NEPHROLOGIE VERTE

SFNDT

TOWARDS GREEN DIALYSIS: GOOD PRACTICE GUIDE

2023

RECHERCHE EN SANTÉ RÉNALE
FONDS DE DOTATION

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FORWORD

This guide is the English translation of the good practice guide for green dialysis, published in French by the Green Nephrology group of the Francophone Society of Nephrology, Dialysis and Transplantation (SFNDT) in March 2023 on World Kidney Day (available here). The Société Francophone de Néphrologie Dialyse Transplantation wanted to make it available to all European nephrologists, with the help of the ERA (European Renal Association).

For several years now, experts have been warning us about global warming and its dramatic consequences, which we are already seeing. The measures put in place by states are insufficient, and the goals set by the Paris agreements will not be met. The mobilisation of all citizens and in all areas of activity is necessary and must not be delayed.

The healthcare sector is an indisputable contributor to greenhouse gas (GHG) emissions, accounting for 4 to 10% of total emissions depending on the country (8% in France). However, the mobilisation of its stakeholders is relatively recent, except for the UK. In our practice as nephrologists, hemodialysis has been identified as a treatment with a high environmental impact in terms of water and energy consumption as well as waste production.

The involvement, conviction and training of healthcare and non-healthcare staff are fundamental.

Measures recommended in this guide to improve the environmental footprint of hemodialysis have been drawn from literature and experience feedback. This is a first version which will evolve over time; an annual update is planned.
The guide will be enriched by the results of these first measures, by the experiences of nephrologists, and by new regulations. It has been designed for hemodialysis, especially in-centre hemodialysis. The Green Nephrology group will continue its work, following the same approach, with peritoneal dialysis and the various hemodialysis modalities, including home dialysis. The aim is to offer an ecological indicator when choosing a dialysis technique, alongside waste water treatment efficiency and patient quality of life. Our assessments will be sufficiently robust only once we have the environmental footprint of medical devices and medicines and an analysis of their life cycle. The National Health Service (NHS), which has an undeniable lead over other healthcare systems, will require this by 2028.

As you will read in the guide, the involvement, conviction and training of healthcare and non-healthcare staff are fundamental to the success of such action plans. Everybody must participate and everybody can participate. There are so many things to do! If all European learned societies unite to launch a virtuous ecological movement in their respective countries, their contribution to reducing GHG emissions and limiting global temperatures in the years to come will undoubtedly be significant.

The Green Nephrology Group of the SFNDT

PART 1
Introduction

About SFNDT

SFNDT (Société Francophone de Néphrologie Dialyse Transplantation) is a learned society specialising in nephrology, with the aim of reducing the incidence of kidney disease. Its involvement in the acquisition and dissemination of knowledge, and in research, helps to **improve the care of patients suffering from kidney disease, and to offer them the best possible access to dialysis and transplantation in advanced stages.** The SFNDT has over 1,200 nephrologists practising in France and throughout the French-speaking world (Europe, North Africa, Lebanon, sub-Saharan Africa, North America and Asia), pooling the vital **forces of French and French-speaking nephrology, in liaison with patient associations and health authorities.**

SFNDT's main tasks are to:

Train nephrologists throughout their careers, through congresses, webinars and practical CPD training.

Clarify practices and care pathways, through recommendations and publications such as the White Paper on home dialysis in 2021 and kidney transplantation in 2022.

Innovate by supporting research in order to find tomorrow's treatments, with grants, calls for research proposals and awards, aimed in particular at young practitioners.

To encourage innovation and support research, SFNDT has created, in 2021, **an endowment fund dedicated to renal health research.** The 4 priority projects funded by the donations focus on research and training, patient quality of life, international solidarity and green nephrology. This last section focuses more specifically on **integrating sustainable development issues into dialysis, a care practice that consumes a lot of water and energy and produces waste and greenhouse gases.**

Guide presentation

With the aim of **promoting good ecological practices in dialysis, the SFNDT created a Green Nephrology group in 2020** to assess the ecological impact of dialysis in France and support the transition to more sober and sustainable practices.

To this end, the Group has decided to roll out a comprehensive guide for dialysis centres (public, private and voluntary). This guide sets out the **measures that can be put in place to reduce environmental impact.** However; the CSR approach (Corporate social responsibility) also encourages an **interest in social and societal issues.** The current crisis in the healthcare sector means that we must not overlook this aspect of the dialysis activity. These issues are not covered in depth in this first version of the guide, but will be in a subsequent update.

Dialysis encompasses a number of different practices and care modalities (peritoneal dialysis, in-center hemodialysis, home hemodialysis, etc.), each with its own constraints for which it would be necessary to deploy appropriate actions. Indeed, depending on the equipment used, treatment duration, the location of the treatment, etc., the direct and indirect impacts are not the same. **This guide focuses largely on in-centre hemodialysis practice, even if many of the measures detailed are generalisable.**

It contains information to help you better understand the challenges of sustainable development for dialysis centres, the current regulatory context and the issues associated with its evolution, the methods for assessing GHG emissions and the measures needed to reduce their impact. The first version of the guide focused on dialysis centres in France, in terms of both GHG emissions and regulations. In this guide, the context has been broadened to include European data, enabling us to generalise the measures for reducing environmental impact.

The work we have undertaken aims to describe a range of measures to be implemented, from the best-known and easiest to deploy to the most innovative, as identified by "green dialysis" precursors. These measures may be costly in the initial installation phase, but they often generate savings in the long term. Based on feedback from key measures and contributions from dialysis stakeholders, **this guide aims to enlighten professionals in the sector about the sustainable development issues associated with dialysis, and guide them in the deployment of appropriate measures.** It will lead to a review of internal practices, with the aim of improving them by bringing together all teams and institutional decision-makers, as well as patients. **With this in mind, the SFNDT is committed to an eco-responsible approach and is showing the way for the nephrology of tomorrow.**

Acknowledgements

This work was initiated in May 2022 by **Maryvonne Hourmant,** chair of the Green Nephrology group within SFNDT, in collaboration with **the sustainable innovation consultancy firm, In Extenso Innovation Croissance.** Numerous professionals from the dialysis sector contributed to the writing and proofreading of the guide. Their knowledge of the sector highlighted the challenges of green dialysis, and the main obstacles and leverage for transition. Everyone's experiences have helped to provide the guide with examples of concrete measures to be implemented, and the associated feedback.

We would particularly like to thank:

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Cécile Legallais, CNRS Research Director at Compiègne University of Technology

Hubert Métayer, President of the Dialysis Technicians Association

François Vrostsnik, Professor of Nephrology at Hôpital Bichat Paris and Vice-President of SFNDT

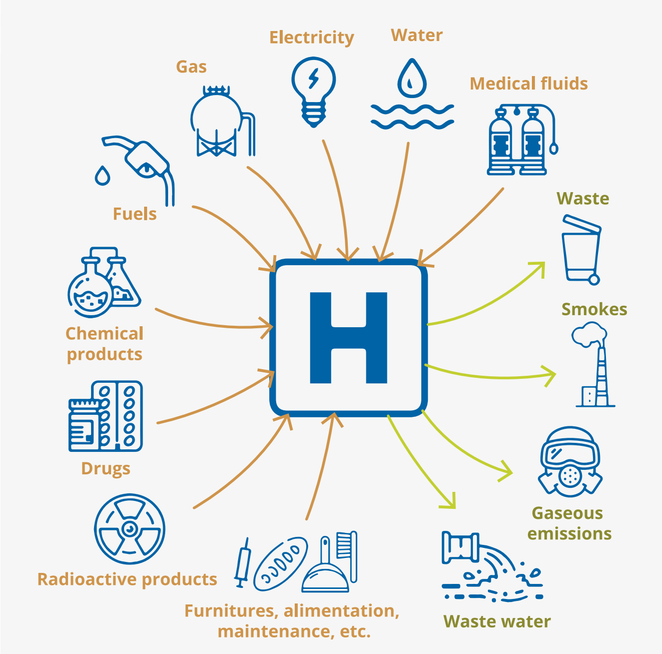
A reminder of the environmental, social and societal challenges facing dialysis centres

The healthcare system at the heart of environmental issues

The fight against climate change is a major international challenge requiring the rapid transformation of our society to limit its devastating impacts, as highlighted in the latest IPCC (Intergovernmental Panel on Climate Change) report published in March 2023.

Care activities, which are essential for all citizens, have a major impact on the environment, which is still not sufficiently taken into account today. The healthcare system is at the centre of numerous flows with significant contribution to GHG emissions, air and water pollution, consumption of natural resources, waste production and so on.

The healthcare sector is at the forefront of the response to climate change because of its significant contribution to resource consumption and associated GHG emissions, which contribute to climate and biodiversity degradation, and to the impact of climate change on human health.



All the flows shown in Figure 1 are responsible for GHG emissions estimated at over 2 billion tonnes of CO2e (2 GtCO2e), or nearly 4.4% of the global total. The European Union is responsible for 12% of these emissions, with around 250 million tonnes of CO2e, with some countries emitting more than others, such as France, which emits almost 49 million tonnes[1,2].

Figure 1: Flows linked to health and social care establishments

Source: Sector guide for health and medico-social establishments – ADEME

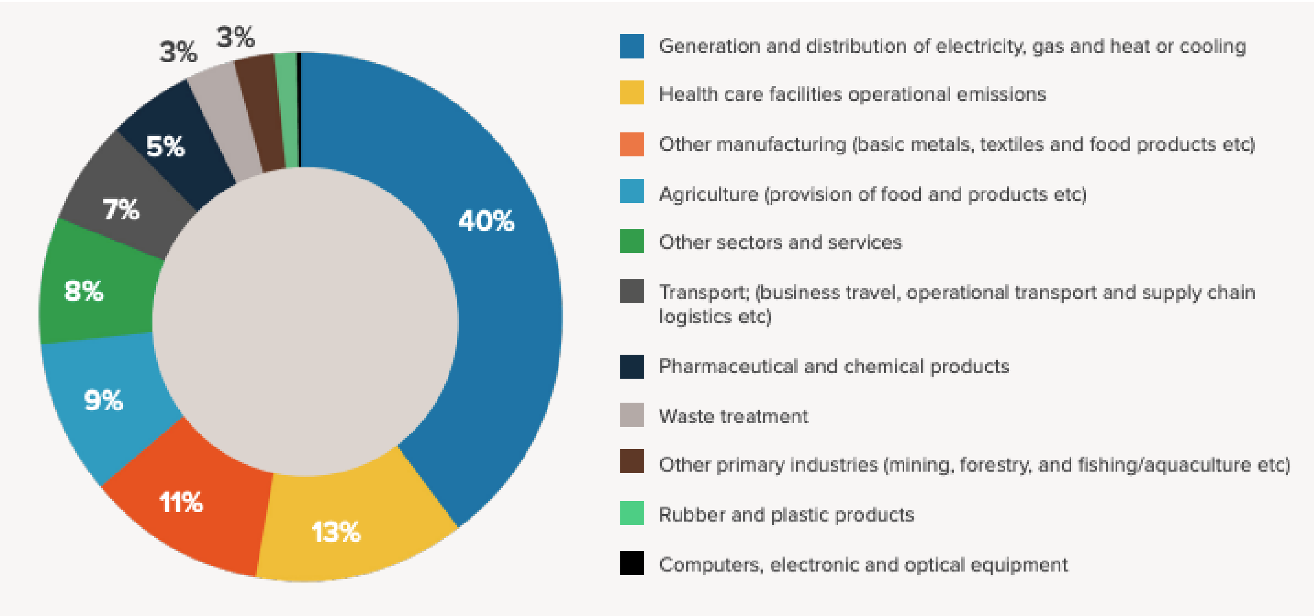


Figure 2: Breakdown of total GHG emissions in the healthcare sector by type of production

Source: Health Care's climate footprint 2029

In addition, climate disruption affects human health through both direct threats, associated with rising temperatures and extreme climatic events (worsening floods and droughts), and indirect threats, such as deteriorating air quality, dwindling water resources, lowering agricultural productivity and changing the epidemiology of many infectious diseases[3]. **Environmental degradation is now considered a major health issue, responsible for a significant number of deaths and chronic illnesses worldwide (23% and 25% respectively, according to the WHO[4]).**

The increased risk of acute or chronic renal failure is one of the consequences of climate change, as illustrated on the Figure 3. Moreover, patients suffering from chronic kidney disease are more vulnerable to the threats of climate change, as they are often elderly and have multiple co-morbidities, notably cardiovascular.

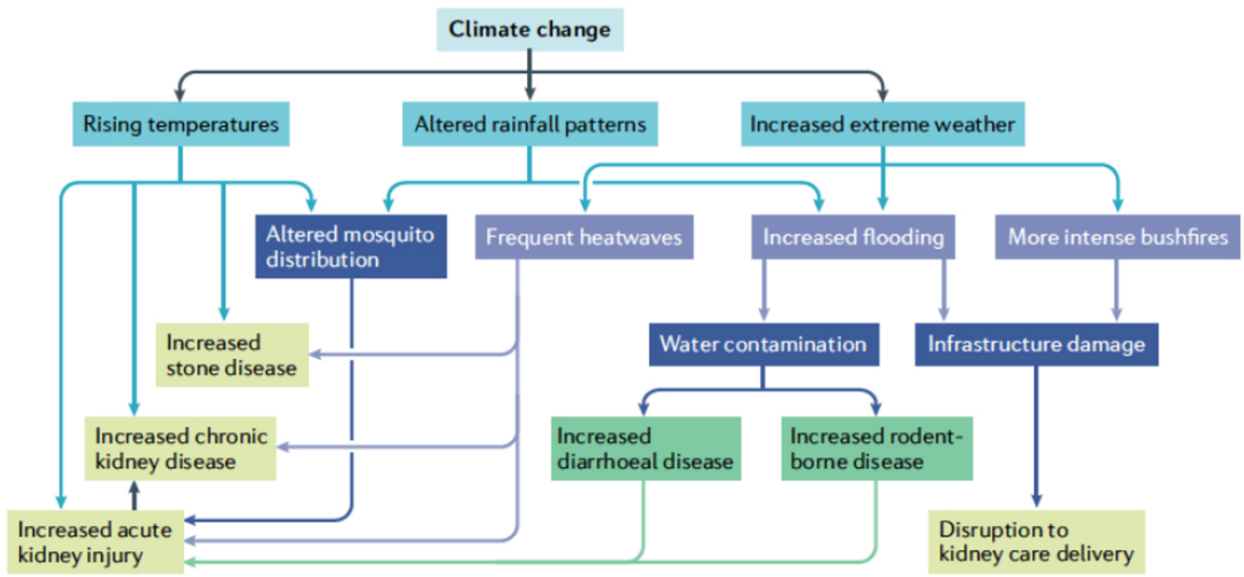


Figure 3: Impact of climate change on kidney disease[5]

The healthcare sector is at the heart of a vicious circle: environmental degradation seriously jeopardises the health of populations and the healthcare system as a whole, and its ability to prevent and treat, which in turn generates a significant ecological impact.

The healthcare sector, like all others, must therefore adopt a low-carbon strategy to reduce its impact on climate and biodiversity degradation, and limit its contribution to the deterioration of public health[6]. **The healthcare system plays a central role in ecological transition, and the implementation of concrete measures in the health and medical-social sector is a powerful lever for creating the convergence needed to achieve environmental and public health objectives.** The rise in global temperature, which the Paris Agreement's experts predict will increase by 1.5°C, means that our response is urgent.

Hemodialysis: a treatment with a significant environmental impact

According to a 2022 study, **843.6 million patients worldwide suffer from chronic kidney disease, including 100 million in Europe**[7,8]. Around 3.4 million people worldwide receive dialysis treatment, including 2,991,000 on hemodialysis, the most widely used treatment method.

In Europe, around 330,000 people undergo hemodialysis treatment every year.
This process is associated with high consumption of resources such as water and electricity, and generates large quantities of waste.

	Hemodialysis impact (Europe)	Hemodialysis impact (World)	Comparison with European households
Energy consumption	Between 1,500 and 4,500 kWh/year/patient[9] **825 million kWh/year**	Around 5 billion kWh/year	3,700 kWh/year/household
Water consumption	500 litres/session/ patient equivalent to 78m³/patient/year[10] **25.7 million of m³/year**	Around 265 million of m³/year	45 m³/inhabitant/year
Waste generation	Between 1,7 to 2,5 kg/ session/patient (based on French data) [11,12] **256 to 390 kg/year/ patient**	Around 600 000 tonnes / year	438 kg/inhabitant/year

Table 1: Key figures for hemodialysis environmental impact worldwide and in Europe

Limiting GHG emissions linked to dialysis is therefore a major challenge for the healthcare sector, requiring a review of current practices and the deployment of new ways of doing things in order to move towards an "eco-responsible dialysis" approach.

PART 2
Good practices

Carrying out a greenhouse gas assessment

Definition and benefits of greenhouse gas assessments

A Greenhouse Gas (GHG) emission balance is an evaluation of the quantity of greenhouse gases emitted (or captured) into the atmosphere over one year by the activities of an organisation or territory.
This type of assessment makes it possible to identify the main emission sources and to prioritise the reduction of these emissions.

Two types of emissions are considered in a GHG balance :

Direct GHG emissions, directly generated by an entity on its site: fossil fuel combustion by a machine, chemical reactions, transformation managed by entity itself, etc.

Indirect GHG emissions, which may be linked to the production of energy consumed, the transportation of products and people, raw materials purchased upstream, and products sold downstream.

Results are expressed in tonnes of carbon dioxide equivalent (tCO2e).

These GHG emissions are commonly classified according to 3 "scopes" (or perimeters) as described in the **figure 4 (classification of GHG emissions)**, indirect emissions linked to the production of the energy consumed to **scope 2**, and other indirect emissions linked to the value chain (employee travel, purchase of raw materials or services, sub-contracted transport, waste management, product end-of-life, etc.) to **scope 3**.

The current nomenclature no longer refers to "scopes". The Bilan Carbone® itself should be replaced by the Life Cycle Assessment (LCA). Life cycle assessment is the most advanced tool for global, multi-criteria evaluation of environmental impact. This standardised method (international standardisation ISO 14040 to 14043) goes beyond the Bilan Carbone®, which only measures GHG emissions, and measures the quantifiable effects of products or services on the environment.

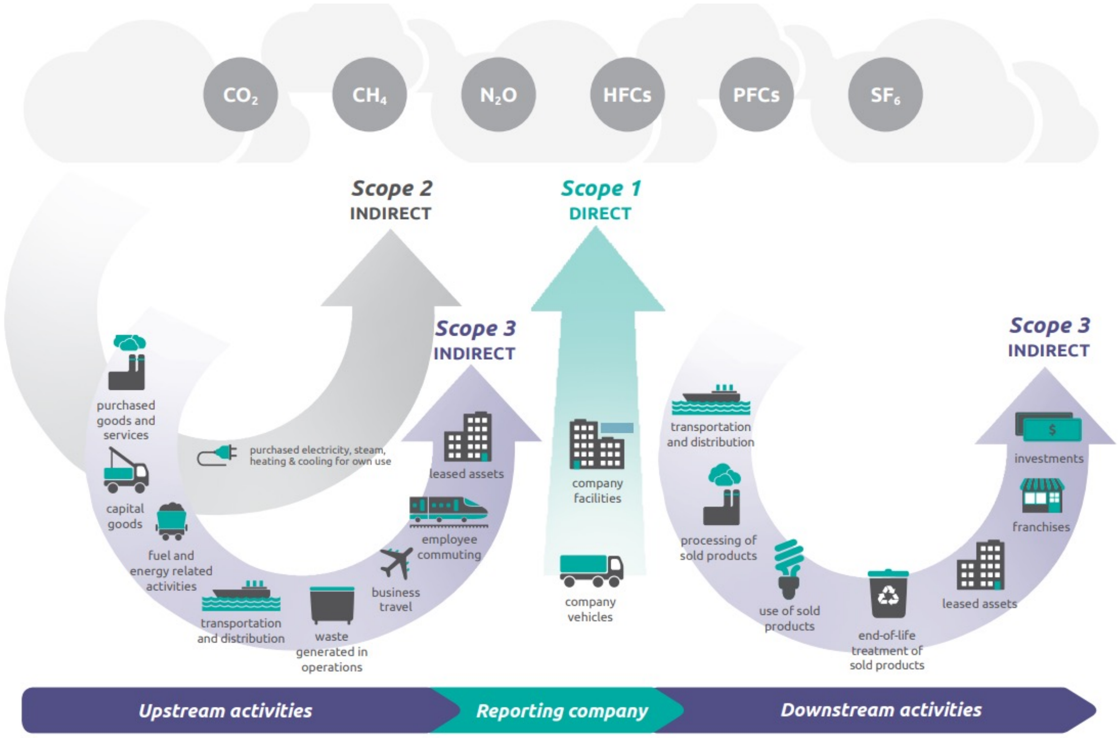


Figure 4: Classification of GHG emissions

According to a study by an international NGO, Health Care Without Harm, **75% of emissions from the healthcare sector in Europe are linked to Scope 3[1].**

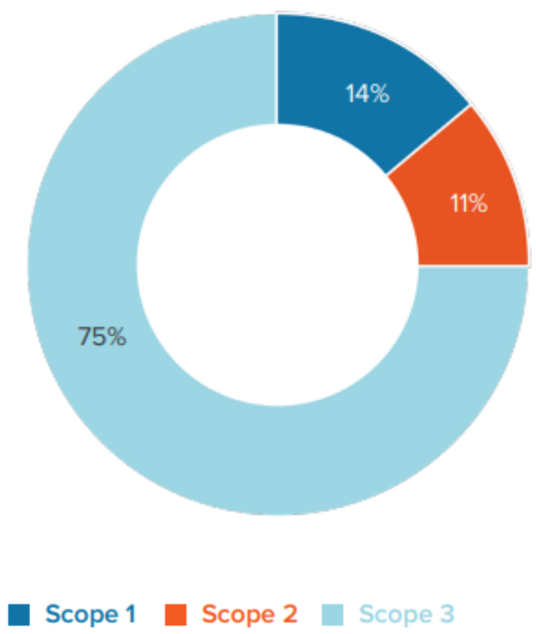


Figure 5: Breakdown of European healthcare sector emissions based on the 3 scopes (MtCO2eq)

The Bilan Carbone® method (registered trademark of the Association pour la Transition Bas Carbone, since the "Agence De l'Environnement et de la Maîtrise de l'Énergie" (ADEME) transferred the rights to it) is an approach (among several others, such as the GHG protocol) to GHG emissions assessment, which records the GHG emissions of all an organisation's activities by identifying its significant emissions items in order to initiate reduction action plans, as part of a continuous improvement process. To calculate GHGs, it is necessary to convert activity data into GHG emissions: this is done through the use of emission factors. They therefore correspond to the average emission rate for a specific activity in a given situation. However, these emission factors have certain limitations due to the representativeness of the emission factor (depending on the techniques used, geographical locations, time frames, samples used, etc.) and therefore of the categorisation of activities and associated methodological simplifications.

Methodological points: different approaches to a GHG assessment

In recent years, a number of studies have focused on this subject, and have led to modelling energy and the ecological footprint of hemodialysis.
Five studies reporting GHG balance results for dialysis centres are presented in the table below.

Reference	Country, year	Characteristics of the structure	Patient emissions/ year	3 main emissions and % of total
Connor et al.[13]	**England, 2008**	Dialysis unit at Dorset Hospital. 225 HD (Hemodialysis) patients and 54 PD patients	7.1 tCO2e	Purchases of goods and services: 46.7 % Patient and staff transport: 25.8 % Electricity and heating: 14.2 %
Lim et al.[14]	**Australia, 2011**	Dialysis unit in suburban Victoria. 12 HD patients (3 sessions of 4h/week)	10.2 tCO2e	Consumables, medical devices: 59 % Electricity and heating: 18.6 % Patient and staff transport: 8.8 %
Mtioui et al.[15]	**Morocco, 2019**	Dialysis unit at Casablanca University Hospital 80 HD patients (3 sessions of 4h/week)	5.1 tCO2e	Electricity: 28 % Purchases of goods and services: 27 % Patient and staff transport: 22 %
Segfal et al.[16]	**United States, 2020**	15 centres in Ohio 13,965 HD sessions per centre 3.8h on average per session	8.6 tCO2e	Electricity and natural gas: 42.6 % Patient and staff transport: 28.3 % Waste management: 17.6 %
Hafsah Hachad (oral communication SFNDT)	**France, 2022**	ARTIC42 Charles de Gaulle dialysis centre 162 patients 25270 sessions (heavy centre 89%)	8.9 tCO2e	Purchases of goods and services: 30 % Patient and staff transport: 25 % Fixed assets: 21 %

Table 2: Comparison of studies assessing the carbon footprint of hemodialysis HD: Hemodialysis; PD: Peritoneal dialysis

PART 2 - Good practices

These studies highlight the impact of hemodialysis on GHG emissions, with three emission items emerging as the most significant: the purchase of goods and services (consumables and medicines), patient and staff transport, and energy consumption (electricity and heating). The North American study highlights the great variability in GHG balances between dialysis centres, even when they belong to the same geographical area, suggesting that each centre needs to undertake its own assessment.

Conduct a GHG assessment through capitalisation of available data

Several dialysis centres have already carried out GHG assessments, and the data is available in the literature. It is possible to capitalise on the results obtained in order to quickly identify the most significant emission sources (see Table 2) and implement concrete measures. This would enable the rapid deployment of an action plan at facility. However, several limitations relating to the data currently available in the literature must be taken into account: the data is old (2 of the 5 reference articles are almost 10 years old), reducing the validity of these studies. Medical practices evolve significantly over time, and the industrial processes used to produce consumables change[17] . In addition, differences in practices between countries (energy sources, for example), and between different centres in the same country, limit the use of this data as references for the GHG assessment of a dialysis centre.

Conduct an In-house GHG assessment

To carry out its GHG assessment internally, a facility can:

- **Enter into a partnership with a university or engineering school:** in this case, students, supervised by trained teachers, will be tasked with carrying out the facility's GHG balance.
- Use **standardised "turnkey" tools that perform calculations online.** However, these tools rarely take into account scope 3, which is associated with the majority of emissions in the healthcare sector. It is also necessary to receive a minimum of training on the emission scopes.
- The European Commission proposes the **Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF) methods as a common way of measuring environmental performance** (European Commission recommendation 2021/2279). PEF and OEF are the life cycle assessment (LCA) methods recommended by the EU for quantifying the environmental impacts of products (goods or services) and organisations[18].
- The Carbon Disclosure Project (CDP) has developed the **Sectoral Decarbonisation Approach**, a scientific method enabling companies to set GHG emissions reduction targets. Global Green and Healthy Hospitals have developed Climate Impact Checkup, a calculator that helps healthcare facilities around the world measure their GHG footprint[19].
- **The Sustainable Healthcare Coalition has launched a new resource designed to assist in-centre hemodialysis services (ICHDs) in assessing their carbon footprint** and identifying where their reduction efforts can be focused. The ICHD Carbon Calculator was developed in association Newcastle upon Tyne NHS Foundation Trust.

For this reason, it makes more sense for an establishment to carry out its own GHG assessment if it has the necessary resources and capabilities.

The ARTIC42 (Association Régionale pour le Traitement de l'Insuffisance rénale Chronique, Loire) carried out its in-house GHG assessment in March 2022. ARTIC42 used the Bilan Carbone® approach developed by ADEME and the Association Bilan Carbone® (ABC), adapted to the specificities of the sector thanks to a collaboration between a nephrologist and a SHIFT PROJECT engineer. Data collect was carried out by students from ECAM La Salle LYON.

The study began in October 2021 and was completed in March 2022. The data analysis concerned activity during 2021 at the Centre Charles De Gaulle of the ARTIC42 association, located in the commune of Saint-Priest en Jarez and providing hemodialysis activity distributed over 48 heavy centre stations and 8 training stations (In 2021: 162 patients, 25,270 hemodialysis sessions. Heavy centre: 89% of activity)

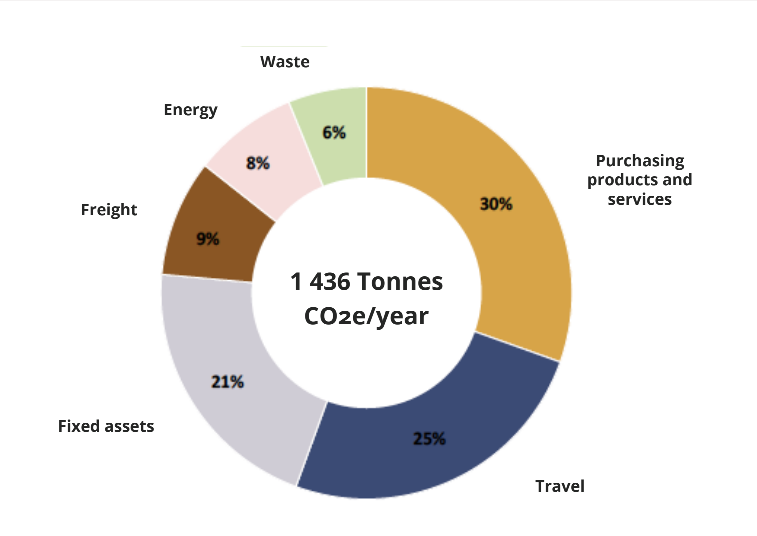


Figure 6: GHG emissions (in Tonnes CO2e/year) by emission category within ARTIC42

These results confirm the high carbon impact associated with in-centre hemodialysis, with an initial estimate of GHG emissions of 8.9 tCO2e/patient/year, or 57kg CO2e/session. By comparison, the average carbon footprint of a French person is 9tCO2/year[20].

Emissions are mainly indirect. The main sources of emissions are: purchases of products and services (30%), patient and professional travel (25%), fixed assets (21%). Energy consumption (particularly electricity) and waste treatment account for a relatively small proportion of emissions (14%).

These results, combined with those of the international literature (Table 2), show that **energy consumption is the most variable emission item, accounting for between 8% and 42% of GHG assessments carried out in dialysis centres.** Differences in the electricity mix, defined as the distribution of energy sources used in a country's power generation, explain the divergence observed in the results of the French study. Indeed, electricity generation in France is dominated by low-carbon sources, which account for over nine-tenths of production (mainly nuclear and hydropower).

The completion of this GHG assessment will enable ARTIC42 to set up road maps for priority measures to reduce the most significant emissions sources.

Carry out an assessment with a specialised service provider

Several service provider firms offer support in carrying out a GHG assessment. Using a service provider can be advantageous for a company, as the human investment is lower and the time required to calculate it is generally shorter. However, this method is nevertheless more expensive than carrying out an in-house GHG assessment.

FOCUS:

EUROPEAN GHG REGULATIONS APPLIED TO HEALTHCARE FACILITIES

On a global scale, the Kyoto Protocol has become the starting point for controlling GHG emissions. This international agreement, which came into force in 2005 and was originally due to expire in 2012, has given impetus to a number of standards, good practices and regulations concerning the GHG emissions assessment.

European Directive on the publication of non-financial information 2014/95/EU, adopted in October 2014, introduces new rules on the publication of CSR information by companies that exceed certain thresholds. The directive requires all companies with more than 500 employees to declare, in a non-financial report, the impact of their activities on environmental issues especially. This report must include a description of the policies implemented to address these issues, and indicators to monitor the results of these policies. All member states had to transpose this directive into national law by 1st January 2017.

The Sustainability Reporting Directive (SRD), European Directive (EU) 2022/2464, will hold companies more accountable by forcing them to make public the impact of their actions on people and the planet. It is part of the European Green Deal and the goal for carbon neutrality by 2050. This directive, which will gradually come into force from 1st January 2024, will strengthen companies' reporting obligations with regard to their social and environmental risks and impacts. Companies will be required to meet 13 reporting requirements specific to climate change, including the integration of GHG emissions reduction into company policy. The reports to be supplied will be based on new, harmonised European norms. This directive will also extend the scope of reporting to a larger number of companies, since a timetable has been set to reach listed SMEs by 2028.

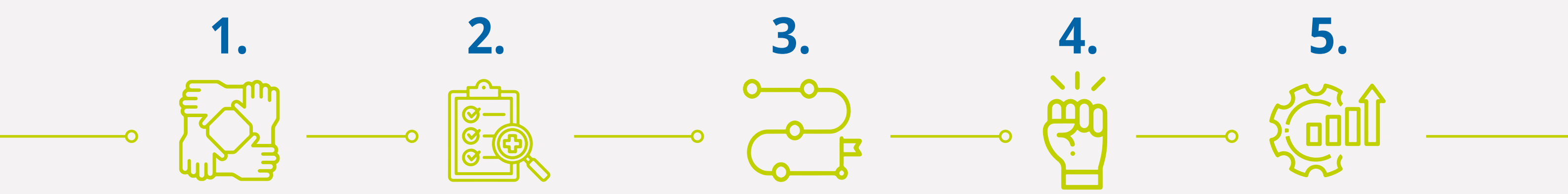
The Duty of Vigilance Act is to require all large companies (500 employees and more and a turnover of at least €150 million) to prevent human rights violations and environmental damage throughout their value chain. This directive provides for the reporting of all environmental incidents and the implementation of risk mitigation measures. It also provides for the implementation of vigilance measures and the monitoring of their effectiveness (the directive is in the process of being adopted and should be voted on in 2023).

Draw up a Sustainable Development (SD) or a CSR strategy

CSR strategy – definition

Corporate Social Responsibility (CSR) is defined by the European Commission **as the voluntary integration by stakeholders of social and environmental concerns into their activities and their relations with the relevant parties**[21]. It can be considered as the establishments' contribution to the challenges of sustainable development. It refers to either a CSR strategy or a Sustainable Development (SD) strategy.

This CSR or SD strategy must be integrated into the company's overall strategy, so that the two do not exist independently of each other. To facilitate the implementation of a CSR or SD strategy in a company, we recommend a 5-step process.



1. Company commitment: commitment of management and staff

Over and above legal requirements, **embarking on an SD strategy requires strong commitment and involvement on the part of management, whose support legitimises the approach** and who alone can decide on financial investments, for example.

Without this commitment, and without a real conviction of the environmental, social and economic benefits of such a strategy, it could be relegated to the background at each issue or difficulty. Indeed, even if the strategy is sometimes costly to put in place and mobilises some of the staff, it responds to a growing awareness in society of new ways of managing and consuming.

Depending on the size of the company, **it is advisable to appoint a contact person to coordinate services and monitor the strategy in support of management**. This is a project management role that enables each department manager to set objectives, propose measures and deploy the strategy within his or her teams.

Each company chooses its own work organisation according to its own specific characteristics. **Thematic working groups, preferably multi-professional, could be set up**, for example, led by the reference person, setting objectives and meeting regularly to report on the progress of project results.

A system for escalating proposals from staff to management can also be organised in various forms (cards, a board in the staff room, a notebook, etc.). Information meetings to keep all staff informed of measures taken can be organised to increase staff motivation and commitment.

Members of working groups can go further by acting as ambassadors, embodying the approach and encouraging their colleagues to join through their communication. Patients must also benefit from this communication on sustainable development measures, and it is even desirable for them to be represented in working groups.

Validation by the "authorities", management, the infection control committee, etc. - can only reinforce the legitimacy of the working groups' actions. The success and long-term viability of such a sustainable development strategy depend to a large extent on the establishment of dialogue between management, doctors and staff, whether or not the response to suggestions is positive.

Build on internal resources as a source of ideas to enrich practices is a rewarding and unifying practice. The ecological approach must be a strong and constant one. All the facility's projects must be seen from a sustainable development perspective. This commitment can make a position as a doctor, nurse, technician, etc. more attractive. External communication, beyond the department or the establishment, is also an element to be implemented.

ZOOM:

FEEDBACK

At ARTIC42, the "Sustainable Development Commission" is made up of 16 **multidisciplinary professionals**. There are 2 managers (a doctor and a medico-technical executive) who work closely with the director and the chairman of the association. The team also includes professionals from the field: a health care manager, nurses, care assistants, the building maintenance department, a pharmacist, and a dietician. As a result, all professionals working in the field are able to share their views and comments to the designated contact person, who in return communicates them to the managers during regular working sessions. By the same token, the decisions taken, and the objectives set by the committee are passed on to the field through their intermediary, making for greater efficiency.

Special days are organised to inform staff and patients about the various projects undertaken and, above all, the results obtained.

2. Diagnosis of initial state

Diagnosis enables to assess the initial situation of the facility, in order to identify its strengths and areas for improvement. **There are several ways to carry out a CSR diagnosis:**

1. Build on CSR labels that offer self-assessment questionnaires (Responsibility Europe, SGI Europe, etc.).
2. Call on specialised structures that can help carry out a diagnosis appropriate to your challenges and activities.

If possible, third-party diagnosis will ensure objectivity. They can visit your premises and interview some of your internal stakeholders (management, staff from several departments, patients) to confirm and visualise the measures already in place or not. They can also complete the diagnosis by interviewing external stakeholders (suppliers, local authorities, purchasing groups, associations, etc.) to obtain a broader view of your impact and the associated issues in your area.

An example of the grid used to diagnose a facility is provided in the appendix.

3. Drawing up an action plan and road maps

Based on the data collected during the initial diagnosis, the person in charge, the management and all those involved in the process draw up the action plan to be implemented. As not all subjects can be conducted simultaneously, **it is necessary to prioritise 3 to 5 main projects over the year, depending on available resources** (human and financial).

The establishment can select priority issues according to its materiality, i.e., the issues that characterise its activity. **For dialysis, these include energy, water and waste issues (in relation to the choice of dialysis modalities) from an environmental point of view, as well as issues relating to patient well-being and staff involvement in the facility's social and community projects.**

It is also a good idea to prioritise quick and easy measures that enable to achieve objectives almost instantaneously, a source of motivation and satisfaction for teams.

Management must also validate the annual expenditure budget it wishes to have available in order to carry out the year's various projects.

The action plan is made up of road maps, at least for each priority area, which define: concrete measures, the associated timetable, the financial and human resources committed, and the objectives targeted. These road maps enable to track progress over time, and serve as a steering tool for management.

4. Deployment of measures and motivating teams

The implementation of the action program is supervised and coordinated by the person in charge of the SD strategy. Depending on the size of the facility, each department manager or employee manages measures related to their own activities, in line with the SD strategy.

At the same time, **raising the awareness of all staff (nursing and non-healthcare) is essential to ensure the successful deployment of the approach.** Staff commitment ensure the expected results are achieved and make the environmental approach a long-term and integral part of the company's project.

This approach creates a virtuous dynamic, since the successful completion of an action usually results in a feeling of satisfaction that will motivate teams to continue their commitment.

All the measures implemented will also serve to raise awareness among patients, suppliers and other stakeholders, and thus encourage the emergence of environmentally virtuous behaviour in the overall dialysis ecosystem.

5. Tracking key indicators

The aim of this final stage is to **ensure that measures are properly implemented, and to quantify their economic and environmental benefits**. Tracking key indicators will then need to be defined in order to monitor the progress of measures and enhance the value of the company's commitments.

These indicators can be coupled with any targets the facility may have set itself (waste reduction or water consumption targets, employee buy-in targets, etc.).

Examples of key indicators:

- Measuring energy, water and detergent/ disinfectant consumption
- Waste tracking (HW, NHW, recyclables, etc.)
- Measuring patient satisfaction through a survey

PART 3
Decisive measures

You will find below the different themes covered, with a general introduction for each theme, followed by measures to implement within your organisation.

Measures to reduce water consumption

The depletion of our water resources is becoming a threat to the well-being of the entire population, and the use of water for healthcare contributes significantly to the depletion of this resource.

Hemodialysis is one of the most water-intensive medical practices[22].

In Australia, it has been calculated that the reuse of water discharged by dialysis reverse osmosis could cover 2% of the water consumed by hospitals.

A very large volume of water is required to manufacture ultra-pure dialysate, as defined by the pharmacopoeia. The dialysate is prepared in the centres, following a rigorously defined pre-treatment process comprising successive stages leading to demineralised water. Reverse osmosis is a crucial stage in the treatment process, as it retains the ions naturally

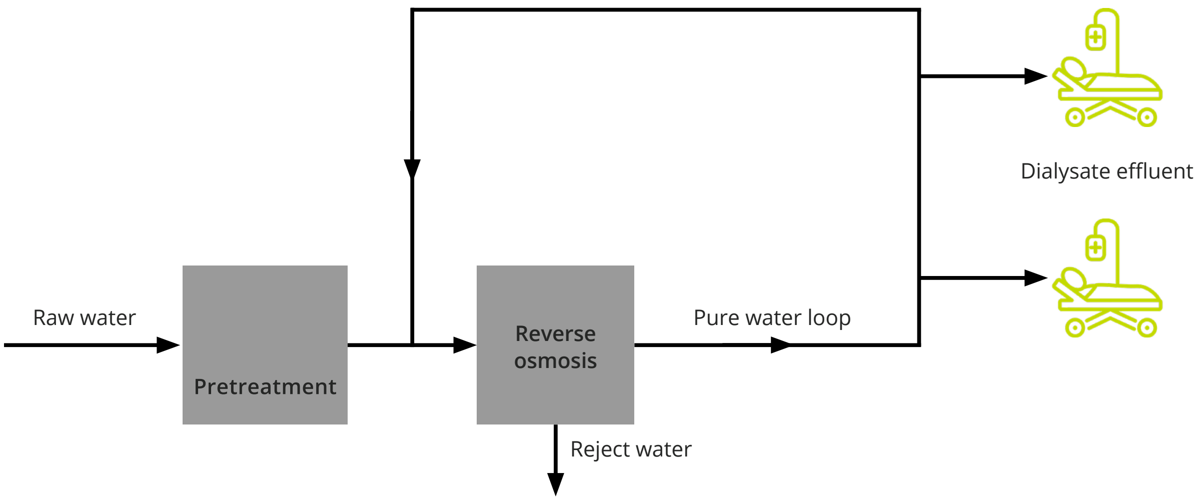


Figure 7: Design of a dialysis water treatment system[24].

present in tap water and those produced by the resins, through a membrane with very low permeability. **A significant volume of water is discharged directly into the sewer using this technique, which can vary from 30% to 50% of the volume consumed, depending on the age of the installation, depending on the centre (and the use of a simple osmosis/ bi-osmosis principle)**.

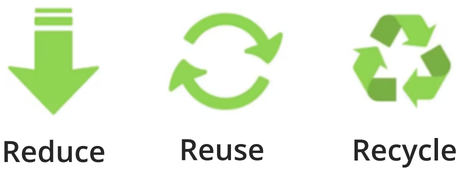
The dialysate, containing electrolytes at a concentration close to that of plasma, will be used to purify the patient's blood through exchanges via a semi-permeable membrane. **This dialysate circulates in an open loop. Once loaded with substances capable of diffusing through the membrane (uremic toxins, small and medium-sized molecules, drugs, etc.), it is also discharged into the sewer.**

New strategies to limit water consumption during dialysis treatments and promote water reuse need to be implemented in every dialysis centre.

However, before embarking on any potentially costly work, a "water audit" should be carried out, taking into account the expected benefit (the volume of water that can be recovered, depending on the size of the dialysis unit, among other factors), the possible uses and the cost of the installation to limit water consumption during dialysis treatments and promote water reuse should be implemented in every dialysis centre.

We recommend reading the Australian "Handbook for Reusing or Recycling Reverse Osmosis Reject Water from Haemodialysis in Healthcare Facilities".

Seven levels of potential water savings have been identified, and are reflected in the measures proposed below. **The underlying principles are to reduce, reuse and recycle.**



Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Cross-functional measures	
Install **dual flush toilets**.	
Install **automatic sensors** on water taps or water aerators.	
Collect rainwater to water outdoor planting.	
Tracking your consumption	
Install sub-meters to identify water consumption for dialysis and report the data per dialysis session.	
Consider **installing meters on the water pre-treatment section** in order to optimise water consumption at this stage of the process.	
Renewing water treatment utilities and optimising their maintenance	
Minimise any injection of disinfectant, permanent or temporary chlorination, or periodic disinfection of the device followed by rinsing with water, as this water is lost.	
Renewing water treatment plants.	
Optimise regeneration frequencies for softeners, activated carbon, sand filters, night-time thermal disinfection and flushes, so that these actions are only carried out when necessary.	

Limiting water loss through reverse osmosis

Optimising the conversion rate of osmosis units

The conversion rate of osmosis units can be improved by limiting the osmosis unit's discharge flow rate. Two solutions are used to limit the discharge rate:

1 - Re-injection of part of the effluent at the osmosis inlet. The flow of recycled waste is modulated by an automatically controlled motorised valve.
2 - Re-injection of osmosis water not used by the dialysis machines at the osmosis inlet.
The quality of the feed water to the osmosis unit is thus improved by injecting unused osmosis water. The volume of unused osmosis water varies according to the number of generators in operation. It is therefore necessary to modulate the discharge flow rate, either according to the flow rate of unused reverse osmosis water re-injected, or by measuring the conductivity (or resistivity) of the water at the osmosis membrane inlet and/or at the discharge level.

Changing your water treatment system for new water-saving equipment. The back-flow preventer must be kept in perfect condition to prevent loss of water to the sewer. The sand filter, softeners and any activated carbon must be perfectly calibrated to optimise its washing cycles and the flow of washing water discharged to the sewer.

Reduce dialysate flow

Modify the flow rate of the dialysate administered to reduce the consumption of water, acid concentrate and bicarbonate[23].

Reusing waste water

Reuse the water discharged by reverse osmosis, which has a moderate salinity (from 1.5 to 3 g/l max) to supply sanitary facilities, rehabilitation pools in hospitals, laundry, watering of green spaces, local agriculture, etc. It should be noted that, depending on the intended use, it may be necessary to treat or dilute this water to reduce salinity and comply with standards and recommendations[24].

Reuse of rejected dialysate

A few litres of water may be enough for a haemodialysis session using this technique, as experience with the REDY® has shown (6 litres per dialysis, 21 years of use, 6 million sessions, abandoned due to aluminium poisoning caused by the cartridge).
The process involves regenerating the dialysate by filtering it through a sorbent cartridge . This method purifies the dialysate by adsorption, absorption and ion exchange. Its disadvantages are the elimination of certain ions, calcium, magnesium and potassium, and the increase in sodium ion concentration due to ion exchange between zirconium oxide and zirconium carbonate. This method is currently being used in the WAK (Wearable Artificial Kidney). New machines based on this principle are currently being evaluated[25].

Reuse rejected dialysate, particularly for agriculture, after dilution **or electrodialysis. Further research is required before it is ready to use.** This practice is not currently recommended. Rejected dialysate is a high-risk source of water since it is potentially contaminated with infectious substances and toxic products, even if electrodialysis is able to eliminate certain components[26].

Table 3: List of measures for optimising water consumption. The measures indicated by a magnifying glass ( ) are described in detail in a focus sheet.

FOCUS SHEET N°01

Renewing water treatment plants

OBJECTIVE OF THE MEASURE:

The objective of this measure is to modernise the water treatment equipment in the dialysis centres to use machines that consume less water.

Significant progressess have to be made to renew the osmosis units used. For example, in France a survey has been conducted by the SFNDT's Green Nephrology group in 2021 (in which 68 out of 300 dialysis centres in France responded) showing that **33% of units have water treatment plants that are more than 15 years old, with poor environmental performance.** These outdated plants generally have a chemical disinfection system, which could add to the environmental risk, however, a comparison with steam disinfection has never been made from this perspective.

DETAIL OF THE MEASURE:

An improvement in reverse osmosis systems (switch to bi-osmosis systems, with an internal water recirculation system, i.e. part of what was discharged is recovered and re-injected into circulation) means less water is wasted during the reverse osmosis process. A study to assess changes in environmental data in NephroCare centres in France[27] showed a **significant drop in the amount of water consumed per session** over a 13-year period (between 2005 and 2018) **from 800 to 382 litres/session** following the renewal of osmosis units.

The significance, in terms of water savings, gained by renewing water treatment machines was also tested by ARTIC 42, which recorded water consumption in its 9 different departments following the adoption of new equipment: **the average volume recorded fell from 699 L/dialysis session in 2009 to 397L in 2021**. These records cover the volumes of water used for maintenance and upkeep of water treatment units (in particular for the regeneration of softeners, sand filters, activated carbons, loop flushing and night-time thermal disinfection of loops).

EASE AND TIME OF IMPLEMENTATION:

The main limitation to this measure is the financial investment required to implement it.

TRACKING INDICATORS:

Renewal rate for water treatment plants.
Change in water consumption (L/session) following renewal of machines.

HUMAN AND FINANCIAL RESOURCES REQUIRED:

Cost of the new osmosis unit.
Technician training.

EXPECTED SAVINGS:

Based on the results of the above experiments, water consumption is expected to fall by around 300 litres per session and per patient.

FOCUS SHEET N°02

Reusing reverse osmosis waste water

OBJECTIVE OF THE MEASURE:

Reverse osmosis waste water complies with all biochemical and bacteriological drinking water standards[28]. The Australian authorities also consider that the risk to human health associated with reverse osmosis discharges is extremely low. **The aim of this action is to limit water losses from reverse osmosis by means of a recycling system.**

DETAIL OF THE MEASURE:

The waste water from the osmosis unit can be used for a variety of purposes in the dialysis centre and other nearby facilities: sanitary facilities, showers, floor cleaning, watering of green areas, laundry, sterilisation system, swimming pool, etc. The water discharged has high levels of chlorides, nitrates and sulphates, but it is above all its salinity that limits its use without pre-treatment, for certain purposes and for pipes.

It has been suggested that it can be subjected to an electrodialysis process for certain uses, but today it is generally used without prior treatment (see Feedback)[29]. However, **it is compulsory to analyse the physico-chemical and bacteriological composition of the effluent to ensure the water's quality (See appendices for the list of physico-chemical analyses to be carried out).**

The installation of a system for reusing the water discharged by the osmosis equipment requires **the installation of a collection tank,** if possible buried so as to limit the degradation of the stored water by heat in summer and freezing in winter. Otherwise, it should be insulated or installed in a temperature-controlled room. In addition, these tanks should not be too large and should be adapted to the intended use. The risk comes from bacterial proliferation (including Legionnaire's disease) caused by stagnation, particularly as they fill up all day long. If the water is not used every day, we recommend chlorinating the discharges. The tank will also be fitted with an overflow drain. A pump should also be installed to pressurise the stored water. The distribution network for the recycled water should be identified and perfectly isolated from the drinking water network, and likewise, the drainage network for the reverse osmosis waste should be separate from that for the dialysate waste. Finally, it is important to be aware of the potential risks of scaling and corrosion depending on the quality of the tap water (high chlorite/sulphate concentration, for example).

EASE AND TIME OF IMPLEMENTATION:

The implementation of a reverse osmosis water recovery procedure should be preceded by an assessment of its benefits and costs. For example, according to the Australian "Handbook for Reusing or Recycling Reverse Osmosis Reject Water from Haemodialysis in Healthcare Facilities", recovering less than 2,000 litres of water per week without major work is cost-effective, whereas it is not if the work is substantial. The guide also points out that using water for everyday purposes is more interesting than only for seasonal uses such as watering plants. The point at which the water is used should not be too far from the source (< 100 metres).

TRACKING INDICATORS:

Recycled water volume (which can be monitored using a volumetric metering device).
Water consumption per dialysis session.

HUMAN AND FINANCIAL RESOURCES REQUIRED:

A water audit is necessary to assess the balance between the expected water savings and the reuse projects.
Architectural and technical feasibility study.
Additional costs to be estimated to assess return on investment.

EXPECTED SAVINGS:

According to the French Environment and Energy Management Agency (ADEME), the carbon footprint of drinking water production is 132 gCO2e/m³. Multiplying this figure by the volume of water recycled will reveal the amount of greenhouse gases (GHG) reduced[30].
The volume of recycled water recorded by the metering system multiplied by the price per m³ of water will be used to calculate the financial saving obtained.

FOCUS SHEET N°03

Reduce dialysate flow rate during treatment

OBJECTIVE OF THE MEASURE:

During dialysis treatment, the dialysate flow rate is not necessarily optimised to meet the patient's needs.
The aim of this measure is to modify the flow rate of the dialysate administered in order to reduce the water, acid and bicarbonate consumption[31].

DETAIL OF THE MEASURE:

The standard flow rate is 500mL/min, which can be optimised to reduce water consumption.

EASE AND TIME OF IMPLEMENTATION:

Simple

TRACKING INDICATORS:

Water consumption.
Published experiments have not shown a reduction in water treatment quality in the short term, and there is a lack of long-term evidence. The impact on Kt/Vurea and Beta2-microglobulin in each patient must be monitored on a long-term basis.

HUMAN AND FINANCIAL RESOURCES REQUIRED:

None

EXPECTED SAVINGS:

Reduced water, acid concentrate and bicarbonate consumption.

Feedback		
Structure	**Measure implemented**	**Advantages**
Clinique de saint Exupéry France - Toulouse 2015	Installation of a 3 m3 buffer tank that recovers some of the reject water from reverse osmosis, placed under the water treatment system (with an overflow that discharges into the sewer), which is fed by a lift pump to a tank located at the top of the building, which in turn redistributes this grey water for 4 uses. This grey water network is made of PVC, thus identified as "grey water". Water treatment by bi-osmosis is carried out, and the waste from the 2 osmoses is mixed.	**2000 L of water/h supplying 4 distribution points:** flushing toilets, watering green areas, washing windows and rinsing generator drains to prevent the formation of bio-film that could clog them. **In 10 months, 1128 m3 of water saving[32].**
Barwon Health Renal Services Australia - Geelong 2003-2004	Installation of a reverse osmosis water recycling system. In the main centre: Installation of two 36,000-litre tanks recovered from local manufacturers to supply: - Steam sterilisation system - Sanitary facilities - The water needed for floor cleaning - Green areas At a secondary centre: Installation of 2 tanks, with free access for schools, sports associations and communal green areas.	**~4.8 million L of water saving/year** The payback period was 30 months, yet the tanks were donated by local industry[33].

Centre in Malaysia 2018	Osmosis water recovery system for aquaculture, horticulture and hydroponics. **The water discharged by the reverse osmosis treatment unit is redirected and pumped into fish tanks.** The quantity of water discharged is estimated between 10,000 and 12,000 L/day. From there, **some of the water is channelled into the aquaponics system and some is used to water the horticultural crops twice a day.**	The fish and cultivated plants are given to the staff and patients. The number of fish is estimated at approximately 150-350 every 6 months, and the quantity of plants harvested is approximately 4-8kg per month, depending on the culture, the weather and the season. The overall cost required to construct these installations and the purchase of all the equipment was approximately €2000. Annual expenses (purchase of fish seed, fish pallets, maintenance, electricity) are estimated at €400. **The estimated saving in terms of recycled water is €550 per year[34].**
Ashford & St Peter's Hospital NHS Trust UK - London 2007	**Integration of a simple water recycling system:** the recovered waste water is channelled to a recovery tank and is **pumped into a grey water tank for use in the laundry.** Float switches divert discharge water to the drain if the grey water tank is full, and bypass valves direct discharge water directly to the drain from the reverse osmosis system during monthly chemical disinfection.	**Saving of 750kg CO2e/year** **€9,735/year** **4492 million litres of water/year[35].**
Bradford Teaching Hospitals NHS Foundation Trust 2014	A systematic review of haemodialysis prescriptions was undertaken to **optimise and reduce water, acid and bicarbonate consumption,** using the automatic dialysate flow function available on "modern" water treatment machines. Prior to the implementation of this change, patients on dialysis machines were using a dialysate flow rate of 500 mL/min or 800 mL/min. The dialysate flow rate is now set at 1.5 times the blood flow rate.	**9% reduction in water, acid and bicarbonate consumption.** **1140 m3 of water/year savings** Reduction in the purchase of pharmaceutical products (€2,600 in savings on bicarbonate bags and €3,300 in savings on acid concentrate, i.e. a total of €9,917 per year), **corresponding to a reduction of 3,715 kg of CO2e per year[36].**

Table 4: Feedback on measures for reducing water consumption

Measures to reduce energy consumption

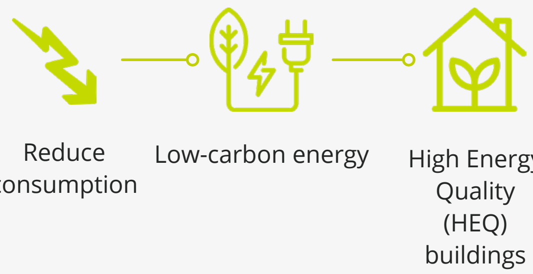
The energy consumption of the healthcare sector in Europe represents between 0.8 and 2.7% of the total European consumption, i.e. Between 130 and 439 TWh/year[37,38]. There are disparities between countries in terms of energy consumption as a proportion of GHG emissions. Indeed, France for example, has a lower share of energy consumption (<20%) than other countries such as the United States (42.6%) (see Table 2).

The Energy Efficiency Directive (EU) 2018/2002 establishes a common framework of measures to promote energy efficiency. The aim of this directive is to reduce energy consumption and achieve the EU's energy saving targets: a reduction of around 30% in energy consumption by 2030. Since the directive came into effect, large companies, including healthcare establishments, are required to carry out an energy audit to help them identify possibilities for reducing energy consumption.

Dialysis is an energy-intensive healthcare practice. The osmosis machine, haemodialysis generator and their disinfection, lighting, heating/air conditioning, televisions, computers and small equipment are all energy-consuming primary equipment.

There are many ways of reducing energy consumption, depending on whether it concerns the dialysis activity itself or the building. Certain measures regarding energy consumption monitoring and raising staff awareness are cross-functional.

The main principles underlying these actions are



Regulatory framework:

Directive on buildings energy performance (EU) 2018/844: **The 2030 Climate and Energy Action Framework sets out ambitious commitments at EU level to further reduce greenhouse gas emissions by at least 40% by 2030.** To achieve this, an annual average building renovation rate of 3% would be needed to meet the EU's energy efficiency ambitions in a cost-effective way. Each Member State must therefore establish a long-term renovation strategy to support the renovation of the domestic stock of residential and non-residential buildings, both public and private. As healthcare establishments occupy a large surface area, they are priority areas for improvement.

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Measures for monitoring energy consumption	
Set up **a dashboard to monitor consumption and the impact of reduction measures**. Draft monthly or quarterly energy consumption monitoring tables.	
Install **electricity sub-meters**, take regular readings and set up specific indicators by relating consumption to the dialysis session.	
Conduct **regular audits**.	
Measures for reducing buildings' energy consumption	
Raising awareness of eco-gestures by producing a guide for staff and patients. Put up reminder posters for simple actions (turn off the lights, the heating, close the blinds, etc.). Encourage energy-saving behaviour.	
Communicate information on the good practices to be applied (or already applied) and the associated performance indicators.	
Have all equipment, including boilers, serviced annually, to ensure compliance with standards for nitrogen oxide (NOx) content in combustion gases.	
For appliances using refrigerant gases or hydrofluorocarbons (air conditioners, refrigerators, etc.), **select gases with the lowest possible GWP (Global Warming Potential)**. Check with your technician that the gases are feasible and safe (toxicity, flammability, pressurisation, etc.). You will find the list of gases and their associated GWP in the appendices.	
Choose solar energy solutions (adjustable solar protection, thermal bridges, etc.). Building insulation is essential (loft insulation, external insulation, sunscreens, double-glazed windows, etc.).	
Using low-carbon energy sources. Opt for an electricity contact from your supplier that supports renewable energy development.	
Measures for reducing energy consumption related to dialysis	
Educating people about electronic devices (biomedical and IT): standby mode, charging, useless emails, useful storage, etc.	
Renewing dialysis machines to use machines that incorporate functions to optimise energy consumption, in particular via heat exchangers and an automatic dialysate flow function.	
Measures for reducing energy consumption in buildings – hygrothermal comfort	
Promote bio-air conditioning of buildings: air conditioning is achieved by making the most of the sun's rays and the natural circulation of air to reduce energy consumption.	

Recovery of heat and cold using dual-flow devices (to maximise the benefits of the exothermic dialysis process) such as preventive heat pumps, dialysate recycling or the use of heat exchangers to transfer heat from the dialysate effluent to the incoming fresh dialysate.
Specific temperature controls: temperature control and programming devices for each type of room.
Use solar panels in shaded parking areas (saves on air conditioning, and therefore fuel, and provides greater comfort for drivers in addition to producing electricity).
Provide night-time ventilation of premises (when very hot).
Measures for reducing energy consumption in buildings – lighting
Choose natural lighting with black-out blinds, screens.
Use LED lighting.
Install motion detectors and presence sensors with light timers and twilight switches.
Measures for reducing energy consumption in buildings – Site and construction
Choose organically sourced materials with low maintenance costs. Construction using wood is a good solution.
Establish a "Green construction" charter with companies.
Define works processes validated by public health experts for a site with low environmental impact.
For existing buildings, **massively expand comprehensive, high-performance thermal building renovations:** carry out energy performance diagnostics before renovations and prioritise renovation work.
Construct enclosures with possible future modifications in mind.

Table 5: List of measures to optimise energy consumption. The measures indicated by a magnifying glass ( ) are described in detail in a focus sheet.

FOCUS SHEET N°04

Constructing a passive dialysis centre (case study of the François Berthoux Centre)

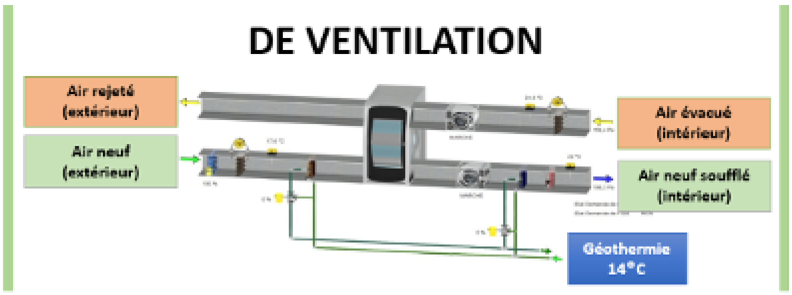
OBJECTIVE OF THE MEASURE:

The concept of the "passive house" is a sustainable construction standard for near-zero energy buildings. **This concept combines an extremely high level of insulation with a special ventilation system.** Geothermal energy and energy from inside the building, such as the body heat of residents or solar heat entering the building, are used as the main sources of energy.

DETAIL OF THE MEASURE:

The initiative involves applying the PassivHaus standard to design an eco-responsible dialysis centre. The François Berthoux Centre (ARTIC42) which is 4,400 m2 is a good example, demonstrating the advantages of such a construction, which is both affordable and sustainable. It demonstrates the possibility of extending the ecological construction concept to dialysis centres. This building, which opened in 2019, is the **first healthcare establishment in Europe to be awarded the "PassivHaus" label.** Since its conception everything has been designed with energy performance in mind, from the smallest detail to controlled, meticulous installation:

- The centre has many large glass surfaces, as well as a 70 m² central patio, all equipped with triple glazing.
- The sophisticated ventilation system is coupled with geothermal energy. Six 190-metre-deep boreholes preheat the incoming air in winter, and cool it in summer via a dual-flow ventilation system.
- Particularly meticulous insulation: the 2 care floors are in a so-called "warm" envelope, airtight, with no thermal bridges, which recovers heat through ventilation.



- The heat generated by patients, staff, televisions, IT equipment, and above all by the dialysis generators and osmosis water loops, was taken into account in the building's design and played a part in calculating the thickness of the thermal insulation on the façade.

- A system of radiating plates has been installed for supplementary heating throughout the establishment.
- In summer, the 4 dialysis halls need air-conditioning.
- Adjustable sunshades have been installed on all windows to limit solar heat gain in summer.
- The patio is shaded by a blind in summer to protect it from the sun.

Additionally, the centre is controlled by software (temperature setpoints), which also helps to monitor energy consumption (50 counters).

FICHE FOCUS N°04

Constructing a passive dialysis centre (case study of the François Berthoux Centre)

OBJECTIVE OF THE MEASURE:

The concept of the “passive house” is a sustainable construction standard for near-zero energy buildings. **This concept combines an extremely high level of insulation with a special ventilation system.** Geothermal energy and energy from inside the building, such as the body heat of residents or solar heat entering the building, are used as the main sources of energy.

EASE AND TIME OF IMPLEMENTATION:

Implementing a passive building is complicated. It takes to 2 years to construct such a building.

TRACKING INDICATORS:

Energy consumption per dialysis session

HUMAN AND FINANCIAL RESOURCES REQUIRED:

The additional construction cost compared with a conventional facility has been estimated at 3 to 5% for the François Berthoux centre.

EXPECTED SAVINGS:

Passive houses offer energy savings on heating and cooling of up to 90% compared with conventional housing, and more than 75% compared with conventional housing under current thermal regulations (RT 2012). Overall, the **energy savings achieved by the François Berthoux Centre exceeded 50%.**

Feedback		
Structure	**Measure implemented**	**Advantages**
Barwon Health Renal Services Australia - Geelong 2011	Using solar panels on the roof.	**Network energy consumption has been reduced by 91% and electricity costs by 76.5%[39].**
Beijing Huilonguan Hospital China - Pékin 2012 - 2015	A strategy for reducing energy in 3 key areas: - **Management system optimisation** Prioritise the "quick win" solution. Create an "energy saving" work group. Impementing rules: publication of data, obligation to set objectives for each department and to specify each person's responsibilities. - **Communication and awareness-raising on the environmental issues.** Use multiple forms of communication media: pictures, banners, posters, etc.. Awareness-raising workshops. Incorporating "environmental advertising" into the workplace: instructions on how to save energy, information on the right heating temperature, etc. - **Highlighting best practice and innovation**. Replacing old, energy inefficient machinery. Install LEDs. Renovate plumbing to prevent water loss	**The hospital reduced its energy consumption by 35%[40].**

Yzu-Chi Dialysis Centre Malaysia 2017	Implementation of **6 measures to reduce energy consumption:** - Controlling tap water consumption - Installation of ventilation control systems to optimise temperature by zone - Solar power supply for exterior lighting - Modification of switches to make them manual and accessible - Automatic door closing to prevent heat loss - LED installation **The centre encountered two main obstacles: staff resistance to change, which could only be mitigated by an awareness-raising campaign, and a lack of measurement indicators to accurately assess the most energy-consuming jobs.**	This policy has enabled the centre to **reduce its electricity consumption** by 16.5% and **cut daily emissions by 6 kgC02**[41]**.**
NephroCare France 2005 - 2013	Several measures were implemented at the Nephrocare dialysis centres (29 centres) to reduce electricity consumption: - Eco-reporting training for staff - Installing newer dialysis machines - Presence detectors and lighting timers - Transition to LED lightbulbs - Reducing the size of the establishment - Moving one of the units to a more energy efficient building - Changing or updating air treatment systems	**Reduction in energy consumption of 30% i.E. 92,400 tCO2e saved**[42]**.**

Table 6: Feedback on measures for reducing energy consumption

Measures for air quality optimisation

The dialysis centres are generally equipped with closed treatment rooms which welcome several patients for a number of hours. However, air quality is often a neglected issue, with little monitoring.

COVID-19 has raised awareness of the need to ventilate and monitor air quality, particularly in public places and specifically in healthcare establishments.

On 12 May 2021, the European Commission adopted the EU Action Plan: "Towards a Zero Pollution for Air, Water and Soil" (and annexes) - a key deliverable of the European Green Deal.

The aim is to tackle air pollution and achieve the EU's zero pollution vision for 2050. This is translated into key 2030 targets to speed up reducing pollution at source. These targets include: improving air quality to reduce the number of premature deaths caused by air pollution by 55%[43].

A number of measures that need to be taken have been identified to ensure that the people involved take ownership of this issue and to achieve continuous improvement in indoor air quality.

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Staff awareness on the importance of air renewal in treatment rooms.	Short-term
Establish a procedure for air renewal (duration, number of windows to open depending on the season, etc.).	Short-term
To ensure patient comfort, attention should be paid to **the location of the diffusers and the air velocity**, which should be limited to 0.25 m/s at chair height.	Short-term
Limit the number of cleaning products and use simple products, ideally organic sourced products. Preferred labels include: ecocert, ecolabel, etc.	Medium-term
Choose materials that emit as few pollutants as possible, A+ rated construction and decoration products in terms of volatile pollutant emissions in public procurement and contracts.	Medium-term
Use a CO2 sensor to measure the CO2 content in the air and control the speed of a ventilator or the opening of a fresh air or other air intake control as a result.	Medium-term

Table 7: List of measures for improving air quality.

Measures for waste management optimisation

On average, around 1.5 kg of waste/bed/day is produced by healthcare establishments in Europe, i.e., almost 2.4 million tonnes per year. This would represent 10% of global waste production by healthcare establishments (15 kg/bed/day)[44].

To address this issue, Directive on waste framework 2008/98/EC aims to bring the EU closer to becoming a greener and more recyclable society by promoting waste prevention and reduction and encouraging the use of waste as a resource. It provides a waste prevention and management hierarchy with the following order of priority: a) prevention; b) preparation for reuse; c) recycling; d) other recovery, in particular

PART 3 - Decisive measures

energy recovery; and e) disposal. It also confirms the "polluter pays principle" whereby the waste producer must bear the costs of waste management. Amending Directive (EU) 2018/851 sets new recycling targets for municipal waste: **by 2025, at least 55% by weight of municipal waste must be recycled. This objective will increase to 60% by 2030 and 65% by 2035.**

In addition, Directive on landfilling (EU) 2018/850 aims to:

- Introduce, starting from 2030, restrictions for all waste likely to be recycled or give rise to other material recovery or energy recovery
- Limit the proportion of municipal waste sent to landfill to 10% by 2035

The vast majority of waste produced by the healthcare sector (around 85%) is non-hazardous and similar to domestic waste, meaning that much of it can be easily recycled. Over 50% of the non-hazardous waste produced by hospitals consists of paper, cardboard and plastic. As a general rule, only 15% of waste from the healthcare sector should be classified as hazardous, i.e. waste that is potentially infectious, toxic, radioactive and/or likely to present other environmental and health risks [45].

The NHW/HW distinction has financial consequences: the cost of destroying NHW and HW is respectively €200 and €1,200 per tonne in France, and can be as much as €1,000 for NHW and €3,600 for HW in other European countries. Incinerating and transporting HW also emits 3 times more greenhouse gases than treating NHW. It is therefore important to differentiate between them at the sorting stage.

The conventional and historical classification of waste from healthcare facilities, according to the European Works Council (EWC) guide on waste classification by category, is shown in the table below.

Regarding dialysis centres, they generate a large volume of waste in various categories, in particular household waste (NHW: Non Hazardous Waste) and waste from healthcare activities involving infectious risks (Hazardous Waste). This is due to (i) a high rate of packaging and wrapping of pharmaceutical products and medical devices, generating a high quantity of cardboard, plastic, polystyrene, etc. (ii) the use of single-use medical devices (iii) the use of still too large quantities of paper (iv) the containers/contents of pharmaceutical products and food waste. Waste has a significant environmental impact due to the GHG emissions generated during its treatment.

Waste classification	
Hazardous waste (HW)	• **Pathological waste:** human tissues, organs or fluids, body parts • **Sharps waste:** syringes, needles, disposable scalpels and blades, etc • **Infectious waste:** contaminated with blood and other body fluids: • Dialysis filter • Connection and disconnection sets • Contaminated single-use material: drapes, gauzes, compresses, bandages, etc
Non-hazardous waste (NHW)	• Waste whose collection and disposal are not subject to special requirements to prevent infection: • Dressings, plasters, linen, disposable clothing, diapers • Single-use gloves and unsoiled compresses, small equipment packaging, apron, mask, overblouse, gown, etc. • Medical bags (nutrition, bicarbonate, physiological serum...)

Directive on waste framework 2008/98/EC completes the definition of infectious substances: substances and preparations containing viable micro-organisms or their toxins known or suspected with certainty to cause disease in humans or other living organisms.

One of the first objectives for the dialysis team is to identify which healthcare products are considered to be infectious and comply with regulations. In pragmatic terms, a healthcare device soiled with blood, urine or biological fluid should only be considered infectious if it is contaminated by an agent (bacteria, virus, cytotoxic product) which, if transmitted to a living organism, could have a pathogenic effect. The concept of infectious risk contaminated waste is therefore considerably restricted.

Nowadays, practices have drifted over time and healthcare equipment that has been in contact with a patient's blood is very often wrongly considered to be HW, leading to a significant increase in this type of waste and its recycling/destruction cost. Returning to the initial definition above is therefore a major tool for improving the ecological balance and practices of dialysis centres in Europe.

Several measures for reducing waste generation in the dialysis centre have been identified and are detailed below.

The main principles underlying these measures are:

REDUCE SORT REDUCE RECYCLE

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Analysing care procedures and equipment used	
Perform an audit or create a catalogue of practice and relevance regarding: - the different waste categories, **in particular HW** - the use of disposable single-use equipment vs re-usable equipment or devices - the use or not of sterile equipment - the use of care kits or separate equipment	
Measures to monitor the quantities of generated waste	
Create a catalogue of the equipment used, including the composition and weight of each item, its disposal route and areas for improvement.	
Implement **tracking indicators** of the annual weight and cost of HW and NHW.	
Implement an **audit** of the weight of waste generated annually.	
Measures for reducing the quantities of packaging waste generated	
Implement **agreements for waste take-back** with suppliers.	
Implement **recycling schemes**; such as those imposed by law.	
Include criteria for reducing the amount of packaging used when purchasing from suppliers.	
Measures for reducing the quantities of paper waste generated	
Opt for electronic storage rather than printing paper (daily reports, test results and other documents, soft copy equipment manuals, etc.).	
Reduce the number of available printers, or get rid of them altogether, if possible.	
Use **certified paper** (recycled or from sustainably managed forests).	
Measures for reducing the quantities of HW generated	
Adopt the same definition as in Public Health Code R 1335-1 (see above)	
Check the bags of recycled waste before closing: healthcare waste (compresses, gloves, bags, etc.) can often be redirected to HW or NHW facilities.	
Drain the lines helping to considerably reduce the weight of discarded dialysis circuits. Either manually, or automatically using the newer dialysis machines.	
Purchase HW **dehydration, compaction or conversion equipment**, to significantly reduce the volume of HW waste and convert it into NHW (for conversion equipment). These devices limit the GHG emissions associated with HW treatment using innovative processes (steam or microwave treatment).	

Measures helping to save, sort, recycle and recover waste	
Staff awareness and education on the correct use of equipment required for healthcare and on sorting procedures. Communicate, set challenges, show the concrete results of taking action, etc.	
Implementation of the 14 existing sorting procedures applicable to dialysis and **checking compliance** (regulations governing waste sorting, storage and disposal).	
Do not throw away EOL dialysis machines: donate them, sell them or use them for spare parts.	
Use **specific waste recovery channels**.	
Measures helping to save, sort, recycle and recover waste	
Staff awareness and education on the correct use of equipment required for healthcare and on sorting procedures. Communicate, set challenges, show the concrete results of taking action, etc.	
Implementation of the 14 existing sorting procedures applicable to dialysis and **checking compliance** (regulations governing waste sorting, storage and disposal).	
Do not throw away EOL dialysis machines: donate them, sell them or use them for spare parts.	

Table 8: List of measures for optimising waste management. The measures indicated by a magnifying glass ( ) are described in detail in a focus sheet.

Zoom on the 14 waste sorting schemes applicable for dialysis in France

1. HW
2. NHW
3. Expired medicines and bottles containing dangerous products
4. Paper
5. Cardboard
6. Transparent flexible plastic
7. Caps and hard plastic
8. Ink cartridges
9. Batteries
10. Magazines and documentation included in equipment boxes
11. Unused equipment
12. Glass including medicine bottles
13. Mattresses/furniture
14. Waste electrical and electronic equipment (WEEE)

A sorting facility for composting and small office equipment should soon be operational.

Despite the identification of various measures for limiting the generation of waste, the first measure to be put in place is to limit the consumption and wastage of the elements needed to carry out healthcare.

FOCUS SHEET N°05

Create an in-house product catalogue

OBJECTIVE OF THE MEASURE:

The objective of this measure is to enable each centre to know exactly what equipment is being used, in what quantities, and how it is disposed of.

Depending on the standard practices of dialysis centres and treatment methods (PD, home haemodialysis, haemodialysis in a heavy centre, etc.), the quantity and type of equipment used will vary. This product catalogue provides qualitative and quantitative traceability of the waste generated during use of each component, as well as existing or potential disposal and recycling processes. This catalogue also helps to identify and prioritise potential areas for improvement.

DETAIL OF THE MEASURE:

Identifying the equipment used for each modality in each dialysis unit and the waste sorting and disposal circuits. By using the catalogue, the centre is able to determine the volume (assessed by weight) before and after use, as well as the operational efficiency of the sorting process to ensure that the items in the catalogue are recycled as efficiently as possible:

- Cumulative weight of waste equivalent to the cumulative weight of materials used
- More recoverable waste than non-recoverable waste

PRIORITY:

High and initial for every project

ESSENTIAL EQUIPMENT:

20 g sensitivity scale, product sheet, Excel or Word file, etc.

EASE AND TIME OF IMPLEMENTATION:

No difficulty. Annual updates, routinely every six months for the first 18 months of the catalogue's existence.

TRACKING INDICATORS:

Weight of different types of waste per dialysis session.

HUMAN AND FINANCIAL RESOURCES REQUIRED:

- 2 people (+ the help of a pharmacy expert) for comprehensive “product sheets”
- 10 hours of work not including formatting
- No ancillary costs

EXPECTED SAVINGS:

- Stakeholder awareness: Administrative, pharmacy, care team
- Updating care procedures and protocols
- Reducing the volume of waste products
- The proliferation of specific recycling channels (selective sort-ing)
- Reducing the weight and therefore the cost of eliminating HWs

FOCUS SHEET N°06

Purchasing a device for converting HW into NHW

OBJECTIVE OF THE MEASURE:

The objective is to significantly reduce the amount of HW waste, limit the GHG emissions related to treatment and reduce costs.

DETAIL OF THE MEASURE:

Five manufacturers are approved by the Laboratoire National de Métrologie et d'Essais and comply with AFNOR standard NF X30-503. There are three different techniques for **transforming HW into compact, inert, dry waste that can be deposited in NHW**: (i) shredding + autoclave, (ii) shredding + microwave, (iii) compression + heating to 150°C. There are two types of HW that **should not be processed in any sort of converter: HW containing non-conventional transmissible agents or cytotoxic/cytostatic products.** Water and electricity supply requirements are high for the first technique and very low for the second. Apart from compression, liquid and gaseous effluents are emitted for the autoclave technique, and gaseous effluents only for the microwave technique, with a marked odour requiring a ventilation or VMC system and consideration given to the location of the equipment. Maintenance is accessible to the technical or biomedical departments.
The range of sizes of the units (capable of disposing of between 12 and 2,500 litres) means they can be adapted to suit all types of structure.

PRIORITY:

High because **conversion is 5 times less polluting than the transporting the HW for incineration.**

EASE AND TIME OF IMPLEMENTATION:

Moderate: Depending on the size of the appliance, a greater or lesser surface area will need to be freed up.
If several centres wish to share a unit for treating all the HWs, they will have to be transported to the unit. It will therefore be necessary to bring their transport into line.

TRACKING INDICATORS:

Volume and weight of infectious waste, reduction in long-term HW disposal costs.

HUMAN AND FINANCIAL RESOURCES REQUIRED:

Dedicated manual labour is required: depositing the number of boxes to be destroyed, waiting for the system to operate, collecting the waste, reinstalling the boxes, etc.
The initial investment is high, but once the equipment has been amortised, the cost of maintenance is relatively low, depending on the type of unit. In addition, the unit can be a source of benefits if it is shared with other structures.

EXPECTED SAVINGS:

- Volume reduction of infectious waste > 80%
- Weight reduction >25%
- Reduction in HW disposal costs

Feedback		
Structure	**Measure implemented**	**Advantages**
University Hospital Clermont-Ferrand 2022	**Reducing paper consumption at hospital level** • Using standard 75 g paper • Essential printing only, double-sided and in black and white • Reducing margins and font size • Buying paper in cardboard boxes rather than reams • Electronic communication • Electronic pay slips and other documents	16,711,335 sheets of paper purchased in 2021. These measures have enabled a reduction in paper use of 18.85%.
Queen Margaret Hospital Ecosse	For each dialysis session, **a 1L pouch of standard saline solution is used** for re-injecting the patient's blood at the end of treatment but **only 200 mL is necessary.** The remaining 800 mL of saline solution, the plastic bag containing it and the plastic administration set were then placed in an orange bag and disposed of through the clinical waste stream. The bag was suspended at the start of treatment in the event of an emergency: by using **in-line facilities** for emergencies and re-injections, the **use of saline solution and infusion kits was reduced**. The new machines make it possible to prepare an ultra-pure sterile replacement fluid directly from the dialysate by passing it through an ultrafilter.	A pouch of saline solution costs €0.50 each, and a single infusion set costs €0.35. Over the course of **the 10,764 treatments dispensed each year, the use of online liquid substitutes saves €10,784 in supply costs alone.** **A reduction of 2 kg in clinical waste from a single treatment** thanks to the disposal of a bag of saline solution for re-perfusion (which generally still contains 800 mL), an administration kit and a bag of bicarbonate. Of the 10,764 annual treatments provided by the unit using Fresenius 5008 machines, this would result in a **reduction in clinical waste of 21,528 kg, or 21.5 tonnes.** Total annual savings of €6,383.

PART 3 - Decisive measures

CH Vichy 2021	Quantification of waste in kg of haemodialysis care, all techniques combined, and (method 1) separation according to 2 types of waste, (method 2) separation by techniques (conventional HD, Hemodiafiltration, Acetate-free biofiltration with profiled potassium) and according to 5 different types of waste.	- Average weight of waste generated per session: 2.58 Kg - A catheter session generates 0.5 kg more waste than an AVF (arteriovenous fistula) session - The average weight of waste generated per session is 0.3 kg higher (residual water, blood, solutions) than the weight of the equipment used. For the same technique, there is great variation from one session to the next, reflecting the heterogeneity of practices.
Polyclinique de Blois, France 2009-2021	**HW management:** checking the sorting of HW bags (photos, feedback to teams, updating of sorting) combined with a distinction between "clean" HW and "infectious" HW.	**HW reduction of 30% to 40%.**
	Implementation of 40 sorting channels: these channels are supported by eco-organisations (e.g. Ecomaison for mattresses).	NA
	Awareness-raising and recovery measures: in parallel with the various initiatives, the clinic is stepping up its awareness-raising campaigns. Since 2017, the clinic has **set up a "Recyclerie" where all usable materials that meet hygiene standards are offered to staff:** eutectic plates, pallets, plastic crates, paper used for sterilisation, sterile water containers, cardboard, etc.	NA

ARTIC 42	The association set up a "kilo time" day based on the weight of HWs ("conventional, unrestricted definition") before raising staff awareness. To do this, two dialysis techniques were analysed: Fistula and catheter	The results highlighted the differences in practice from one department to another, **although the same equipment was used:** the average weight measured ranged from 0.97 kg to 1.47 kg. It should be noted that the same equipment was used in each category, showing the differences in practice from one team to another.
ARTIC 42 2020-2021	**Implementation of a staff training module** • Provision of tools that facilitate sorting: specific media, colour coding, posters with sorting instructions, etc. • Encouraging more recycling of X-rays, hard plastic, soft and transparent plastic, cardboard, paper, etc. • Raising awareness to limit the use of single-use products (cleaning cloths)	Reduction in the generation of NHW (-7.65%) and HW (-4.9%). Recycling increased by 34.62%, of which 45.54% for soft plastics and 540% for hard plastics.
Recommendation of the SFAR (French Society of Anaesthesia and Intensive Care)	Reducing the use of single-use equipment and fabrics: • Replacement of single-use trays with non-sterile recycled cellulose pulp trays which, after use, are recycled as paper [46] • Comparing textiles and single use products. An SFAR and Société Française d'Hygiène Hospitalière study based on a literature review concludes that there is no difference in terms of infectious safety between single-use non-woven surgical textiles and reusable cotton textiles [47].	However, the environmental impact has not been assessed. It should weigh up the cost of importing disposable clothing and fabrics from China against the environmental cost of washing the fabrics (water, chemicals, transport to the washing centre, etc.).

Table 9: feedback on measures for optimising waste management

Measures to promote sustainable purchase

The environmental impact of purchasing equipment and consumables in dialysis centres is considerable.
It is important **to put in place a responsible purchasing policy**, demanding products and practices that emit little carbon and respect the environment.

To achieve this, a strict supplier and **product selection process needs to be implemented, incorporating sustainable development criteria.**

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Inclusion of environmental, social and economic criteria in supplier specifications: sustainable development charter, in-house production, location, transport, etc.	Short-term
Working with **platforms for evaluating the CSR performance of suppliers** and responsible purchasing, such as Ecovadis.	Short-term
Encourage central purchasing departments to incorporate sustainable development criteria.	Medium-term
Improve the way dialysis acid is purchased: use **central distribution centres for acid concentrates** to limit packaging, waste, transport and greenhouse gas emissions (use a centralised delivery system with storage tanks).	Medium-term

Table 10: List of measures for promoting sustainable purchasing. The measures indicated by a magnifying glass ( ) are described in detail in a focus sheet.

FOCUS SHEET N°07

Making responsible purchasing a systematic approach

OBJECTIVE OF THE MEASURE:

The objective of this measure is to integrate environmental, social and economic purchasing criteria into dialysis equipment and consumables purchasing, with the aim of promoting sustainable purchasing practices.

DETAIL OF THE MEASURE:

Drawing up a responsible purchasing charter with quantifiable objectives would make this approach systematic.

Examples of criteria to include:

- Manufacturing location: give preference to European manufacturing.
- Sterilisation method: use steam or radiation sterilisation.
- Raw materials used: choose raw materials that are free from phthalates, chlorine derivatives and glue (laser welding).
- The weight of a medical device.
- Disposal and destruction processes: assessing the release of toxic products (incineration, conversion, etc.).

PRIORITY:

High and initial for every project.

EASE AND TIME OF IMPLEMENTATION:

The steps involved in implementing this approach are as follows:

- **Training** buyers in sustainable purchasing;
- **Analysis of the existing situation**: quantification of purchasing volumes by category and by supplier, and identification of strategic purchasing groups and key suppliers;
- **Identification** of environmental, social and economic criteria by strategic purchasing group;
- **Drafting and distributing a responsible purchasing charter;**
- **Include environmental, social and economic criteria in the specifications** for products, suppliers and service providers, and use these criteria in the selection process;
- **Reporting and monitoring** suppliers.

For this measure to be successful, the medical team needs to be convinced that it can exert positive pressure on purchasers, pharmacists and manufacturers.

FOCUS SHEET N°07

Making responsible purchasing a systematic approach

OBJECTIVE OF THE MEASURE:

The objective of this measure is to integrate environmental, social and economic purchasing criteria into dialysis equipment and consumables purchasing, with the aim of promoting sustainable purchasing practices.

TRACKING INDICATORS:

- Percentage of purchases that take sustainable development criteria into account
- Reporting and monitoring suppliers

HUMAN AND FINANCIAL RESOURCES REQUIRED:

- Each establishment needs a purchasing manager and a technical manager trained in these issues.
- A percentage of the establishment's budget must be earmarked for investment in sustainable purchasing.

EXPECTED SAVINGS:

Incorporating the department's eco-responsible approach into an overall purchasing chain that is more respectful of current environmental issues.

FOCUS SHEET N°08

Encourage centralised distribution of acid concentrates

OBJECTIVE OF THE MEASURE:

The objective of this measure is to change dialysis acid purchasing practices in order to promote sustainable, environmentally-friendly purchasing. **The objective of this measure is to eliminate the need to purchase containers of acid by investing in an acid plant.**

DETAIL OF THE MEASURE:

By reconstituting the acid concentrate in situ, acid concentrate manufacturing and/or distribution plants are able to :

- **Reduce liquid transport** (manufacturing plant)
- **Reduce the generation of plastic packaging and the waste of residual concentrates contained in containers,**
- **Reduce the carbon footprint associated with transporting** this type of product
- **Facilitate stock management** while preventing the risk of musculoskeletal disorders among care staff, who are forced to carry heavy loads on a daily basis.

PRIORITY:

High

EASE AND TIME OF IMPLEMENTATION:

- Automated and secure concentrate production, carried out by nurses. A doctor is not required.
- Difficulties linked to the storage area required and the number of dialysis stations served.
- Reduced prescription options.
- Be equipped with generators fitted with inlets for the centralised acid.
- Regular maintenance is required.

TRACKING INDICATORS:

Annual number of acid containers used.

HUMAN AND FINANCIAL RESOURCES REQUIRED:

- A feasibility study (by consulting engineers or a pharmacist) is required.
- The initial cost of setting up an acid plant is high (around €50,000).

EXPECTED SAVINGS:

- Cost savings from reduced acid waste and plastic packaging.
- Significant reduction in plastic consumption (several tonnes per year).

Feedback		
Structure	**Measures implemented**	**Advantages**
University Hospital Nice 2014-2015	Provision of tools for an eco-responsible purchasing policy (labels, questionnaires, Sustainable Development criteria by market segment, etc.). The objectives of the University Hospital through this measure were: • Giving priority to purchases with the lowest environmental impact at the lowest cost • Integrating social considerations into purchasing decisions • Optimising requirements To achieve these objectives and help implement this approach, **the University Hospital's purchasers have a number of tools at their disposal:** • A tool to assess suppliers' readiness to tackle CSR issues: a questionnaire with 22 items on 3 themes (the environment, social issues and good professional practice). • A list of all existing labels and their areas of application • A list of sustainable development criteria by market segment • A list of ways to reduce packaging	NA
Bradford Teaching Hospital NHS Foundation Trust – UK-bradford 2007	The centre has installed acid vats, supplied monthly by tankers. This acid is then distributed to the dialysis machines via a pressurised loop. A system of barriers to prevent leaks has also been put in place. The objectives of this measure were: • Reduced acid waste: only the acid actually needed is used • Reducing solid waste • Saves storage and handling space (no need to transport containers from one floor to another) • Resilience in the face of supply disruptions: reserve up to 3 weeks in advance	Investment cost: €47,000 for the vats + €4,500 for the barrier system = €51,500 Cost savings: €22,500/year on acid + €5,200/year on plastic waste = **€27,700/year** Environmental benefits: 8 330 kgCO2e/year on supply chain savings + 7 700 kgCO2e/year on packaging = **16 tCO2e/year** **The 5-year return on investment is 163%[48].**

Table 11: Feedback from sustainable purchasing measures

Measures to promote sustainable transport

The mobility sector, which enables staff and patients to travel and the flow of materials, is the second largest source of GHG emissions in the healthcare sector. This is particularly true for dialysis, which requires patients to travel regularly to the dialysis centre for their medical check-ups (on average 3 times a week). The GHG emissions of various dialysis centres around the world (see Table 2) have highlighted **the emissions generated by transport in the healthcare sector, representing between 8% and 28% of the GHG assessment.**

A number of measures can be taken to **encourage staff to use more sustainable modes of transport, limit freight and optimise patient travel.** We also saw in the "sustainable purchasing" chapter the importance of selecting suppliers on the basis of their sustainable development approach, in particular by taking into account their location in order to limit the material transport.

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) the technical difficulty of deploying the actions, (ii) the financial/human investment required and (iii) the time required to implement the actions.

List of measures	Implementation
Measures for assessing the impact of mobility and transport	
Conduct an **initial survey of employees, users and patients on their travel habits.** Publish the results and propose alternatives. The survey must be updated annually.	Short-term
Take stock of the **vehicle fleet** (including ambulances) and their usage. Identify the types of vehicle used (diesel, electric, etc.) and mileage in order to implement the necessary corrective actions.	Medium-term
Ask suppliers and service providers about GHG emissions linked with deliveries.	Medium-term
Mobility measures for employees	
Implement an **awareness-raising programme** on : - eco-driving - car sharing - alternative modes of transport: bus, bicycles, electric bicycles if necessary - "greener" vehicles - purchase/hire of hybrid or electric cars The objective is to **raise awareness of the environmental and health impacts of travel,** and to provide information on local transport options (public transport, car-sharing, etc.).	Short-term
Work on a regional scale with all stakeholders (particularly municipalities) to find out about existing or developing sustainable mobility schemes. For example, use the "Geomob" dynamic mapping tool to support mobility and commuting management.	Medium-term

Encourage alternative forms of transport: • Making bicycles/electric bikes available, helping people to buy bicycles • Replenish the car/utility fleet with electric or hybrid vehicles • Installing an electrical charging point • Optimising commercial vehicle journeys • Building a secure bicycle shelter • Implementing a car sharing platform • Sharing vehicles • Use ADEME's mobili'pro scheme to manage the vehicle fleet and travel requirements	
Implement a **company travel plan.**	
Organisation of mobility days/challenges.	
Mobility measures for patients	
Encourage home dialysis.	
Use tele-consultation wherever possible.	
Introduction of car-sharing in all its forms, including public transport, municipal shuttles, etc.	

Table 12: List of measures for promoting sustainable transport.

The European Commission's strategy for sustainable and intelligent mobility aims to encourage the switch to cleaner and more sustainable modes of transport, including within healthcare establishments. In addition, some healthcare establishments are already implementing sustainable mobility solutions, such as using electric vehicles to transport patients and encouraging staff to use public transport.

Feedback		
Structure	**Measure implemented**	**Advantages**
University Hospital Nice 2018-2019	**Implementation of a sustainable mobility plan** Several projects have been launched as part of the University Hospital's sustainable mobility plan: **The University Hospital has joined the online platform "La roue verte"** (the Green Wheel), a car-sharing solution for pooling journeys between members of staff A **car-sharing service** • An increase in video-conferencing and teleworking • For supplies, the hospital favours "full truck" orders and offers **eco-driving training** for drivers • A **free shuttle bus** links the various centres on the site to reduce journeys and improve access between sites	NA
University Hospital Bordeaux 2008	• **Implementation of a sustainable mobility plan:** • Personalised **travel advice** • Introduction of **incentives** (including a sustainable mobility package) • Partnerships/external relations **Raising awareness** of alternative modes of transport: events, communications, in-house and internet sections, presentations on welcome days, etc.	Survey carried out every 4 years to update the action plan in line with perceived benefits. **Between 2008 and 2020:** 25% reduction in car journeys, +12% use of public transport, +12% use of bicycles.
University Hospital Grenoble 2018	Promotion of cycling and car-sharing, awareness-raising campaigns, training days, promotional offers, distribution of cycling guides, organisation of car-sharing speed dating events. **Launch of a mobility challenge in June 2019.**	64% modal shift on the mobility challenge day. 17% of staff at Grenoble University Hospital come by bicycle and 15% by public transport.
Nord Parisien Private Hospital 2015	Introduction of **car-sharing for medical transport within the establishment.**	Between 2015 and 2019, the number of patients travelling by car sharing rose from 20% to 61%.

Table 13: Feedback on sustainable transport measures

Measures to encourage digital sobriety

Current scientific studies estimate that **digital technology is responsible for 3 to 4% of global greenhouse gas emissions,** i.e. twice as much as the aviation sector[49]. It is also a sector responsible for significant consumption of abiotic resources (non-renewable natural resources), water and energy.

Adopting more responsible digital practices in order to significantly reduce the sector's environmental footprint is necessary in the current context of the fight against climate change, the decline in biodiversity and the increasing scarcity of natural resources. The healthcare sector and dialysis activities in particular, are no less concerned by these issues than any other sector. Digital technology in dialysis is opening up a promising field of possibilities (remote monitoring, data collection, connected dialysis, stock and waste management, etc.), but these impacts must be monitored and controlled to limit any devastating effects.
For these reasons, we thought it would be interesting to identify the key measures and lessons learnt that could be taken to promote digital sobriety.

Implementation: Short-term | Medium-term | Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Awareness-raising measures	
• **Train professionals and patients** to make informed and useful use of digital technology in healthcare, particularly by raising awareness of its environmental impact. • Set up challenges (e.g. 1 day without email).	Short-term
Calculation of the environmental impact of an IT system in a dialysis centre.	Medium-term
Integrate Digital Responsibility skills into the training plan.	Medium-term
Measures concerning the exchange/storage of digital data	
Measure and control the volume of data exchanged, taking into account the phenomenon of infobesity: not all data may be relevant.	Medium-term
Implement **a data management strategy.**	Long-term
Measures concerning messaging services	
Avoid sending unnecessary emails (such as thank-you notes) and use instant messaging instead.	Short-term
Adopting good digital practices: avoiding attachments when not necessary, reducing the number of recipients, un-subscribing from unwanted emails, deleting unnecessary emails, sorting your inbox regularly, eliminating spam.	Short-term
Measures relating to IT equipment/digital devices	
Encourage using eco-designed devices / reconditioned or second-hand electronics when ordering.	Short-term

Combat obsolescence by proposing not to renew equipment that is still functional and to systematically recycle devices at the end of their life.	
Switch off your computer and/or monitor completely when you are not using it; in particular, do not leave it on standby or plugged in.	
Collect WEEE (Waste Electrical and Electronic Equipment) via a professional service provider to encourage recycling and the clean treatment of non-recyclable waste.	
Uninstall unused services and regularly **clean servers and computers** to avoid the accumulation of digital waste that consumes energy unnecessarily.	
Integrate Lifi in dialysis rooms: an alternative to Wi-Fi that uses the light waves from LED bulbs rather than the electromagnetic waves from Wi-Fi. Higher speed, lower energy consumption, impervious to cyber attacks. Note that this system only works in the room where the bulbs are located. Waves do not pass through walls. Good for intra-room communication, between dialysis machines and the central computer.	
Eco-responsible labelling or certification of HIS (hospital information systems) and digital devices in general (computers, medical technologies, etc.).	

Table 14: List of measures for promoting digital sobriety.

Feedback		
Structure	**Measure implemented**	**Advantages**
University Hospital Bordeaux 2020	In 2020, an Ecosia 4 ecological search engine was deployed on all workstations (Mozilla Firefox and Microsoft Edge Chromium browsers, excluding Internet Explorer dedicated to the intranet and business applications). Preventive treatment against external polluting messages: 40 to 50% of messages destined for the University Hospital are deleted upstream, with up to 80,000 deletions per day. Print stations are rationalised/mutualised by geographical area to avoid duplication of equipment; they are set to black and white, double-sided by default.	Benefits to be assessed in 2025

Table15: Feedback on measures reducing the impact of digital technology

Measures to preserve biodiversity

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
• Take stock of the **environmental impact of the company's activities on biodiversity** and learn about the environmental context. • **Limit light pollution at night**, as it has a real impact on the ability of species to find their way (give preference to lamps that do not emit UV rays and are yellow-orange in colour, reduce lighting periods, select only the areas that are necessary, etc.). • **Limiting noise pollution** that disturbs the instincts of wildlife. • **Encouraging the development of green spaces** that are beneficial to fauna, flora and human well-being. • **Limiting the use of biocides as far as possible.** • Organise awareness-raising campaigns to preserve biodiversity.	Medium-term

Table16: List of Measures for preserving biodiversity

Feedback		
Structure	**Measure implemented**	**Advantages**
University Hospital Bordeaux 2017	On a 30-hectare site, the group has set up a protected area and created a therapeutic walking trail to protect and enhance biodiversity while promoting physical activity for patients[50].	NA
Chartreuse Hospital Dijon 2012	The hospital promotes biodiversity through differentiated management of its parks and gardens. Park management and enhancement programme: safety work and replanting: gradual replacement of mono-specific hedges with living hedges to encourage natural habitats.	• **200 varieties of trees and 500 varieties of shrubs in the hospital grounds.** • 3 hectares of grassland have been transformed into meadowland with a single mowing per year, allowing species such as butterflies and wild pollinators to thrive[51].

PART 3 - Decisive measures

Foyer de Vie Oustalado de Salindre 2018-2019	**Implementation of a thermal weeding system** to maintain outdoor areas and encourage residents to use the gardens. In the past, weeding was carried out once a year by an outside company.	Outdoor areas are regularly maintained, but require more work than with chemical products. The use of chemical weedkillers is no longer permitted on the site since 1 January 2019[52].
University Hospital Henri Guérin	An eco-responsible approach to environmental protection. Collaboration with "les Ruches d'Hyères": **Installation of beehives on the hospital's green spaces.** 3 beekeeping workshops were held for patients/residents and hospital staff: opening hives, swarming and extraction.	Raising public awareness of biodiversity and the importance of pollinator species for the survival of ecosystems[53].
University Hospital Toulouse 2017	Mindful of its duty to set an example, the University Hospital has undertaken, with financial assistance from the Adour Garonne water agency, to stop using phytosanitary products (fungicides, pesticides, herbicides) from 1 January 2017. The objective was to set up an organisation that would rationalise the work carried out by the gardeners by limiting pruning and watering and by eradicating chemical weeding and phytosanitary treatments, which will soon be banned. This has led to a rethink of the landscaping of the University Hospital's 40 hectares of green spaces, with the aim of optimising their management[54].	NA

Table17: Feedback on measures for preserving biodiversity

Key measures for optimising relations with the company's ecosystem and stakeholders

Societal issues are a key aspect of sustainable development, integrating relations with our ecosystem and stakeholders, particularly patients.

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Measures concerning sponsorship and civic involvement	
Make donations and set up partnerships with **associations**[3] **and funds specifically dedicated to nephrology.**	
Skills sponsorship or **solidarity days** in place.	
Measures concerning local development	
Capitalise on the time patients spend on dialysis to try to raise their awareness of climate issues and get them on board the process. Propose a medium to introduce subjects and organise events linked to sustainable development (theme day). **Raising awareness among patients with advanced CKD** at an early stage, for example during therapeutic education sessions.	
Organising workshops (culinary, sustainable development) and encouraging patients to take part in **group activities** (walking groups, coastal walks etc.).	
Encourage patients to take part in physical activity: either during the dialysis session, by using pedal cycles on medical beds to enable patients to play an active role in their care, or outside the session.	
Evaluate the well-being and satisfaction of patients and their care in relation to the establishment: create a good-treatment group responsible for measuring the level of well-being of patients and implementing personalised improvement plans.	
Prevention and openness to **complementary medicine** (hypnosis, meditation, sophrology, etc.).	
Link with **local businesses:** encourage them in their choice of tenders.	
Encourage **synergies with federations.**	
Encouraging the development of **partnerships with schools and training centres** in the region (hosting trainees, students, etc.).	
Implement a communications plan, including the publication of articles and the promotion of actions and events organised by the establishment.	

Table18: List of measures for optimising relations with its ecosystem and stakeholders

ZOOM ON:

HOLISTIC MEDICAL SUPPORT

Kidney failure in dialysis patients is mostly associated with other pathologies such as diabetes and hypertension. It is advisable to follow a healthy lifestyle in order to prevent the onset of these diseases and/or slow down their progression to more critical stages, which may eventually lead to kidney failure[55].

Hygienic and dietary rules play a central role in individual health. Eating a healthy diet, being physically active, getting regular sleep, etc. are all good practices that can be put in place on a daily basis to prevent and curb kidney disease.

Combating stress is also essential. Osteopathy, hypnosis (see Centre de Dialyse Aura Santé in Auvergne[56]), meditation and sophrology are increasingly recommended, especially for patients requiring dialysis.

ZOOM ON:

PATIENT WELL-BEING

Dialysis is a heavy and restrictive treatment, with major consequences for patients' lives. **Dialysis worsens the quality of life of patients** and the first step towards alleviating this burden is to **provide them with conditions that are as adapted as possible to their particular case: location, timetable**. It is vital, and a patient's right, that everyone is given **full information about all dialysis procedures, even those that are not carried out in the establishment** (e.g. long nocturnal haemodialysis).

To improve patients' quality of life, their life plan must be taken into consideration. In this area, it is worth noting the low rate of integration into the world of work for dialysis patients of working age. Staying at work or returning to work is influenced by the dialysis and probably also by the type of dialysis[57].

The table below lists some of the measures taken by dialysis centres to improve patient comfort during treatment:

Feedback		
Structure	**Measure implemented**	**Advantages**
AURAL Centre 2019	Implementation of a **noise reduction system** during a dialysis session (alarms, generators, ventilation, discussion). The dialysis room was treated for noise by an external service provider, using an absorbent coating and screens.	The improvement felt by patients is about 50%, and they complain on average ten times less of headaches.
Aurar Centre	Organising a **day of social interaction** every year with patients, their families and employees.	Témoignages positifs des patients et du personnel
Association saint André 2015	Proposal for a physical activity **programme entitled PACAP (P lung, A artery, C heart, A activity, P physical).** Physical activity takes place during haemodialysis sessions, using a pedal system that can be compared to a stationary bike used in the supine position.	NA
Fondation AUB santé	At present, only a small proportion of healthcare establishments in France offer nocturnal HD, enabling patients to carry out their dialysis session while they sleep. Yet this is the most inclusive option, with 75% of people remaining in employment. The AUB has developed this modality with **7 centres (soon to be 8) with 110 places available offering long nocturnal haemodialysis in a single room.**	65% of "active" dialysis patients undergoing long nocturnal haemodialysis in a single-room centre are in employment.

Table19: Feedback on measures for patient well-being

Measures for internal social conditions optimisation

The health professions are losing their appeal in a context where working conditions are deteriorating and pay is not keeping pace.

Health crises have had a major impact on structures in the medical-social sector. All professionals have been forced to adapt in order to care for vulnerable groups. **Staff shortages, lack of recognition, remuneration and administrative constraints are seen as obstacles to the smooth running of services and staff satisfaction.** The proposals set out below are intended to **improve pay, commitment and job satisfaction**, but will not correct any shortcomings inherent in the organisation of the medical-social sector.

The proposals below can be considered in conjunction with the actions of the Company Works Council.

Implementation: Short-term Medium-term Long-term

The implementation time was estimated by taking into account the criteria of (i) technical difficulty of deploying the measures, (ii) financial/human investment required

List of measures	Implementation
Measures concerning employment and recruitment	
Personalised integration process, with a dedicated pathway for new arrivals.	Short-term
Employee satisfaction survey.	Short-term
Employer branding and attractiveness: Social benefits, remuneration, policies that are more advantageous than legal obligations (for transport reimbursement or the number of days of parental leave).	Medium-term
Training and career development measures	
Staff training: survey and training policy.	Medium-term
Annual assessment.	Medium-term
In-house animation measures	
Team-building, in-house events, celebrating the year's successes and projects; recognition for services rendered to the establishment.	Short-term
Setting up a warning system, a listening unit and a contact person.	Medium-term
Measures concerning ethics	
Employee representative body (compulsory for public health establishments), ethics charter signed by all employees; staff trained in ethical issues.	Short-term

Table 20: List of measures for improving in-house social conditions.

APPENDICES

List of refrigerant gases and their Global Warming Potential (GWP)

For appliances using refrigerant gases or hydrofluorocarbons (air conditioners, refrigerators, etc.), select gases with the lowest possible GWP (Global Warming Potential). Check with your technician that the gases are feasible and safe (toxicity, flammability, pressurisation, etc.).

GWP of Select Regrigerants

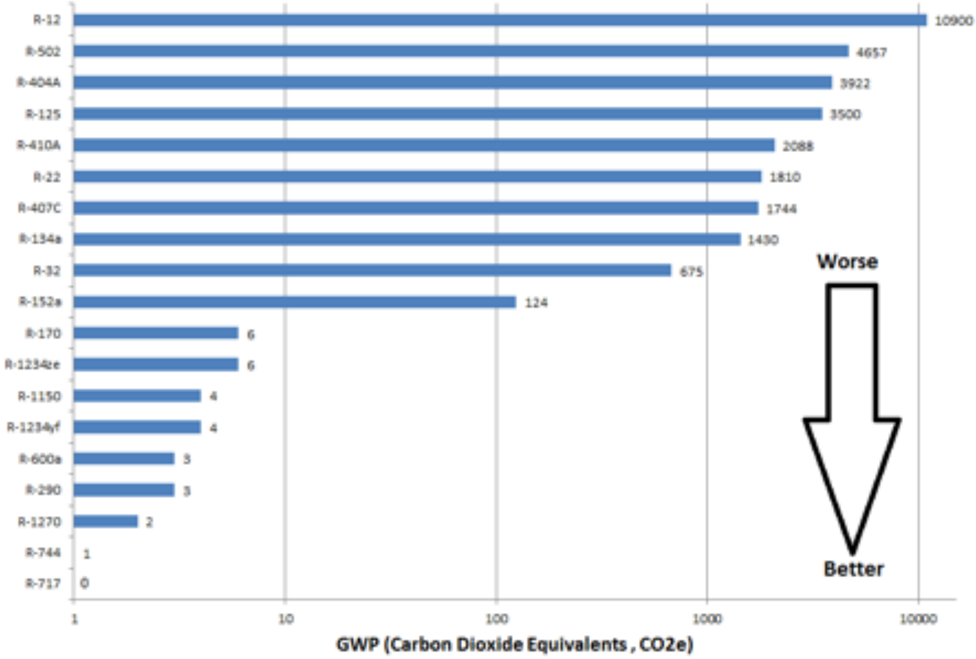


Table 21: List of refrigerant gases and their Global Warming Potential (GWP)

List of physico-chemical analyses to be carried out to ensure the quality of the water discharged by reverse osmosis

Chemical Parameter	Unit	Standard S_i	Weight W_i	Relative Weight w_i
pH	-	6.5–8.5	3	0.103
TDS	mg/L	500	5	0.172
Ca^{2+}	mg/L	75	2	0.069
Mg^{2+}	mg/L	50	2	0.069
Na^{+}	mg/L	200	3	0.103
K^{+}	mg/L	12	1	0.034
HCO_3^-	mg/L	120	2	0.069
SO_4^{2-}	mg/L	250	3	0.103
Cl^-	mg/L	250	3	0.103
NO_3^-	mg/L	45	5	0.172
Total			29	1.000

Table 22: Physico-chemical parameters of the water discharged by reverse osmosis to be analysed

Unresolved issues in this guide

Several measures for reducing the environmental, social and societal impact of dialysis have been identified, detailed and supported by feedback throughout this guide. **We have focused on the issues arising from dialysis centre activities that have the most harmful impacts** (water consumption, waste production, energy consumption, transport), while at the same time suggesting **ways of improving on issues that are less taken into consideration these days** (preserving biodiversity, air quality, sobriety, etc.). However, this guide is not intended to cover all the issues exhaustively, and will continue to evolve.

Several subjets have not yet been covered and should be during the updated guide. It is hoped that the same work will be carried out for other modes of dialysis (peritoneal, at home, etc.).

Other subjects that are not, or only to a limited extent, covered in this guide, but which should be in a later version, include: chemical pollution (medicines, biocleaning of surfaces, machines, etc.), food, eco-design, development of access to healthcare, well-being at work, health and safety at work, etc.

CSR Diagnostics: Grid for CSR strategy initial analysis

This analysis grid, which can be printed out or reproduced on a computer file, will enable dialysis centres to take stock of the CSR initiatives in place or under way. The columns to be filled in correspond to:

- "Status of the measure": indicate here whether the measure has already been carried out, is underway or is still to be carried out.
- "Priority measures to be implemented": indicate here the level of priority assigned to the measures that the centre would like to implement. The centre can prioritise measures based on the complexity of implementation, the resources to be deployed (human and financial), the timescale, etc.
- "Person responsible for the measure": indicate here the person in charge of the measure at the centre (job title, department).
- "Resources to be allocated": indicate here the resources allocated for the measure in question (human time and financial resources required or available).

	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
	Install **dual flush** toilets.					
	Install **automatic sensors** on water taps or water aerators.					
	Collect rainwater to water outdoor planting.					
	Install **sub-meters** to identify water consumption for dialysis and report the data per dialysis session.					
	Consider **installing meters on the water pre-treatment section** in order to optimise water consumption at this stage of the process.					
	Minimise any injection of disinfectant, permanent or temporary chlorination, or periodic disinfection of the device followed by rinsing with water, as this water is lost.					
	Renewing water treatment plants.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Water: water treatment units	Optimise regeneration frequencies for softeners, activated carbon, sand filters, night-time thermal disinfection and flushes, so that these measures are only taken when necessary.	Long-term				
Water: limiting the loss of waste water	**Optimising the conversion rate of osmosis units.**	Long-term				
Water: limiting the loss of waste water	**Changing your water treatment system.**	Long-term				
Water: reduce dialysate flow	Modify the flow rate of the dialysate administered to reduce the consumption of water, acid concentrate and bicarbonate.	Medium-term				

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Water: reuse	**Reusing reverse osmosis reject water.**					
Water: reuse	**Reuse of rejected dialysate.**					
Energy: monitor energy consumption	Set up **a dashboard to monitor consumption and the impact of reduction measures.** Draft monthly or quarterly energy consumption monitoring tables.					
Energy: monitor energy consumption	Install **electricity sub-meters,** take regular readings and set up specific indicators by relating consumption to the dialysis session.					
Energy: monitor energy consumption	Conduct **regular audits.**					
Energy: building consumption	**Raising awareness of eco-gestures** by producing a guide for staff and patients. Put up reminder posters for simple actions (turn off the lights, the heating, close the blinds, etc.). Encourage energy-saving behaviour.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Energy: building consumption	**Communicate information on the good practices** to be applied (or already applied) and the associated performance indicators.					
Energy: building consumption	**Have all equipment, including boilers, serviced annually,** to ensure compliance with standards for nitrogen oxide (NOx) content in combustion gases.					
Energy: building consumption	For appliances using refrigerant gases or hydrofluorocarbons (air conditioners, refrigerators, etc.), **select gases with the lowest possible GWP (Global Warming Potential).** Check with your technician that the gases are feasible and safe (toxicity, flammability, pressurisation, etc.). You will find the list of gases and their associated GWP in the appendices.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Energy: building consumption	**Choose passive energy solutions** (adjustable solar protection, thermal bridges, etc.). Building insulation is essential (loft insulation, external insulation, sunscreens, double-glazed windows, etc.).					
Energy: building consumption	**Use of low-carbon energy sources.** Opt for an electricity contact from your supplier that supports renewable energy development.					
Energy: dialysis-related consumption	**Educating people about electronic devices** (biomedical and IT): standby mode, charging, useless emails, useful storage, etc.					
Energy: dialysis-related consumption	**Renewing dialysis machines to use machines that incorporate functions to optimise energy consumption**, in particular via heat exchangers and an automatic dialysate flow function.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Energy: hygrothermal comfort	**Promote bio-air conditioning of buildings:** air conditioning is achieved by making the most of the sun's rays and the natural circulation of air to reduce energy consumption.					
Energy: hygrothermal comfort	**Recovery of heat and cold using dual-flow devices** (to maximise the benefits of the exothermic dialysis process) such as preventive heat pumps, dialysate recycling or the use of heat exchangers to transfer heat from the dialysate effluent to the incoming fresh dialysate.					
Energy: hygrothermal comfort	**Use solar panels in shaded parking areas** (saves on air conditioning, and therefore fuel, and provides greater comfort for drivers in addition to producing electricity).					
Energy: hygrothermal comfort	**Provide night-time ventilation of premises** (when very hot).					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Energy: lighting	**Choose natural lighting** with black-out blinds, screens.					
Energy: lighting	**Use LED lighting.**					
Energy: lighting	**Install motion detectors and** presence sensors with light timers and twilight switches.					
Energy: Site and construction	**Choose organically sourced materials** with low maintenance costs. Construction using wood is a good solution.					
Energy: Site and construction	**Establish a "Green construction" charter with companies.**					
Energy: Site and construction	**Define works processes** validated by public health experts for a site with low environmental impact.					
Energy: Site and construction	**Construct enclosures with possible future modifications in mind.**					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Energy: Site and construction	For existing buildings, **massively expand comprehensive, high-performance thermal building renovations:** carry out energy performance diagnostics before renovations and prioritise renovation work.					
Air quality	**Staff awareness** on the importance of air renewal in treatment rooms.					
Air quality	**Establish a procedure for air renewal** (duration, number of windows to open depending on the season, etc.).					
Air quality	To ensure patient comfort, attention should be paid to **the location of the diffusers and the air velocity**, which should be limited to 0.25 m/s at chair height.					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Air quality	**Limit the number of cleaning products and use simple products**, ideally organic sourced products. Preferred labels include: ecocert, ecolabel, etc.	Medium-term				
Air quality	**Choose materials that emit as few pollutants as possible,** A+ rated construction and decoration products in terms of volatile pollutant emissions in public procurement and contracts.	Medium-term				
Air quality	**Use a CO2 sensor** to measure the CO2 content in the air and control the speed of a ventilator or the opening of a fresh air or other air intake control as a result.	Medium-term				
Waste: listing	**Perform an audit or create a catalogue** of practices.	Short-term				
Waste: tracking	**Create a catalogue** of the equipment used, including the composition and weight of each item, its disposal route and areas for improvement.	Short-term				

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Waste: tracking	Implement **tracking indicators** of the annual weight and cost of IW, HW and NHW.					
Waste: tracking	Implement an **audit** of the weight of waste generated annually.					
Waste: Amount of packaging waste	Implement **agreements for waste take-back** with suppliers.					
Waste: Amount of packaging waste	**Implement recycling schemes; such as those imposed by law.**					
Waste: Amount of packaging waste	**Include criteria** for reducing the amount of packaging used when purchasing from suppliers.					
Waste: paper	**Opt for electronic storage** rather than printing paper (daily reports, test results and other documents, soft copy equipment manuals, etc.).					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Waste: paper	Reduce the number of available printers, or get rid of them altogether, if possible.					
Waste: paper	Use **certified paper** (recycled or from sustainably managed forests).					
Waste: HW	**Adopt the same definition as in Public Health Code R 1335-1.**					
Waste: HW	**Check the bags of recycled waste before closing:** healthcare waste (compresses, gloves, bags, etc.) can often be redirected to HW to NHW facilities.					
Waste: HW	**Drain the lines** helping to considerably reduce the weight of discarded dialysis circuits. Either manually, or automatically using the newer dialysis machines.					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Waste: HW	Purchase HW **dehydration, compaction or conversion equipment**, to significantly reduce the volume of HW waste and convert it into NHW (for conversion equipment).					
Waste: recycle and recover	**Staff awareness and education** on the correct use of equipment required for healthcare and on sorting procedures. Communicate, set challenges, show the concrete results of taking action, etc.					
Waste: recycle and recover	Implementation of the 14 existing sorting procedures applicable to dialysis and **checking compliance** (regulations governing waste sorting, storage and disposal).					
Waste: recycle and recover	Do not throw away EOL dialysis machines: donate them, sell them of use them for spare parts.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Waste: recycle and recover	Use **specific waste recovery channels.**					
Waste: single-use products	**Limiting the use of sterile clothing and equipment .**					
Waste: single-use products	**Reuse of dialysis membranes.**					
Sustainable purchasing	**Inclusion of environmental, social and economic criteria in supplier specifications:** sustainable development charter, in-house production, location, transport.					
Sustainable purchasing	Working with **platforms for evaluating the CSR performance of suppliers** and responsible purchasing, such as Ecovadis.					
Sustainable purchasing	Encourage central purchasing departments to incorporate sustainable development criteria.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Sustainable purchasing	Take action regarding the purchase of dialysis acid: Use **central distribution centres for acid concentrates** to limit packaging, waste, transport and GHG emissions (use a centralised delivery system with storage tanks).					
Sustainable purchasing	Conduct **an initial survey of employees, users and patients on their travel habits.** Publish the results and propose alternatives. The survey must be updated annually.					
Sustainable purchasing	Take stock of the **vehicle fleet** (including ambulances) and their usage. Identify the types of vehicle used (diesel, electric, etc.) and mileage in order to implement the necessary corrective actions.					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Sustainable mobility: assessing the impact	Conduct an **initial survey of employees, users and patients on their travel habits.** Publish the results and propose alternatives. The survey must be updated annually.					
Sustainable mobility: assessing the impact	Take stock of the **vehicle fleet** (including ambulances) and their usage. Identify the types of vehicle used (diesel, electric, etc.) and mileage in order to implement the necessary corrective actions.					
Sustainable mobility: assessing the impact	**Ask suppliers and service providers about GHG emissions linked with deliveries.**					
Mobility of healthcare professionals	Implement an **awareness-raising programme.**					
Mobility of healthcare professionals	Organisation of mobility days/ challenges.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Mobility of healthcare professionals	Implement a **company travel plan.**	Medium-term				
Mobility of healthcare professionals	**Work on a regional scale with all stakeholders** (particularly municipalities) to find out about existing or developing sustainable mobility schemes.	Long-term				
Mobility of healthcare professionals	**Encourage alternative forms of transport.**	Long-term				
Patient mobility	Encourage home dialysis.	Short-term				
Patient mobility	Use tele-consultation wherever possible.	Medium-term				
Patient mobility	Introduction of car-sharing in all its forms, including public transport, municipal shuttles, etc.	Long-term				

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Digital: awareness-raising measures	• **Train professionals and patients** to make informed and useful use of digital technology in healthcare, particularly by raising awareness of its environmental impact. • Set up challenges (e.g. 1 day without email.					
Digital: awareness-raising measures	Integrate Digital Responsibility skills into the training plan.					
Digital: awareness-raising measures	**Calculation of the environmental impact of an IT** system in a dialysis centre.					
Digital: storage	**Measure and control the volume of data exchanged**, taking into account the phenomenon of infobesity: not all data may be relevant.					
Digital: storage	Implement **a data management strategy.**					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Digital: messages	**Avoid sending unnecessary e-mails.**					
Digital: messages	**Integrating digital best practice.**					
Digital: equipment management	**Encourage using eco-designed** devices / reconditioned or second-hand electronics when ordering.					
Digital: equipment management	**Combat obsolescence** by proposing not to renew equipment that is still functional and to systematically recycle devices at the end of their life.					
Digital: equipment management	**Switch off your computer and/or monitor** completely when you are not using it; in particular, do not leave it on standby or plugged in.					
Digital: equipment management	**Collect WEEE** (Waste Electrical and Electronic Equipment) via a professional service provider to encourage recycling and the clean treatment of non-recyclable waste.					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Digital: equipment management	**Uninstall unused services** and regularly **clean servers and computers** to avoid the accumulation of digital waste that consumes unnecessary energy.					
Digital: equipment management	**Move over to Lifi.**					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Biodiversity	Take stock of the **environmental impact of the company's activities on biodiversity** and learn about the environmental context. • **Limit light pollution at night,** as it has a real impact on the ability of species to find their way (give preference to lamps that do not emit UV rays and are yellow-orange in colour, reduce lighting periods, select only the areas that are necessary, etc.). • Limiting noise pollution that disturbs the instincts of wildlife. • Encouraging the development of green spaces that are beneficial to fauna, flora and human well-being. • Limiting the use of biocides as far as possible. • Organise awareness-raising campaigns to preserve biodiversity.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Relations with ones ecosystem: civic commitment	Make **donations** and set up **partnerships with associations and funds specifically dedicated to nephrology.**					
Relations with ones ecosystem: civic commitment	**Skills sponsorship** or **solidarity days** in place.					
Relations with ones ecosystem: local development	Capitalise on the time patients spend on dialysis to try to raise their **awareness of climate issues and get them on board the process.** Propose a medium to introduce subjects and organise events linked to sustainable development (theme day). **Raising awareness among patients with advanced CKD** at an early stage, for example during therapeutic education sessions.					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Relations with ones ecosystem: local development	**Organising workshops** (culinary, sustainable development) and encouraging patients to take part in **group activities** (walking groups, coastal walks etc.).					
Relations with ones ecosystem: local development	Encourage patients to take part in **physical activity**: During the dialysis session: use of foot pedals on medical beds to enable patients to play an active role in their care. Outside the session.					
Relations with ones ecosystem: local development	**Evaluate the well-being and satisfaction** of patients and their care in relation to the establishment: Set up a well-treatment group to measure patient well-being and implement personalised improvement plans.					
Relations with ones ecosystem: local development	Prevention and openness **to complementary medicine** (hypnosis, meditation, sophrology, etc.).					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Relations with ones ecosystem: local development	Link with **local businesses:** encourage them in their choice of tenders.					
Relations with ones ecosystem: local development	Participate in **synergies with local federations.**					
Relations with ones ecosystem: local development	Encouraging the development of **partnerships with schools and training centres** in the region (hosting trainees, students, etc.).					
Relations with ones ecosystem: local development	Implement a communications plan, including the publication of articles and the promotion of actions and events organised by the establishment.					
Internal social conditions: employment and recruitment	**Personalised integration process,** with a dedicated pathway for new arrivals.					

Implementation: Short-term Medium-term Long-term

APPENDICES

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Internal social conditions: employment and recruitment	**Employee satisfaction** survey.					
Internal social conditions: employment and recruitment	**Employer branding and attractiveness:** Social benefits, remuneration, policies that are more advantageous than legal obligations (for transport reimbursement or the number of days of parental leave).					
Internal social conditions: training and careers	**Staff training:** survey and training policy.					
Internal social conditions: training and careers	Annual assessment.					

Implementation: Short-term Medium-term Long-term

THEMATIC	MEASURES	COMPLEXITY OF THE MEASURES TO BE TAKEN	STATUS OF THE MEASURE (COMPLETED, IN PROGRESS, TO BE COMPLETED)	PRIORITY MEASURES TO BE IMPLEMENTED	PERSON RESPONSIBLE FOR THE MEASURE	RESOURCES TO ALLOCATE
Internal social conditions: in-house events	Team-building, in-house events, celebrating the year's successes and projects; recognition for services rendered to the establishment.					
Internal social conditions: in-house events	Setting up a warning system, a listening unit and a contact person.					
Internal social conditions: ethics	**Employee representative body** (compulsory for public health establishments), ethics charter signed by all employees; staff trained in ethical issues.					

Implementation: Short-term Medium-term Long-term

List of abbreviations

ADEME: Environment and energy management agency

CSR: Corporate Social Responsibility (CSR)

EOF: End Of Life

GHG: Greenhouse gas

HD: Hemodialysis

HW: Hazardous Waste

IPCC: Intergovernmental Panel on Climate Change

LCA: Life Cycle Analysis

NHW: Non-Hazardous Waste

PD: Peritoneal dialysis

SD: Sustainable development

tCO2e: Tonne of CO2 equivalent

WHO: World Health Organisation

APPENDICES

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