting groups of people and local environment.</p> <p>Example area of the scope: Sea area and cities nearby (Kilpilahti, Porvoo, Sipoo).</p>	<p>Rare</p> <p>1-5 contacts / year</p> <p>Casual contacts from stakeholders or media.</p>	<p>Can be remedied</p> <p>The impact can be remedied, but it requires notable efforts and time, and changes in Neste's sites, operations or supplier engagements. Might need to involve external stakeholders.</p>	<p>Internal goal or company policy</p> <p>Company's own policies and desired goals.</p>
3	<p>Moderate</p> <p>Consequences that require a coordinated response and substantial efforts to manage.</p> <p>Example of environmental consequences: Locally lasting effect. Environmental permit limit exceedance. Environmental damage inside and/or outside of the site boundaries.</p>	<p>Regional</p> <p>The impact is regional, potentially affecting a large amount of people and regional environment.</p> <p>Example area of the scope: Region (Uusimaa).</p>	<p>Occasional</p> <p>5+ contacts / year</p> <p>Occasional contacts from stakeholders or local media on the same topic.</p>	<p>Partially remediable</p> <p>The impact is partially remediable but leaves lasting results, potentially needing long-term strategic shifts in Neste's sites, operations and involving external stakeholder(s).</p>	<p>Voluntary requirements</p> <p>ISO 14001 etc.</p>
4	<p>High</p> <p>Considerable effects.</p> <p>Example of environmental consequences: Large geographic effect. Serious environmental permit exceedance. Corrective measures both inside and outside of the site are necessary.</p>	<p>National</p> <p>The impact is national, potentially affecting to all the citizens of the nation and the nation environment.</p> <p>Example area of the scope: Finland.</p>	<p>National publicity</p> <p>Article in national media.</p>	<p>Largely irremediable</p> <p>The impact is largely irremediable and requiring complex, long-term initiatives to mitigate. Several external stakeholders need to be involved.</p>	<p>Requirement by law or permit</p> <p>Environmental permit, IED, etc.</p>
5	<p>Extremely grave</p> <p>A crisis level scenario with fundamental effects.</p> <p>Example of environmental consequences: Large geographic effect for multiple years. Serious and permanent environmental effects both inside and outside the site boundaries.</p>	<p>International</p> <p>The impact is widespread; having a international reach on people and environment.</p> <p>Example are of the scope: Several nations.</p>	<p>International publicity</p> <p>Big headlines in global media.</p>	<p>Irremediable</p> <p>The impact is completely irremediable and irreversible.</p>	<p>Administrative compulsion</p>

Appendix 5. Scoring Explanations for environmental aspects scoring results

Scoring explanations	
Scoring	Significancy
6 - 20	Not significant
21 - 45	No immediate need for corrective actions
46 - 70	Need for corrective actions
71 ≤	Highly significant, immediate need for corrective actions

Appendix 6. Automated list of Significant Aspects

Significant Aspects			
Name of the Aspect	Total score	Final Score	Proposal for corrective action
Aspect 1	50	50	
Aspect 2	46	46	
Aspect 3	46	46	
Aspect 4	50	50	