

Nordic Working Paper

Green-listed waste (GLW) exports from the Nordic countries

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Summary

Shipments of green-listed waste (GLW) for recovery do not require a notification or an authority consent within EU and OECD. The aim of the Nordic Working Group for Circular Economy (NCE) study was to gather information about how GLW exports are reported in the participating Nordic countries and in the selected reference countries and to suggest improvements for data collection systems. The study is based on interviews and screening of publicly available information on the procedures and information on GLW shipments in Denmark, Finland, Åland, Faroe Islands, Greenland, Iceland, Norway and Sweden and selected reference countries: Ireland, Northern Ireland and Slovenia.

The European Commission has started a process to review the EU Waste Shipment Regulation (WSR) to guarantee that waste shipped across borders are managed in an environmentally sound manner. The results of this Nordic study of GLW exports in the Nordic countries provides information that can be utilized when renewing the EU regulations.

Waste shipments, waste business and circular economy are closely linked. Shipments of waste are part of circular economy material streams. To secure the up to date information on exported amounts, it is important that the management and reporting systems for GLW are in place. In addition, The EU waste package (EU) 2018/851, (EU) 2018/852, (EU) 2018/850 and (EU) 2018/849 introduces new waste data calculation and reporting requirements.

Reporting of GLW by exporters varies in the Nordic countries. The background for variation is that WSR demands no reporting; shipment of GLW for recovery in EU and OECD countries is regulated by EU's WSR and OECD decision, and no mandatory reporting is required. Basel Convention is followed in all of the Nordic countries. Reporting is not done in real-time in any of the participating countries. In Northern Ireland there is a real-time management system for approval of GLW shipments. In addition to that, also in Denmark GLW exporters can choose to report in real-time. Several proposals emerged as possibility to improve on-line GLW reporting. Among others, easiness to use and possibility to utilise the information by all stakeholders are perspectives that shall be considered when developing on-line reporting.

Three alternative on-line reporting systems for the Nordic countries have been identified. These systems are 1) Country specific system 2) Common system for all participating countries and 3) Hybrid System, which is country specific systems with common components/services.

The assessment is that a common reporting system for all countries would be the most effective way to enhance the reporting, increase information on material flow and decrease the possibilities for illegal shipments. However, a common system to all Nordic countries for supervising and reporting of GLW shipments does not seem to be realistic, because the present methodology of reporting varies in every country. Therefore, a hybrid system would be the most potential option.

Key words

Annex VII

Circular economy

Green-listed waste

On-line reporting

Transfrontier shipments of waste

Waste criminality

Waste export

Waste import

Waste Shipment Regulation

Abbreviations

Annex VII: Shipment document according to WSR article 18

ARSO: Environmental Agency of the Republic of Slovenia

EPA: Environmental Protection Agency

EU: European Union

GLW: Green-listed waste

NEA: Norwegian Environment Agency

OECD: Organisation for Economic Co-operation and Development

SWOT: Strengths, Weaknesses, Opportunities, Threats

TFS: Transfrontier shipment of waste

TVINN: Norwegian customs' Electronic system

WRMS: Irish Waste Regulation Management System

WSR: Waste Shipment Regulation (Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste)

YLVA: Finnish Environmental Monitoring System YLVA

1 Background

The Nordic Working Group for Circular Economy (NCE) which coordinates projects on circular economy within the Nordic countries conducted a study on green-listed waste (GLW) exports in the Nordic countries to acquire new knowledge on GLW shipments. Current problem is that there is not sufficiently data available on GLW exports from the Nordic countries in order to implement efficient supervision. Thus, there is a need to improve the data collection, possibly via an on-line reporting tool.

The Norwegian Environment Agency coordinated the proposal phase, and Netum Oy and AFRY Finland Oy performed the study in March - September 2020. The Transfrontier Shipments of Waste Group (TFS), a subgroup to NCE, acted as the Steering Group. The leader of the Steering Group was Hannele Nikander from SYKE, Finnish Environment Institute.

The aim of this project was to gather information about how GLW exports are reported in the participating Nordic countries and in the selected reference countries (Ireland, Northern Ireland, and Slovenia), and to suggest improvements for data collection systems. Data of the exported amounts of GLW was not collected in this study.

The Nordic Council has previously published two reports on GLW shipment. "Shipments of green-listed waste" provides a picture of transboundary shipments of GLW involving project countries Denmark, Finland, Norway, and Sweden (*Emma Nurmi, Dorte Skjøtt Jakobsen, Beate Langset, Margareta Eriksson, Pär Kollberg and Kaija Rainio. 2017*). The second publication "Shipping green-listed waste" includes instructions for shipping GLW (*Hannele Nikander, Agnes Andersson, Vanja Sverdlilje, Dorte Jakobsen, 2018*). The new project "Green-listed waste exports from the Nordic countries" continues the work by gathering information on reporting of GLW exports in the Nordic countries.

The results of this project aim to reduce the illegal shipments from the Nordic countries. The knowledge gained in the project may be used for more targeted controls to prevent illegal shipments in the future.

The first interim report dated on May 18, 2020 describes procedures regarding GLW reporting in Denmark, Faroe Islands, Greenland, Finland, Åland, Iceland, Norway, Sweden, Northern Ireland, Ireland and Slovenia (Annex 1 of this report). The second interim report dated on August 28, 2020 includes analyses of the previously gathered information on GLW shipments and regulative framework in the Nordic countries and the selected European countries (Annex 2 of this report).

Recommendations and proposals for further actions are presented in this final report.

2 Methodology

The study is based on interviews and screening of publicly available information on the procedures and information on GLW shipments in Denmark, Finland, Åland, Faroe Islands, Greenland, Iceland, Norway and Sweden and the selected reference countries: Ireland, Northern Ireland and Slovenia. Interviews of the authorities of the Nordic countries were made in March and April 2020 by email. The interviewed persons are presented below in Table 1. The questionnaire focused on gathering information on national GLW regulation, supervising procedures, reporting procedures, best practices and development ideas. The target was to get information on how GLW are managed in the reporting systems.

Table 1 The procedures and information on GLW shipments in the Nordic and selected EU countries were asked from the following organizations and persons by e-mail questionnaire in March and April 2020:

Country	Organization	Contact person(s)
Denmark	The Danish Environmental Protection Agency	Johan Vestergaard Paulsen & Tor Søltoft
Faroe Islands	The Environment Agency	Ingvarð Fjallstein
Greenland	The Government of Greenland, Department for Nature and Environment	Julie Uldall Jensen
Finland	Finnish Environment Institute	Hannele Nikander & Emma Nurmi
Åland	Åland Environment and Health Authority	Erika Sjöström & Linda Siltala
Iceland	The Environment Agency of Iceland	Margrét Bragadóttir
Norway	Norwegian Environment Agency	Beate Kvaernes Langset & Vanja Sverdlilje
Sweden	Swedish Environmental Protection Agency	Agnes Andersson & Margareta Eriksson
Ireland	National TFS Office	Brian Heffernan
Northern Ireland	Northern Ireland Environment Agency	Brian Luke
Slovenia	Ministry of Environment and Spatial Planning	Ema Starbek-Gregorič & Bojan Počkar

SWOT analysis of the GLW procedures in different countries was used to find the best practices in each country.

3 GLW Regulations in the EU and the Nordic countries

3.1 EU regulation on GLW shipments

According to the EU's Waste Shipment Regulation (EC) No 1013/2006 (WSR), all parties involved must ensure that waste is managed in an environmentally sound manner, respecting EU and international rules, throughout the shipment process and when it is recovered or disposed of. In addition, the EU waste package (EU) 2018/851, EU (2018/852, (EU) 2018/850 and (EU) 2018/849 introduces new waste data calculation and reporting requirements.

The amended OECD Decision on the shipment of wastes destined for recovery operation under OECD C(2001)107 is implemented in EU's WSR. The recovery includes material and energy utilization. Globally the supervision and control of transfrontier waste shipments is based on Basel Convention on the control of transboundary movements of hazardous wastes and their disposal. WSR lays down procedures for the transboundary shipments of waste in the EU.

Shipments of GLW for recovery do not require a notification or an authority consent within EU and OECD. The WSR articles 3 and 18 concern shipments of GLW. Instead of a prior written notification and consent, a shipment document according to the Annex VII and a contract according to the WSR article 18 between the exporter and the consignee are required. Documents and contracts are not required to be sent to the competent authorities. Neither reporting is required.

Shipments of GLW for recovery to non-OECD countries are regulated in Consolidated Commission Regulation (EC) No 1418/2007 on export for recovery of certain waste listed in Annex III or IIIA to Regulation (EC) No 1013/2006 of the European Parliament and of the Council to certain countries to which the OECD Decision on the control of transboundary movements of wastes does not apply. In addition, shipments of GLW for disposal in EU and OECD countries are allowed only with prior written notification and consent of the competent authorities of the countries concerned by the shipment.

GLW is defined as waste that does not pose any likely risk to the environment when shipped for recovery and as, secondly, is listed in WSR's Annex III, IIIA, or IIIB of the WSR. The Annex III A defines which mixtures of wastes can be shipped according to the regulations of GLW shipments. Annex IIIB covers additional GLW in EU, awaiting of changes agreed under the Basel Convention and OECD Decision. GLW can roughly be divided into the following categories based on the origin of the waste: textile, paper, tyres/rubber, metal, plastic, slags/gypsum, glass, ceramics, other wastes containing principally inorganic constituents and some animal or agricultural origin organic waste (e.g. feathers, horsehair). For each waste fraction there is an individual code in Basel Convention Annex IX or OECD decision C(2001)107. Regardless of whether or not wastes are included in the annexes referred to above, they may not be classified as GLW if they are contaminated by other materials that are hazardous or prevent the recovery of the waste in an environmentally sound manner. In general, the purity of GLW must be over 90 weight-%. Stricter requirements may be applied to certain wastes. There might also be specific national requirements.

3.2 Exporters' responsibilities of GLW shipments

Cross-border shipping of GLW requires a contract, according to Article 18 of the WSR, between the person who arranges the shipment and the consignee in the destination country. Also Annex VII (a shipment document) shall be made. These documents are stored by the

operators and must be presented upon request to the authority overseeing the waste shipment.

The person who arranges the shipment, must ensure that Annex VII is included in each shipment.

Exporters of GLW shall ensure that:

- the Annex VII accompanies the shipment from the start until the shipment arrives at the recovery facility.
- a contract between the exporter and the consignee according to Article 18 of WSR is valid when the shipment is dispatched.
- the Annex VII document and the contract are presented to the authorities inspecting waste shipments upon demand.
- only permitted/registered waste carriers are used for the waste shipments.

The exporter, the consignee, and the recovery facility shall retain all documents related to the shipments for at least three years from the day of a shipment.

The person who arranges a shipment has to be under the jurisdiction of the country of the dispatch and the consignee (like a dealer, broker or corporate body) has to be under the jurisdiction of the country of destination and must possess or have some other form of legal control over the waste at the moment when the shipment arrives to the country of destination.

Environmental authorities have information on their web pages on legal procedures of GLW shipments and Annex VII documents and guidance how to fill the document. In addition, the Nordic Council has published instructions for the shipping of GLW "Shipping green-listed waste". GLW shipments are supervised by environmental authorities according to the annual inspection plans together with the police and customs on the roads, borders, and harbours.

3.3 Annex VII waste movement documents

Waste movement documents must accompany GLW shipments. The exporter of GLW fills WSR Annex VII correctly and confirms that it accompanies the shipment. The exporter certifies that the information is complete and correct by signing the document.

The following information regarding GLW export is required to fill in Annex VII:

- Person who arranges shipment
- Importer/Consignee
- Actual waste volumes
- Carriers (contacts, dates)
- Waste generator and origin
- Recovery facility
- Recovery operation and codes
- Waste identification (codes)
- Countries export/dispatch & import/destination

3.4 Updating of EU WSR

The European Commission has started a process to review the EU WSR to guarantee that waste shipped across borders are managed in an environmentally sound manner. The regulation is planned to be updated before 2023.

The review initiative is in accordance with the policy objectives of both the European Green Deal and the new EU Circular Economy Action Plan. The overall goal is to support and facilitate waste re-use and recycling within the EU in order to increase circular economy, take

into account the waste hierarchy and to improve value of waste. The review is needed for strengthening the enforcement of the WSR and the control of the illegal transboundary movement of waste. In addition, there is a need to restrict the export of waste that has potentially harmful environmental and health impacts, or that can be treated in the EU, from being exported to non-EU countries.

The results of this Nordic study of GLW exports in the Nordic countries provides information that can be utilized in updating the EU regulations.

3.5 Implementation of the regulation of GLW shipments in the Nordic countries

Implementation and follow up of EU WSR regarding GLW shipments in the Nordic countries, Ireland, Northern Ireland and Ireland is depicted in Table 2.

The supervising authorities and links to the national legislation are presented in the first Interim Report (Annex I).

Table 2 National regulations in Nordic and selected reference countries

Country	Regulation
Nordic countries	
Denmark	GLW shipments are regulated by EU regulation 1013/2006 and Statutory Order on "Shipments of waste and shipments of used electrical and electronic equipment" in Denmark.
Faroe Island	General waste handling is regulated by the Environment Protection Act. There is no regulation on GLW shipments from Faroe island, however, all hazardous waste shipments are subject to the requirements of the Basel Convention.
Greenland	GLW is regulated by the Environment Protection Act and by a tailored Waste Disposal Regulation for Greenland's needs. All waste exports, whether hazardous or not, will be subject to the requirements of the Basel Convention.
Finland	EU regulations and Basel Convention on GLW shipments have been enacted by the Waste Act.
Åland	In Åland, the Finnish Waste Act (FFS 646/2011) and the Landscape Act (2018: 83) are applied.
Iceland	Iceland has adapted the principles of EU waste regulations in its Waste Act (Iceland follows as a member of OECD EU regulations on GLW shipments).
Norway	EU regulation 1013/2006 and Chapter 13 of environmental regulation Cross border shipments of waste is followed in Norwegian waste legislation
Sweden	EU regulation 1013/2006 and Waste legislation (Avfallsförordning 2020:614) are followed.
Selected reference countries	
Ireland	Regulation 13(d) of the Waste Management (Registration of Brokers and Dealers) Regulations 2008, and Regulation 5(1)(q) of the Waste Management (Shipments of Waste) Regulations 2007.
Northern Ireland	In Northern Ireland GLW is regulated via a Compliance System.
Slovenia	Slovenia has legal provisions regarding the transboundary waste shipments based on the Regulation (ES) 1013/2006 – Decree on the implementation of the Regulation (EC) on shipments of waste.

3.6 New waste import restrictions

After January 2018, China has imposed an import ban for 56 different types of solid waste in 4 categories, including waste plastics, unsorted scrap papers, discarded textile materials and vanadium slags. From the beginning of 2021, China will expand the ban to cover all imports of solid waste. The bans are part of China's efforts to clean its environment and to shift its production towards high-profile products. China, for example, has imported cumulatively 45

% of the world's plastic since 1992, and now these bans have caused a chaos for the global waste recycling system.

The currently imposed waste bans in China have increased the amount of waste imports, both legal and illegal, to African and Asian countries, such as Nigeria, Indonesia, Malaysia, Taiwan, Thailand, Vietnam and India where preliminary recycling capacities have already been established. However, there is not enough capacity to handle large amounts of waste. Some South-east Asian countries have already faced the issue of inadequate recycling facilities and illegal waste shipments. Malaysia, for example has sent over 100 containers of illegal plastic waste back to countries where they came from. After increased waste imports, Taiwan (from 2018 onwards) and Malaysia (2019) have tightened requirements for waste imports. Also, Indonesia is planning to restrict plastic waste imports from 2021 and India has tightened its requirements for waste imports.

Fourteenth meeting of the Conference of the Parties to the Basel Convention agreed on measures to restrict exports of miscellaneous plastic waste in May 2019. In addition, the parties agreed to tighten controls on transboundary movements of plastic waste. The amendments aim to ensure proper management of plastic waste and to reduce the dumping of plastic waste to the sea by preventing the transport of plastic waste to countries that do not have the capacity to handle or recover the waste. The new entries become effective as of 1 January 2021.

3.7 Circular economy

Waste shipments, waste business and circular economy are closely linked. Shipments of waste fractions are part of circular economy material streams. To secure the up to date information transfer between actors to increase circularity of materials inside EU, it is important that the management and reporting systems for GLW are in place.

The new EU Circular Economy Action Plan includes enhanced waste policy to support waste prevention and circularity. There is also a goal to create a well-functioning EU market for secondary raw materials. The goal is to solve the challenges related to competition with primary raw materials including safety, performance, availability, and costs as well as to contribute to preventing a mismatch between supply and demand of raw materials.

Until now, many EU and OECD countries have relied on the possibility to ship waste to countries in Asia and Africa. Now that Asian countries are restricting importing, developed countries are in trouble with the waste materials. The development of recycling facilities has been neglected and currently countries cannot recycle their own waste. According to the European Environmental Agency, EU has for example exported approximately 150 000 tonnes of plastic waste per month in the beginning of 2019, and the consumption of plastics is expected to double in the coming 20 years. According to the European Parliament, after the import restrictions in China, half of the plastic collected in EU for recycling is exported to countries outside of EU to be treated. Most of the plastic treated in EU goes to energy recovery. Land-filling is the next most common option for disposing. This is due to lack of capacity, technology, or financial resources to treat the waste locally.

In order to address the lack of treatment capacity in European and OECD countries, more recycling facilities are needed and also the demand for recycled material must increase in EU and OECD countries. EU will also review thoroughly the EU rules of waste shipments to prepare for re-use and recycling waste.

3.8 Waste criminality

The waste categories presented in GLW list is vast. As the border controls for wastes listed as GLW is minimal, there is a risk that also other waste than GLW is exported as such. These possible illegal waste shipments can be considered as a risk in the Nordic countries as well.

For now, there is no information that waste criminality regarding for example plastic waste would have occurred. To minimize the risk of illegal transboundary GLW shipments in the future, up-to date regulation regarding GLW shipments should be implemented. It is also noted that because of the import bans in China, proper recycling of low-value wastes becomes less cost-effective and illegal shipments to the third countries are likely to increase. There is also a risk that illegal dumping of plastic and other wastes to the oceans and waterways will be more common.

Annex VII of WSR or contract with the recovery facility are not required to be sent to the authority or achieved by authorities. Competent authorities have a possibility to require relevant documentary evidence provided by actors. In addition, in case there appears doubt on the environmentally sound management of waste, approval by the competent authority of destination country can be required.

The shipment concerned shall be considered as an illegal shipment if evidence is not sent by the exporter or it proves to be inadequate. Also, the European Commission (2020) states that "Experience shows however that the export of 'green-listed wastes' is often not controlled by national authorities as closely as the export of 'notified wastes'. Thus, it is not always clear if (and how) operators and authorities ensure that exported waste is treated in an environmentally sound manner".

4 Reporting of GLW exports in the Nordic countries and the selected EU countries

4.1 Summary of GLW exports in the Nordic countries

Table 3 presents summaries of the GLW export reporting procedures in the Nordic countries based on the findings of interviews of environmental authorities of Nordic countries made in April in 2020. A more thorough analysis of GLW management in the Nordic countries is presented in the Interim Report 2 which can be found in the Annex 2.

Reporting of waste on GLW by exporters to the environmental authorities varies in the Nordic countries. The background for variation is that there is no legal responsibility of reporting set in WSR. Free shipment of GLW for recovery in EU and OECD countries is regulated by EU's WSR and no mandatory reporting is required. Customs keeps records of the amount of exported waste from EU countries.

A common concern is the inadequate reporting of GLW. Typically, no up-to-date information is available on all shipments. Reporting of GLW is mandatory only for operators subject to the environmental permit as in the interview of Finland was highlighted. Waste brokers and dealers are not responsible to report GLW shipments. Regarding all GLW shipments, voluntary national alternatives for reporting shall be considered because possible changes of the present regulation (WSR) take time. The national regulations can be updated, and it could include the responsibility to report on GLW exports.

Iceland suggested that one possibility to improve reporting would be to gather information from the final destination of the imported waste, from the facility that actually does the recycling, including the origin of the waste they handle. In this point of view upcoming update of WSR should provide the common responsibility to report the use of GLW within in EU.

No digital or on-line reporting of export or electrical archiving of GLW shipments document was available in Finland, Faroe Islands, Greenland, Åland, Sweden and Iceland. The digital systems for reporting of GLW shipments is available in Denmark and Norway, both being very different. Danish waste shipment documentation system is advanced, compared to other Nordic countries, as it includes both hazardous waste and GLW. The system allows the exporter to fill in the information in the form of Annex VII to the system, so there is no need to fill the information twice to the system and to the Annex VII separately. The idea to fill GLW documents and do reporting in the one national waste data system could be implemented in the other Nordic countries as well.

In Norway, the Customs hosts TVINN system where also GLW shipments are declared regarding the waste code and weight. However, Annex VII documents are not included in TVINN. The Customs' system is not open for other authorities and reporting of GLW shipments by exporters is based on the summary data gathered by the Customs. The best functionalities of the Norwegian system (customs role) could be possibly utilized in Iceland, too, if procedures of GLW reporting will be developed in the future.

In Sweden, there is a digital form to fill the Annex VII. The document is voluntary to be used by the exporters, and the information entered in the document is not stored anywhere. The digital form is well prepared and can be printed to PDF. The digital form confirms that the documents are filled in correctly according to the applicable legislation. The information available in Annex VII is a good basis to develop the digital reporting system.

Regarding Åland, Faroe island and Greenland there is no large scale importing or exporting of waste. However, there is also a possibility of illegal shipments of other wastes being incorrectly classified as GLW. Improvement of the reporting system in each country helps the supervision of GLW shipments.

Table 3 Reporting systems in the Nordic countries

Country	Reporting system	Reporting	Summary
Denmark	The National Waste Data system (NDWS).	All GLW exporters are required to report to the NDWS. The GLW exporter fills the movement document (Annex VII) that is a feature of the Waste Data System. Reporting is required to be done only at the end of the year but GLW exporters can choose to report in real time too.	Both Hazardous waste and GLW are reported through the same system. A recent addition allows the reporter to fill in the required information in the form of Annex VII, thus both reporting the data to the Waste Data System and filling in Annex VII at the same time. This advanced reposting system could be implemented in other Nordic countries as well. The awareness of the system within small companies is not on a level it could be, so there is potential to increase awareness.
Faroe Islands	No reporting system or regulation regarding GLW.	No specific reporting system for GLW in place. Two companies that operate waste shipments report annually their waste transfers.	Currently no regulation on GLW and no waste codes are used to identify the content of shipments. To secure the legal aspects and business opportunities in the future, implementation of <i>principles EU WSR</i> on GLW shipments and a reporting system would be worth of consideration to avoid illegal waste transit in the future. There is a possibility of illegal shipments of GLW due to changes in the markets and challenges of the circular economy.
Greenland	A tailored Waste Disposal Regulation for Greenland's needs.	No specific reporting system for GLW in place.	A reporting and supervising system is suggested to be implemented to manage the issues regarding illegal waste shipments. Even though there is no current need for an on-line reporting system the situation can change in the future. Therefore, if the scale of waste shipments changes, it is recommended to improve readiness to handle information on waste shipments including GLW shipments.
Finland	No overall reporting system which would cover all exporters for GLW. The environmental monitoring system (YLVA) stores information on activities subject to a permit, notification and registration under the Environmental Protection Act and activities subject to a permit and registration under the Waste Act.	Only those who are subject to environmental permit report their GLW waste shipments through environmental monitoring system YLVA. YLVA is used by both municipal environmental authorities and regional authorities (ELY). In practice, operators subject to a permit issued by a regional authority provide information.	Development of the Finnish TFS system and the national environmental reporting system YLVA are the most recommended alternatives for reporting and supervising of GLW shipments, to avoid too much bureaucracy. If the interface of separate reporting systems is not well enough planned, there is a risk of double counting. To reach all GLW shipments, the voluntary alternatives for reporting shall be considered because possible changes of the present regulation (WSR) take time.
Åland	No system for reporting or saving the documents	No specific reporting system for GLW in place.	Currently information on GLW is neither reported nor saved systematically. There is also some unclearness about the authorities' responsibilities and roles in Åland. It is

			recommended that the roles and responsibilities of authorities should be more precisely determined with the Finnish authorities. Also, an inspection plan should be created.
Iceland	No reporting system for GLW shipments in place.	No mandatory reporting on GLW. At the moment authority can get GLW data asking documents afterwards by email.	The on-line reporting system could be built to include all shipment documents, not only those related to waste. All waste exports and imports go through harbour so they could technically be inspected. Supervising and reporting could be developed based on the customs inspection like in Norway where applicable.
Norway	Customs has a system called TVINN where all waste shipments, including GLW shipments are reported.	All exports and imports are reported to the Customs. The Customs produces a report on GLW annually to NEA. It is possible that not all GLW shipments are declared properly.	It would be worth of considering developing an on-line reporting and filing of Annex VII in Norwegian Altinn portal for digital dialogue between businesses, private individuals and public agencies. Paper documents could be replaced with a digital solution, such as the use of QR codes or RFID. The co-operation between Customs and EPA could be more extensive and the information gathering on GLW could be more detailed for environmental authority's needs to make an analysis of the waste. If there are development projects of the TVINN system or waste reporting upcoming in the future in Norway, it is recommended that an on-line reporting of GLW shipments is involved to the projects, if possible.
Sweden	Apparently, there is no system where the GLW shipments documents would be saved.	The Swedish EPA case management system could be developed to cover also GLW shipments.	A digital form to fill the Annex VII of GLW shipments. The document is voluntary to be used by the exporters. The digital form is well prepared and can be printed to PDF. The digital form confirms that the documents are filled right according to the applicable legislation. The information entered in the document is not stored anywhere. In order to simplify for both authorities and for notifiers, one system where the notifier can create a notification and can also fill in the necessary information for Annex VII, would be preferred.

4.2 Best practices on reporting of GLW shipments in Ireland, Northern Ireland and Slovenia

In this study Ireland, Northern Ireland and Slovenia were considered as reference countries. In the following chapters, the strengths, weaknesses and opportunities of GLW reporting by exporters to the competent authorities in these countries are presented.

A mandatory pre-notification system of GLW shipments is in use in Ireland and Northern Ireland.

Ireland

The authority operates an on-line reporting system (WRMS) for the export and import of GLW out of and into Ireland. The person or company who arranges GLW shipments, whether a broker or dealer involved in the export or import of waste, is required to provide information on-line to the National TFS Office in a GLW report. The GLW Shipments report must be completed and submitted on-line at the end of each calendar quarter; this may be accessed via the webpage. Annex VII is not required to be submitted to WRMS.

In Ireland, there are three main functionalities in GLW reporting system: 1) Registration, 2) Creating GLW Shipment Report and 3) Search of GLW Shipments Report(s). Data on GLW is available for all Irish authorities and TSF Office produces a public version for the industry. The data is checked by technical and administrative team.

Information on whether the reported amounts of waste and Customs' data match, is not yet available. There is also a possibility that the reporter reports the incorrect waste parameter (weight) or waste code. Other challenges have not been recognized on the data quality.

The system is user-friendly. It is also seen as an advantage that authorities meet and speak with the industry and get their thoughts when they double check things of the information reported via the on-line system. According to the information authorities see that the on-line reporting system works well to the end users. The Irish waste reporting system is a good model for development of GLW shipments reporting in the Nordic countries.

Northern Ireland

Northern Ireland has a database where all exported waste movements are recorded. A copy of the signed Annex VII is also saved to the system. According to the national legislation, the authority checks the pre-notification before export of GLW is allowed. However, the data on imported waste is currently not stored in the system. Also, the access to the system is restricted to IWS staff and the system is seen somewhat complex.

Slovenia

Slovenia has a system (IS-Odpadki) for waste exports which is not specific for GLW. Waste management facilities are obliged to report wastes annually to ARSO. However, there is no electronical system for saving the GLW shipment documents in Slovenia.

The information on transboundary waste streams from the GLW is not monitored since, under the Waste Shipments Regulation, the competent authority does not have to be pre-notified on the shipments of the waste. To enhance the process, the law or the regulation on waste management should require the recovery facilities to enter Annex VII information into the on-line system for storing waste records in Slovenia (IS-Odpadki).

5 Proposal for improvement of reporting of GLW in the Nordic countries

5.1 Recommendations

In brief, the following nine proposals emerged in this study as possibilities to improve the on-line GLW shipments reporting. The proposals are meant for basis of discussion on how to improve GLW reporting. All ideas need further development and studies before they can be implemented.

1. The on-line reporting shall be easy to use for authorities and exporters as well as importers of GLW.
2. Functionalities that are considered to work well can be introduced to other countries' systems. They include for example the functionalities (digital, saving of data) of Danish and Norwegian reporting systems. Also the present Swedish digital form for GLW shipments is well designed and helps users to fill the Annex VII. In addition, the functionalities of Ireland's waste reporting system are a good model for development of GLW reporting in the Nordic countries.

An additional study is required to create understanding on digital interfaces and functionalities of systems which makes it easy to use for users (authorities and operators).

3. Reporting must cover all operators including waste brokers and dealers. At the moment not all waste providers are obligated to report on waste shipments.
4. At the moment there is no legal obligation to report on GLW shipments based on EU regulations. The importance of possibility to report on-line and supervise GLW shipments shall be highlighted when the regulations are updated.
5. Interactivity of the on-line reporting system is essential for the successful launch of the new system and interaction. Interaction means here that both authorities and GLW exporters and importers can use the system smoothly. It also means that countries can interact with each other, for example to answer to the threat of waste criminality.
6. An improvement of cooperation with competent environmental authorities and Customs shall deepen to confirm that data provided in authorities' and the Customs' systems match. Particularly in Norway and Iceland but also in other countries, improvement of (digital) changing of information between the competent environmental authorities and the Customs is worth considering. As a result, illegal shipment of waste would be under better control.
Before the decision of tighter cooperation, the need and methodologies to improve information change must be further studied.
7. In addition to the national supervision, the on-line reporting system can enable transboundary supervision of GLW movements by environmental authorities. The interfaces of the on-line reporting system in each country shall match to the extent necessary.
8. A review of EU's WSR is ongoing. In the development of the EU and national regulation of GLW reporting of exporters, too heavy bureaucracy must be avoided. In addition, no new permitting systems shall be created so that the updated WSR does not prevent the utilization of GLW in Europe in the future.
9. Voluntary reporting systems can be developed for GLW reporting of exporters in Nordic countries because regulative changes take time. A campaign on voluntary reporting or training of operators could take place in the Nordic countries.

Before campaigning and training, the role of brokers and dealers should be studied in order to identify all relevant parties who import/export GLW.

5.2 Opportunities for on-line reporting system

Reporting is not done in real-time in any of the participating countries. There is a common will that on-line reporting is the future solution. On-line reporting helps EPAs to manage GLW data for reporting and supervising purposes. In addition, digital solution for on-line reporting can enable operators to utilize the information on their GLW shipments.

There are three main alternatives to improve on-line reporting systems of GLW export in the Nordic countries:

- 1) Country specific system
- 2) Common system for all participating countries
- 3) Hybrid System, country specific systems with common components/services

The alternatives are evaluated in Table 4.

To help with the decision making, an impact assessment of the alternatives was conducted. The impact of the alternatives was assessed regarding/with respect to the impacts on reporting and supervising, environment, economic, technical, legal, circular economy, and criminality and its prevention. Green, yellow and red colours are used to highlight the results of the analysis. Green means the most positive outcome with respect to the goal, yellow presents the average outcome and red does not improve the present reporting.

Overall analysis is made from environmental, economic and criminality point of view. Based on the assessment the common or hybrid system are the most effective in this sense. The viewpoints discussed in 5.1 are favourable elements of the on-line reporting. The assessment is that a common reporting system for all countries would be the most effective way to enhance the reporting, increase information on material flow and decrease the possibilities for illegal shipments. However, a common system to all Nordic countries for supervising and reporting of GLW shipments does not seem to be realistic, because the present methodology of reporting and priorities vary in every country. Therefore, a hybrid system would be the most potential.

Table 4 Assessment of three alternatives on-line GLW reporting systems

Aspect	Country specific system	Common system	Hybrid system
<i>GLW reporting by exporters and supervising</i>	Supervising and reporting are easier within a country.	Supervising and reporting are easier in EU and Nordic Countries. Also, other users than authorities can benefit from the system as they can see the material flows.	Supervising and reporting are easier in EU and Nordic Countries. National requirements can be taken into account.
<i>Environment</i>	There is a risk of illegal shipments of GLW which causes risk to environment as illegal shipments of GLW are not likely to be handled in an environmentally sound matter.	GLW are recovered in an environmentally sound matter as the authorities have more means to supervise the shipments. Supervision of the exporters is easier when the reporting is done more systematically in the Nordic countries.	GLW are recovered in an environmentally sound matter as the authorities have more means to supervise the shipments. Supervision of the exporters is easier when the reporting is done more systematically in the Nordic countries.
<i>Economic</i>	No additional investments needed (expecting that the country already has a system)	Requires the biggest investment in the beginning, but as the costs are shared among several countries, in the long term this will be the least expensive alternative.	Requires investments in the common components and services.
<i>Technical</i>	If a system used by country X is down that has no effect on the other countries. On the other hand, as there is no data exchange between the systems, the digital cross-border communications is weak.	In case of total outage, no-one can use the system, but there are many ways to mitigate the technical risks of a centralised system. A new system would be technically up to date.	If a system used by country X is down, then they are not able to send/receive messages to/from the other countries.
<i>Legal</i>	Easiest option as things must be agreed only on national level.	The most difficult to implement as several countries must agree.	More things to be agreed than in country specific system. Stand-

			ards need to be agreed, for example regarding communications and notifications of shipments.
<i>Circular Economy</i>	Doesn't support on-line distribution of information on material flows between countries.	Information about material flows is distributed to other countries in which helps authorities and operators to plan their operations in the Nordic countries.	Information about material flows is distributed to other countries which helps authorities and operators to plan their operations. in the Nordic countries.
<i>Criminality and its prevention</i>	Criminality is difficult to spot as there might be several loopholes in the systems. Criminality causes also impacts to environmental and social aspects.	Easiest system to control illegal shipments as all parties must report using similar criteria. All parties have access to the shipment information.	Decreases illegal shipments as there is more information change between authorities.
Overall analysis	Least effective system	Most effective system	Average system

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