

Sustainable Jet Fuel from Flexible Waste Biomass

Deliverable D8.4: Catalogue of Regulatory Issues

for:
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CO: Coordinator, BEN: Beneficiary

Sulzbach-Rosenberg, 30 April 2019



General Information

Call identifier: H2020-LCE-2017-RES-IA
 GA Number: 792216
 Topic: LCE-20-2016-2017
 Start date of project: 01/04/2018
 Duration: 48 month
 Work Package: WP8 – Regulatory Issues and Risk
 Management Type: Deliverable
 Number: D8.4
 Title: Catalogue of regulatory issues
 Due Date: 31/05/2019, month14
 Submission date: 07/06/2019
 Reference Period: 01/06/2018 – 31/05/2019
 Prepared by: FRA(Lead), UniBo
 Responsible Person: Stefan Eder
 Dissemination Level: Public

Document Type		
<i>PRO</i>	Technical/economic progress report (internal work package reports indicating work status)	
<i>DEL</i>	Technical reports identified as deliverables in the Description of Work	X
<i>MoM</i>	Minutes of Meeting	
<i>MAN</i>	Procedures and user manuals	
<i>WOR</i>	Working document, issued as preparatory documents to a Technical report	
<i>INF</i>	Information and Notes	

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	
CON	Confidential, only for members of the Consortium	



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Executive Summary

The goal of the catalogue of regulatory issues is to better implement FlexJET project actions and successful solutions delivered by the project in the follow up, after project completion. In the following as for “FlexJET technology” and “FlexJET installations” is meant respectively the set of the technologies and the expected configuration of the mature technology (at TRL 9) and the typical installation arising from the main components of the current project.

The scope of the catalogue covers the application of the FlexJET technology to make fuels, green hydrogen, electricity, heat and biochar from the treatment of wastes and residues at industrial scale.

Ultimately, this task aims at satisfy the following questions:

- a) Which *fulfilments* are expected for a FlexJET installation depending on the feedstock, the processing conditions and the products? Which emissions limit values (ELV) and Best Available technology (BAT) apply at a given installation?
- b) Which are the *critical conditions*, i.e. those conditions that might change the magnitude of the required actions such as additional investment, change in the configuration of the technology?
- c) Which *permitting routes* are required as for authorisations and permits? As an example, how many permits are to be demanded and what is the expected timing?

To answer these questions information has been prepared and divided into three products:

- **documentation and database design**, laying down definitions, operational boundaries and requirements for data search and collection,
- **the catalogue (PART A - principles and key provisions)**, a collection of principles and provisions stemming from and environmental law and regulation in EU and consequent permitting routes,
- **the catalogue (PART B - permitting routes)**, focusing on administrative pathways and characteristics of the permits issued by competent authorities.

The first part, documentation and database design contains the necessary definitions and specify the exact scope of the contents and requirements to build up a database with universal rules. Indeed the scope of the Catalogue addresses the EU, however rules were laid down in order to implement it for the international jurisdiction.

The catalogue PART A illustrates the principles of environmental regulation and permitting at EU level and possible permitting routes. A specific section answers specific questions related to the current FlexJET business case.

From this analysis, it was found that there are two Regulations and nine Directives establishing general principles reflected in national regulation affecting FlexJET application in EU:

- 4 EU Directives and 1 Regulation are referring to the core of the activities addressing waste management, environmental pollution, renewable energy
- 5 EU Directives and 1 regulation can incidentally be relevant – depending on circumstances – and include the risk at the processing plant, classification and labelling of dangerous substances, impact assessment and environmental liability.

A synthetic sample of the relevant findings from this section is represented in Figure 1.

- The use of wastes instead of non-waste commodities, the nominal capacity of the plant, the chosen technology, nature of the products are the critical conditions all establishing appropriate regulations, BAT and standards. Different conditions may apply whether a FlexJET installation is a stand-alone plant or is part of other plants such as a waste treatment plant, a wastewater treatment plant, a refinery.



- **The Industrial Emission Directive (IED)** – formerly known as IPPC Directive contains most of the provisions and applies when treating **more than 3 tons per hour** of non-hazardous waste. Below this threshold competent authorities may still include the authorisation of this typology of plants within their local IPPC procedures and request binding rules such as safety measures and monitoring and, more generally, the application of Best Available Technologies (BAT) and Emission Levels Associated with the Best Available Techniques (BAT-AELS), binding rules. BAT and BAT-AELs are indicated as triangles in Figure 1 and apply to different phases and departments of the installation.
- Stemming from IED and other sectorial regulations there are also specific **Emission Limit Values (ELV)**, these are country dependent and are represented as circles in the figure.
- A 3 tonnes per hour threshold is also set in the European Pollutant Release and Transfer Register Directive (E-PRTR), triggering obligations for monitoring and making data accessible and public through a specific European web site.
- The Waste Framework Directive (WFD) recognizes **pyrolysis as a way to perform recovery operations** and allow for classifying this recovery as R3. However, there is uncertainty on how competent authorities might treat FlexJET plant at this regard depending on circumstantial evaluation, irrespective of this decision it has to be considered that all waste treatment installation shall operate with a permit, a permit and qualification for operators shipping wastes is also necessary. Permits to ship wastes and to operate an installation are represented by a star in the figure.
- **Transborder shipping** of wastes require additional permit and consent.
- There is a general **exemption principle** contained in the IED for **waste treatment plants adopting pyrolysis and gasification technology** provided that if the gases resulting from this thermal treatment of waste can cause emissions no higher than those resulting from the burning of natural gas. This principle is embodied in many national regulation and proved useful for the retrofitting of existing plants as a British case demonstrated. Exemptions are represented as a large minus sign (rectangle) in the figure.
- There is a superimposition and overlapping of rules at the level of product compliancy. **REACH apply to crude oil, gasoline and biochar if more than one tonne is produced. Hydrogen is exempted. End of Waste status can be met if REACH and/or existing standards are met.** REACH can help to achieve the End-of-waste status because the requirement for safety to the users and the environment would be met.

Quality standards applying and End of Waste obligations for materials are represented as squares in the downstream side of Figure 1.

- In the case of biofuels, power, heat and hydrogen subsidies have been foreseen either at EU and national level, this is the sign that standards and conditions to circulate these products to the market, this is marked by diamonds.
- While gasoline and biofuels in general are regulated and specific standards play already a role to make waste-derived fuels a norm, standards and quality protocols related to biochar and in general to waste-derived materials such as phosphorous, are still in a suspended status. Despite the many positive running legislative and technical action, despite pending rules, at the date, these materials are to be considered as wastes and disposed as such.

The catalogue include also essential principles and review of EU practices adopted to issues permits for planning, construction and environmental purposes. A synthetic sample of the relevant findings in this section: land law rules over environmental law,

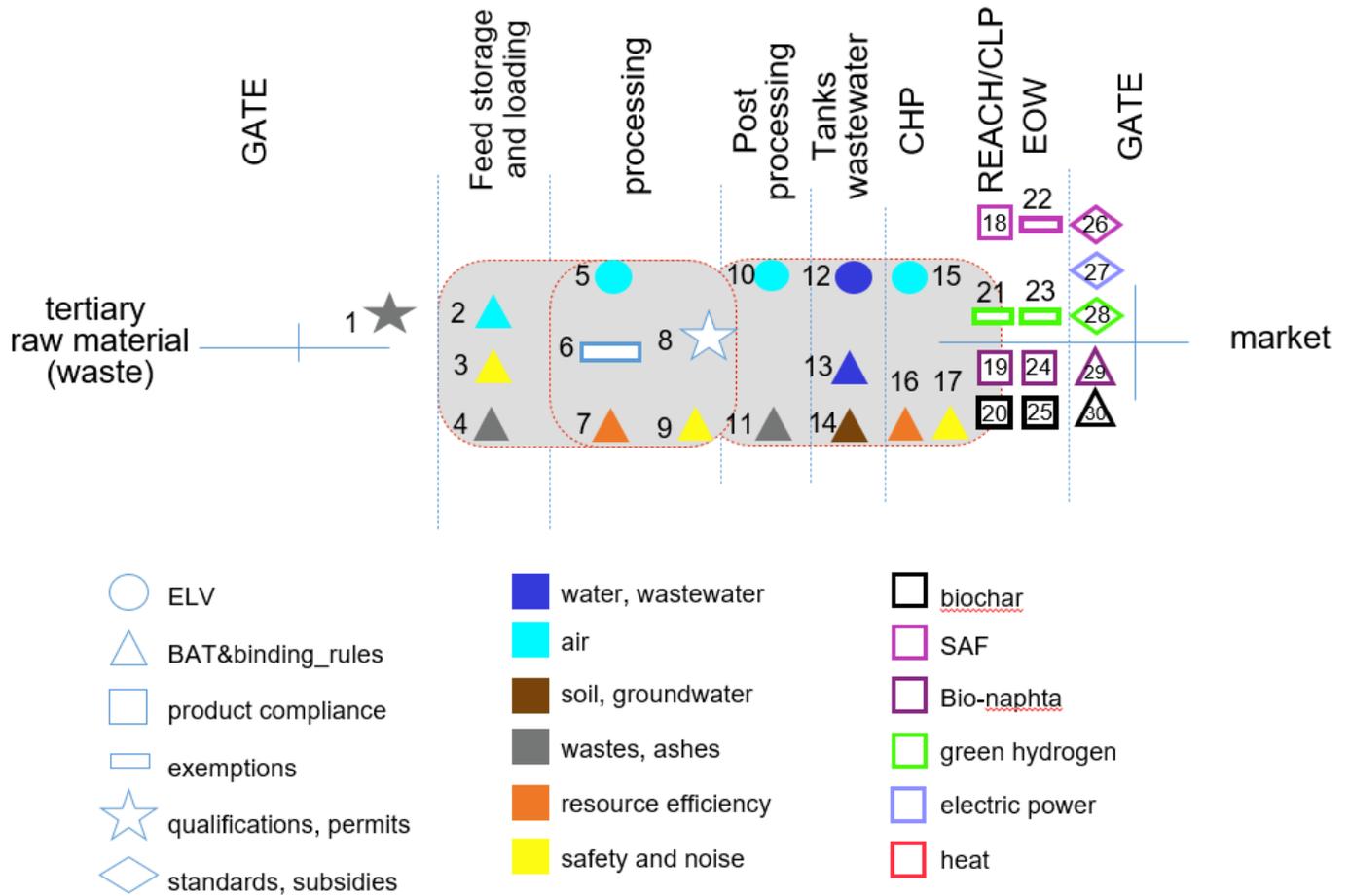
- construction permits ranges from few (4-6) months up to 18 months depending on the jurisdiction,
- new plants undergo a larger number of authorisation procedures/permits than existing ones,
- environmental permits are included or connected to construction permits,
- temporary environmental permits can be issued for research purposes and relevant differences can



- apply across MS,
- new sites treating wastes may trigger national or regional environmental impact assessment (EIA) procedures which can make the process longer.

The catalogue includes some case studies from Italy, Germany, France and UK showing differences in the application of general principles and different configuration as for the permitting route.

Figure 1 - indicative expected key provisions as for a given typical flexJET installation at industrial scale.





1 Introduction and methods

1.1 Goal of the catalogue of regulatory issues and structure of the deliverable

The goal of the catalogue is to prepare action to better implement project actions and successful solutions delivered by the project **in the follow up**, after project completion.

D8.4: “Catalogue of regulatory issues. An intelligence and preparatory action aimed at collecting and sharing specific knowledge to better implement project actions and successful solutions delivered by the project in the follow up. The final output is a document and a highly informative, easy to use and simple database.”

In the following as for “**FlexJET technology**” and “**FlexJET installations**” is meant respectively the set of the technologies and the expected configuration of the mature technology (at TRL 9) and the typical installation at industrial scale arising from the main components of the current project. A more detailed definition of what is meant by FlexJET technology and installation can be found in “Operational boundaries”, page 22.

The task consists in an intelligence and preparatory action aimed at collecting and sharing specific knowledge to better implement project actions and successful solutions delivered by the project in the follow up, at industrial scale. It aims at condensing information into a document and into a highly informative, easy to use and simple database. The following activities have been implemented:

- a) database and documents requirements (chapter/paragraph 1.3, page 16),
- b) database ontology and table of contents (chapter/paragraph 1.4, page 19)
- c) operational boundaries (chapter/paragraph 1.5, page 21)
- d) search with parameters and key words related to FLEXJET challenges, (chapter/paragraph 1.6, page 22)
- e) implementation, (chapter/paragraph 4, page 89)
- f) validation (chapter/paragraph 4, page 89).

The scope of the catalogue covers the application of the FlexJET technology to the treatment of waste and residues to make bioenergy - including fuels, green hydrogen, electricity and heat - and biochar.

Ultimately, this task aims to satisfy the following questions:

- Which fulfilments are expected for a FlexJET installation depending on the feedstock, the processing conditions, the end products? Which emissions limit values (ELV) and Best Available technology (BAT) apply at a given installation?
- Which are the *critical conditions*, i.e. those conditions which might change the magnitude of the required actions (e.g. additional investment, change in the configuration of the technology)?
- Which *permitting routes* are required as for authorisations and permits? As an example, how many permits are to be demanded and what is the expected timing?

Focus is on obligations and compliancy of the operator of the installation excluding the legislative action intended in general to define emission ceilings, targets or general objectives, such as urban air quality condition targets, etc. Specific detail on the focus can be found in paragraph 1.5, page 21.

Therefore, the document and the database will focus on:

- INPUT - compliance to authorisations and permitting to handle inputs and recycling and recovery of input materials such as wastes: this entails all aspects concerning waste treatment and transport including end-of-waste provisions,
- PROCESSING- compliance to health, safety and environmental standards in the perimeter of the plant, this includes all and safety environmental aspects related to the operational activities
- PRODUCTS - compliance of products handling: this includes all labelling and product standard to be secured by the operator.

The focus is on normal operating conditions, excluding emergencies. The covered aspects are detailed in paragraph 2.4 “operational boundaries”.

To answer these questions information has been divided into three sections, each having specific goals

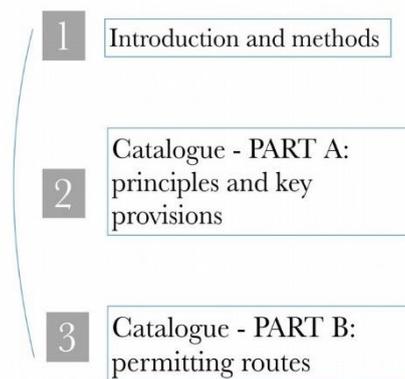
- **method and database design**, this section lays down definitions, operational boundaries and requirements for data search and collection, it has the purpose to organise the content of the catalogue as a databases manageable and to provide a systems design capable to answer fit-to-purposes queries in the course of the project
- **the catalogue (PART A- principles and key provisions)**, a collection of principles and provisions stemming from and environmental law and regulation in EU and consequent permitting routes,
- **the catalogue (PART B- permitting routes)**, focusing on administrative pathways and characteristics of the permits issued by competent authorities.

The catalogue is considered a tool to be implemented and extended to the need of the consortium in the course of the implementation of task 8.1 to serve the specific purposes of the project.

1.1.1 How to read and use this catalogue

The catalogue is organised in three main sections (Figure 2). The general structure of this chapter is illustrated as in the following figure.

Figure 2 - structure and organisation of contents.



Introduction and methods

This section specify the scope of the catalogue, the extent of the detail and the key words, which were regarded as significant and relevant for FlexJET installations. As an example, a key choice was to focus on use of wastes as this is considered more challenging than using other non-waste commodities.

Moreover, in this section details are provided to set up the principle for an operative database.

The catalogue Part A: principles and key provisions

Contains principles and key provisions affecting FlexJET installations. The purpose of this section is to guide FlexJET deployment at industrial scale in view of all fulfilments and consequence, from waste-feedstock supply to processing and product compliancy.

Summarization of the analysis showing the impact on the project can be found in Figure 1, page 9.

The catalogue Part B: permitting routes

This section consider the framework and the rational of permitting procedures and options, including EIA (environmental impact assessment). It may be relevant if projecting the expansion of the technology through different EU and OECD countries.

Contents have been marked in order to provide an indication of the specific purpose and function of the reported information.

→ **{PRINCIPLES}**: these subsections illustrate the key principles and definitions underpinning legislative



provisions, the reader should make use of this information to better interpret and get familiar with the language of specific provisions, their numeration is independent from paragraph numeration. A list of the principles can be found in a specific index. A list of the principles can be found in a specific index.

[KEY PROVISIONS]: these are the regulatory requirements and conditions laid down in the legislative act, which are more likely to affect FlexJET deployment, and may require specific and adequate fulfilments, a list of the key provisions can be found in a specific index. A list of the principles can be found in a specific index.

→**[PRACTICAL DETAILS]:** these are details and specific instructions related to the provisions.

<COMMENTARY>: these are comments underlying the relevance of the provisions.

[! CRITICAL POINTS]: these sections are underlying key parameters, such as the size of the plant, having implications to FlexJET installations, and circumstantial settings, which change the fulfilments.

Moreover, in the text key words have been highlighted in the following ways:

FlexJET keywords: this are specific terms, which belongs to the FlexJET domain including technology, application, products and known issues. Examples of such keywords are **biochar** and **cyanides**.

These keywords are to be used to search through the document and are functional to the database.

regulatory key words, these are keyword belonging to this specific domain and include jargon and topics which should be known and focused.

National case studies are framed in dedicated text boxes and Nagged with country Nags. E.g:

	Case Study. Netherlands

The Catalogue is provided with a list of relevant definition displayed in Table 2, page 14 and most used acronyms Table 1, page 12.

The catalogue is based on a considerable number of works which can be found in the Bibliography/References , while the most updated information, subject to regulation changes from European and national authorities has been reported in a specific DATA SOURCES Annex.

It has to be stressed that as “**FlexJET technology**” and “**FlexJET installations**” is meant respectively the set of the technologies and the expected configuration of the mature technology (at TRL 9) and the typical installation at industrial scale arising from the main components of the current project. None of the considerations hereafter included is addressing the current implementation of the project FlexJET that is at the stage of research & development and demonstration.



1.2 Definitions

Table 1 - acronyms

Acronym	
BAT	Best Available Technology
BAT-AEL	Emission Levels Associated with the Best Available Techniques
BREFs	Best Available Techniques Reference Documents
CAS	Chemical Abstracts Service
CJEU	The Court of Justice of the European Union
CHP	Combined heat and power (cogeneration)
CO	carbon monoxide
EC	European Community
EP	Environmental Permitting
EEC	European Economic Community
ECHA	European Chemicals Agency
EINECS	European Inventory of Existing Commercial Chemical Substances
EIA	Environmental Impact Assessment
ELD	Environmental Liability Directive
ELV	environmental limit values
EMS	Environment Management System
EOW	End of Waste
E-PRTR	European Pollutant Release and Transfer Register
EQS	environmental quality standard
ESB	Reference Document on Best Available Techniques on Emissions from Storage
FMW	Food market waste
GHS	Globally Harmonised System
IPPC	Integrated Pollution, Prevention and Control
MON	Reference Document on the General Principles of Monitoring
MS	Member States
NOx	Nitrogen Oxides
OGC	organic gaseous compounds
OTNOC	Other than normal operating conditions
PAH	Polycyclic Aromatic Hydrocarbons



PCDD-F	Polychlorinated dibenzodioxins and dibenzofurans
REACH	Registration, Evaluation, Authorisation and Restriction of Chemical
RED	Renewable Energy Directive 2009/28/EC
RES	Renewable Energy Source
ROM	Monitoring of Emissions to Air and Water from IED Installations
SAF	Sustainable Aviation Fuel
SCR	Selective catalytic reduction
SDS	Safety Data Sheet
SNCR	Selective non-catalytic reductions
TOC	Total Organic Carbon
TFEU	Treaty on the Functioning of European Union
UCO	Used cooking oil
UVCB	Substances of Unknown or Variable composition, Complex reaction products or Biological materials
WI	Reference Document on Best Available Techniques on Waste Incineration
WID	Waste Incineration Directive 2000/76/EC
WSR	Waste Shipment Regulation
WWTP	Waste water treatment plant



Table 2 - Definitions

Activity	An activity is an industrial activity forming part of an installation
Act of Parliament Legislative Act	The written law of a country. Part of the work of parliaments is to make laws. These are called acts of parliament. Usually a lower and higher chamber /house both debate proposals for new laws and at this stage they are called Bills. If both houses vote for the proposals then the Bill is ready to become an Act. It can only be described as an Act when it has received Assent from the Chief of State (President or Monarch). Referred to as primary legislation.
Backfilling	<p>(art. 2 WFD) means any recovery operation where suitable non-hazardous waste is used for purposes of reclamation in excavated areas or for engineering purposes in landscaping.</p> <p>Waste used for backfilling must substitute non-waste materials, be suitable for the aforementioned purposes, and be limited to the amount strictly necessary to achieve those purposes.</p>
Capacity	(art. 3 IED) 'nominal capacity' means the sum of the incineration capacities of the furnaces of which a waste incineration plant or a waste co-incineration plant is composed, as specified by the constructor and confirmed by the operator, with due account being taken of the calorific value of the waste, expressed as the quantity of waste incinerated per hour
CAS-Number	The Chemical Abstracts Service (CAS), a division of the American Chemical Society (ACS), assigns a CAS name and number to every chemical which enters the CAS registry database. The names and numbers are assigned in sequential order to unique substances identified by CAS scientists. Every substance registered at the Chemical Abstracts Service has a name according to the CAS-nomenclature, which the ACS adopts after recommendations of the ACS committee on nomenclature
Co-incineration	<p>'co-incineration plant' means any stationary or mobile plant whose main purpose is the generation of energy or production of material products and:</p> <ul style="list-style-type: none"> • which uses wastes as a regular or additional fuel, or • in which waste is thermally treated for the purpose of disposal. <p>If co-incineration takes place in such a way that the main purpose of the plant is not the generation of energy or production of material products but rather the thermal treatment of waste, the plant shall be regarded as an incineration plant within the meaning hereunder described.</p> <p>The waste fraction in co-incineration is termed the secondary fuel with the majority fossil (or biomass) fuel known as the primary fuel.</p>
EC Directive	According to art 249 of the EC Treaty, a measure adopted by the 'European Parliament acting jointly with the Council and the Commission', which is 'binding as to the result to be achieved, upon each member state to which it is addressed, but shall leave to the national authorities the choice of form and methods.'
EC-Number (REACH)	The EC-number, i.e. the EINECS, ELINCS or NLP number, is the official number of the substance within the European Union. The EC-number can be obtained from the official publications of EINECS, ELINCS and NLP and of the European Chemicals Agency



EC Regulation	According to art 249 of the EC Treaty (ex art 189), a measure adopted by the European Parliament acting jointly with the Council and the Commission, which 'shall have general application. It shall be binding in its entirety and directly applicable in all Member States.'
Environmental aspect	An activity or group of activities entailing an environmental impact
Emission limit values	maximum emission levels of particular substances from particular installations as defined by authorities or prescribed in permits; it is expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during one or more periods of time;
Environmental quality standard	'Environmental quality standard' means the set of requirements (numerical or qualitative standards) which must be fulfilled at a given time by a given environment or particular part thereof, as set out in Union law.
Facility	'facility' means one or more installations on the same site that are operated by the natural or legal person, it is often the same as installation
Fulfilment	Description of action or actions required to fulfil and meet rules or standards: e.g. "air emissions have to stay below the threshold here below indicated"
Incineration	'incineration plant' means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated. This includes the incineration by oxidation of waste as well as other thermal treatment processes such as pyrolysis, gasification or plasma processes in so far as the substance resulting from the treatment are subsequently incinerated.
Installation	'installation' means a stationary technical unit where one or more activities are carried out such as "Installations for gasification and liquefaction" or "Waste and wastewater management" and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution;
Intermediate	<p>A substance that is manufactured for and consumed in or used for chemical processing in order to be transformed into another substance (hereafter referred to as synthesis):</p> <p>(a) non-isolated intermediate means an intermediate that during synthesis is not intentionally removed (except for sampling) from the equipment in which the synthesis takes place. Such equipment includes the reaction vessel, its ancillary equipment, and any equipment through which the substance(s) pass(es) during a continuous flow or batch process as well as the pipework for transfer from one vessel to another for the purpose of the next reaction step, but it excludes tanks or other vessels in which the substance(s) are stored after the manufacture;</p> <p>(b) on-site isolated intermediate means an intermediate not meeting the criteria of a nonisolated intermediate and where the manufacture of the intermediate and the synthesis of (an)other substance(s) from that intermediate take place on the same site, operated by one or more legal entities;</p> <p>(c) transported isolated intermediate means an intermediate not meeting the criteria of a nonisolated intermediate and transported between or supplied to other sites;</p>



Operator	Operator means any natural or legal, private or public person who operates or controls the occupational activity or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of such an activity has been delegated, including the holder of a permit or authorisation for such an activity or the person registering or notifying such an activity. Also: undertaking, establishment.
Order (Ministerial) aka Decree	A formal written direction given by a member of the executive judiciary; a court decision without reasons.
Permit	A permit is a document issued by a local authority to an operator allowing him or her to operate an installation or mobile plant subject to conditions.
Phase-in substance	<p>A substance which meets at least one of the following criteria:</p> <p>a) It is listed in the European Inventory of Existing Commercial Chemical Substances (EINECS);</p> <p>(b) it was manufactured in the Community, or in the countries acceding to the European Union on 1 January 1995, on 1 May 2004, on 1 January 2007 or on 1 July 2013, but not placed on the market by the manufacturer or importer, at least once in the 15 years before the entry into force of this Regulation, provided the manufacturer or importer has documentary evidence of this;</p> <p>(c) it was placed on the market in the Community, or in the countries acceding to the European Union on 1 January 1995, on 1 May 2004, on 1 January 2007 or on 1 July 2013, by the manufacturer or importer before the entry into force of this Regulation and it was considered as having been notified in accordance with the first indent of Article 8(1) of Directive 67/548/EEC in the version of Article 8(1) resulting from the amendment effected by Directive 79/831/EEC, but it does not meet the definition of a polymer as set out in this Regulation, provided the manufacturer or importer has documentary evidence of this, including proof that the substance was placed on the market by any manufacturer or importer between 18 September 1981 and 31 October 1993 inclusive;</p>
Pollution	pollution’ means the direct or indirect introduction, as a result of human activity, of substances, vibrations, heat or noise into air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment;
Recital	The part of a legal document that explains its purpose and gives other factual information.
Recycling	(WFD, art. 2) Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.
Recovery	as defined in the WFD: any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
Substance	A naturally occurring substance as such, unprocessed or processed only by manual, mechanical gravitational means; by dissolution in water, by



FlexJET technology	flotation, by extraction with water, by steam distillation or by heating solely to remove water, or which is extracted from air by any means
FlexJET installations	It is meant respectively the set of the technologies and the expected configuration of the mature technology (at TRL 9) and the typical installation at industrial scale arising from the main components of the current project.
FlexJET feedstock	Waste to be used in a FlexJET installation as a feedstock (e.g. UCO, FMW, digestate)
Undertaking	(used in the WFD) a company or business

1.3 Database and document requirements

The documents (Catalogue Part A: principles and key provisions and Catalogue Part B: permitting routes) are informed upon the following requirements.

(1) Materiality

The document should be easy searchable because it is assumed that queries will be formulated having as a focus a classification of those issues which matter to the user, i.e. the stakeholders interested in the FlexJET technology diffusion. Such issues include:

- limitations,
- opportunities to improve the technology,
- required investment,
- realisation time.

These elements are the criteria to make choices and which may affect the design of the installation, its geographical placement and key factors, such as the size, or the main products.

(2) Aggregation/Breakdown criterion: fulfilment>specific features>permits>aspects>activities

In order to be easy searchable the information should be organized in order to focus on the key pieces of information. Many different aggregation/breakdown criteria can be adopted:

- all different physical processing units or installation components $c_1, c_2... c_n$ such as "tanks", "TCR package" might have to meet regulation and standards, therefore a compliance list can be aggregated/ broken-down per processing unit,
- classification can be broke-down per impact such air emissions, waste water management, resource depletion, etc., $w_1, w_2... w_j$
- a case sensitive classification can apply therefore results can be broken down per uniform, specific features such as nominal capacity, technology, feedstock (critical conditions) $s_1, s_2... s_5$ operations, activities or processing lines such as start-up, cleaning, char extraction, $a_1, a_2... a_n$ etc. permits all prescriptions originated from a specific permit $p_1, p_2... p_k$.

Among these different options the prevailing principle here is that activities are grouped and divided focusing on the type of action required to satisfy standards and regulations (**fulfilment actions**) $f_1, f_2... f_f$.

Wherever possible the database will allow to search for also according to criteria s, p, c, a , meaning a preference order is established: **fulfilment>specific features>permits>aspects>activities**

(3) Tiered updating effort

The effort to keep the database/document updated should be reduced and divided per levels.

As an example the jurisdiction related to a specific fulfilment can be updated once every 10 years, while



specific fulfilments should be updated yearly.

1.3.1 Database standards

The database makes reference to the conventions, definitions and classification system (ontology) defined by the European Legislation Identifier introduced with Council Conclusions of 10 October 2012 (2012/C 325/02): “Council conclusions inviting the introduction of the European Legislation Identifier (ELI)”.

As an example, the ELI source format for a specific act (law, decree, draft bill, etc.) is formulated according to the following grammar:

eli/{jurisdiction}/{agent}/{sub-agent}/{year}/{month}/{day}/{type}/{natural_identifier}/{level 1...}/{point in time}/ {version}/{language}.

ELI is relevant to the database e will serve as a database standard. The specific ontology is described in the next paragraph 1.4. Moreover, in the database the and the documentation the source format of the Directive will be referred with the following grammar:

{year}/{number}/{emitting body} Directive e.g. 2008/98/EC)

regulations:

Regulation (EC) {number}/{year} e.g. Regulation (EC) 1907/2006)



Table 3 - Properties describing each source of regulation, drawn from the ELI notice.

Field	Field name	Description
Jurisdiction	Jurisdiction	Use of ISO3166: 2 alpha country codes, e.g. 'LU' For international organisations, the registered domain name can be used: e.g. 'EU' or 'WTO'
Agent	agent document	Administrative hierarchical structure, e.g. federal States, constitutional court, parliament, etc. The European institution, other bodies or Member State or regional bodies, who initiated/ adopted the legal resource (e.g. European Parliament, Luxembourg Government, Rheinland-Pfalz Parliament, etc.)
Subagent	Service	Administrative hierarchical substructure, e.g. the responsible ministry
Reference	Year	YYYY Various interpretations allowed depending on countries' requirements, e.g. date of signature or date of publication, etc.
	Month	MM
	Day	DD
Type of legislation	type document	Nature of the act (law, decree, draft bill, etc.). Various interpretations depending on countries' requirements.
	Subtype	Subcategory of an act depending on countries' requirements (e.g. corrigendum)
	Domain	Can be used if acts are classified by themes, e.g. codes
	Natural identifier	Reference or number to distinguish an act of same nature signed or published on the same day
Subdivision	Level 1	Reference to a subdivision of an act, e.g. Article 15
	Level 2	Reference to a smaller subdivision than level 1, e.g. Article 15.2
	Level 3	Reference to a smaller subdivision than level 2
	Level n	Reference to a smaller subdivision
Subject	is about	Reference to "key word" (see Figure 3) If the key word is not found in the list, Eurovoc (eurovoc.europa.eu/) is to be used.
Related sources	Cites	References to other legal resources mentioned in the resource
	Basis for	Legal resource (enabling act) enables another one (secondary legislation)
	based on	Legal resource is based on another legal resource (e.g. a Treaty article, a provision in the constitution, framework legislation, enabling act, etc.)
	Consolidates	Reference to the consolidated version(s) of the resource
Point in time	Point in time	YYYYMMDD Version of the act as valid at a given date
Version	Version	To distinguish between original act or consolidated version
Language	Language	Default language in English (UK). To differ different official expressions of the same act Use of ISO3166: 3 alpha



1.4 Database ontology and table of contents

1.4.1 The ontology of the database

Ontology is an 'explicit, formal specification of a shared conceptualisation and represents a formal description of a set of concepts and the relationships in a given domain. By describing the properties of legislation and their relationships between different concepts, a shared understanding is made possible and ambiguities between terms can be avoided. Being a formal specification, it can be directly machine-processable.

This concept is to key to:

- organise the material in a consistent form,
- make the information in a searchable form,
- make easier the update.

For the purpose of the catalogue (PART – A) an ontology has been conceived as a conceptual ontology where key features of the information to display were presented. The ontology arises from matching four main blocks of information:

- FlexJET key features (e.g. the throughput of TCR is 500 kg/hour, the feeding is FMW and/or digestate),
- Regulation, i.e. the different parts of the corpus of the regulation applying to the specific case,
- Query,
- Critical points.

Key features of FlexJET technology have been considered in chapter 1.5.
The classification of the Regulation is presented in Table 4.

The category "Query" is a standard list of questions, which are asked to a database of regulations and bylaw to isolate and specify certain properties. Despite the number of information sought and reported is larger, the fundamental sought information was:

- applicable emission limit values (ELV),
- permit to operate the plant,
- required qualifications for operators or owners of the plant or facility (e.g. registration, or certified skills)
- binding rules related to the permit and Best Available Technologies (BAT) and Emission Levels Associated with the Best Available Techniques (BAT-AELS) including monitoring,
- compliance requirement for products from wastes,
- presence of standards and voluntary schemes alone or associated to subsidies qualification

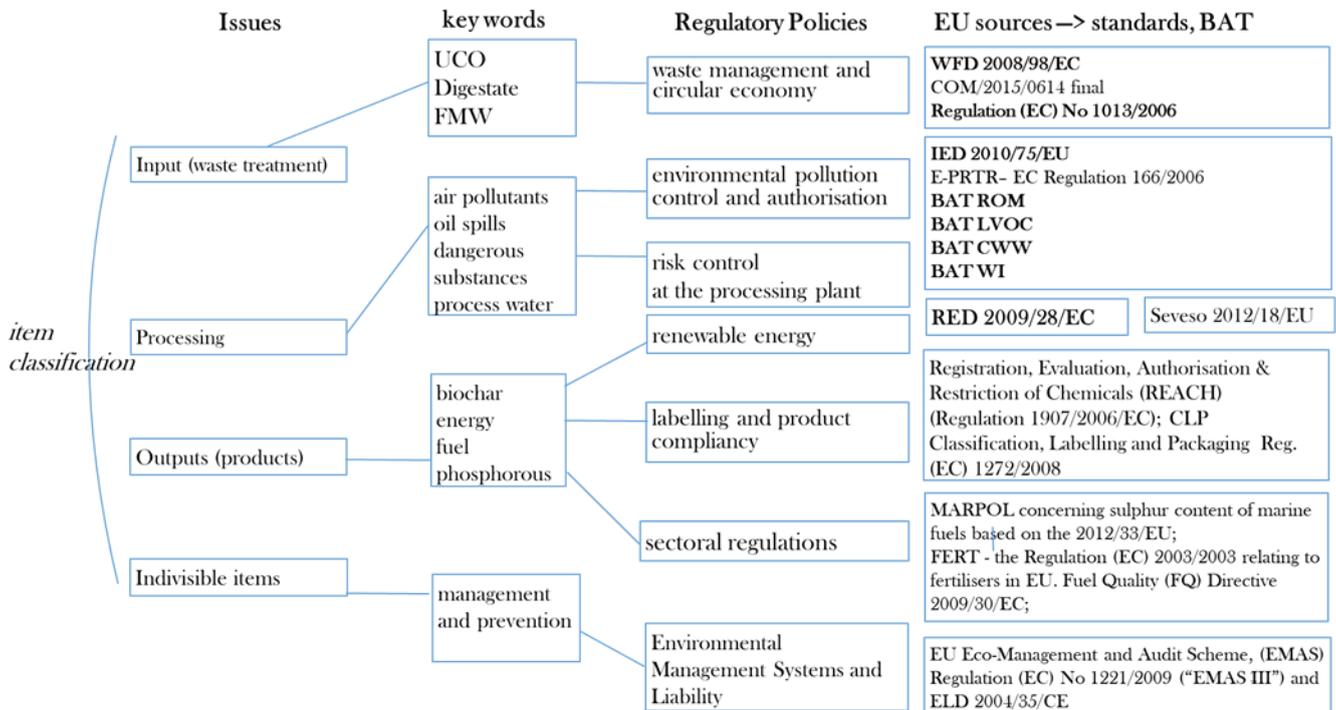
Critical points are defined in the query and they have to be made explicit to understand which part of the regulation would apply.



Table 4 - The object components making of the FlexJET catalogue of regulatory issues.

Class	description
Source	This is a class of legislative acts whose properties are declared in Table 5 including <i>jurisdiction</i> . They can be found with essential identifier across the text.
Issue	This is the domain: classification of the regulatory issues. See representation in Figure 3. Issues are part of the skeleton of the database.
PRINCIPLES	These are the principles underpinning a specific regulation, including recital, purpose and key definitions
PROVISION	This represent the specific fulfilment description invoked by the query (i.e. ELV, mandatory action, required permit, product compliance, qualification) the needed action to be put in place.
COMMENTARY	Annotations of provisions and specific implications for FlexJET
CRITICAL POINT	Critical points are represent circumstantial conditions, which may change provisions, by increasing the number of fulfilments or by generating exemptions.
PRACTICAL DETAILS	These are details and specific instructions related to the provisions, e.g. how to read a certain code, jargon explanation and guide to interpret the provisions.
KEY WORDS	they are key words belonging to a specific source
CASE STUDY	where possible a case study is illustrated

Figure 3 - Domain of research associated to FlexJET challenges and related regulation in EU.





1.4.2 Table of contents

The main questions related to the Catalogue are:

- a) Which fulfilments are expected at the processing installation depending on the feedstock, the processing conditions, and the products? Which emissions limit values (ELV) and Best Available technology (BAT) apply at a given installation.
- b) Which are the critical conditions, i.e. those conditions that might change the magnitude of the required actions such as additional investment, change in the configuration of the technology?
- c) Which permitting routes are required as for authorisations and permits? As an example, how many permits are to be demanded and what is the expected timing?

In Table 5 are indicated the main topics related in the document.

Table 5 - Regulatory issues treated in the document.

<i>fulfilment</i>	<i>section</i>
ELV water	2.2.3
ELV air	2.2.3
BAT and BAT AEs	2.2.3
Waste management procedures and obligations	2.1.2
Waste management transboundary rules	2.1.3, 2.3.4
Waste management EOW	2.1.1, 2.3
Safety obligations	2.2.6, APPENDIX III
Consultation and public participation	2.2.5 3.1.5
Environmental information (e.g. EPTR)	2.2.5
Environmental liability and remedying damage	2.4.1
Export and import provisions of substances	2.1.1, 2.2.52.2.5
Spatial planning	3.1.3
Environmental Impact Assessment	3.1.5
Permits routes	3.1.1
Lead time for permits	81

1.5 Operational boundaries

Operational boundaries include the potential application projected in the future at industrial scale of FlexJET technology. The application include the industrial activities for the treatment of wastes. Details, to be read together with definitions of 1.2 Table 2: definitions, page 12.

Operational boundaries were considered “gate to gate”. However, consideration about the need for supply and trade were included, especially when considering the downstream side of the FlexJET project (see Figure 1).



Table 6 - Operational boundaries.

Activity in scope in accordance to the NACE classification ¹ .	38 Waste collection, treatment and disposal activities, materials recovery 35.1 Electric power generation, transmission and distribution 19 Manufacture of coke and refined petroleum products 20 Manufacture of chemicals and chemical products
Feedstock	waste and namely UCO, FMW and digestate (i.e. flexJET feedstock)
Process	The throughput for transesterification unit is up to 833.3 kg/hr of used cooking oil (UCO), 25.0kg/hr of sodium methylate and 141.7kg/hr of methanol corresponding to a nominal capacity up to 883.33 kg/hr of biodiesel. The throughput for SABR is 21.6 kg/hr of biodiesel and 0.95kg/hr of make-up hydrogen corresponding to a nominal capacity ca. 10.4 kg/hr of jet fuel, 6.19 Kg/hr of (bio-naphta + green diesel) and 0.69 kg/hr of wastewater. The minimal throughput for TCR is 500 kg/hr of FMW and/or digestate corresponding to a nominal capacity between 2-2.5 MW, CHP is less than 1 MW
Potential Products	Bio-naphta Jet fuel Green diesel Crude oil green hydrogen electric power heat biochar
Geographic scope	European Union Additional information when relevant from OECD countries.

Moreover, to better describe the technology and operational boundaries a list of keywords has been prepared (Table 7).

1.6 Search with parameters and key words related to FLEXJET challenges

The following Table 7 indicate the keywords related to FlexJET. These key words have been used to find specific provision in the literature (Chapter 5, 99) and throughout the Sources (APPENDIX I , page 94).

Key words have been identified through the effort of the consortium and were obtained thanks to the description of activities of the project, e.g. in the task “Identifying problems and opportunities” and in the task “Conceptual design study”.

Table 7 - FlexJET keywords.

activity	general keywords	specific keywords
processes and activity	Waste collection and transportation waste treatment waste disposal waste recovery recycling waste water treatment incineration co-incineration electric power generation refined petroleum products chemicals and chemical products	FlexJET feedstock shipping transport, treatment, drying, recovery pyrolysis gasification hydrogen purification crude oil storage SAF storage combined heat and power
feedstock	waste biomas	UCO, FMW, digestate

¹ statistical classification of economical activities of the EU, codes are class of activities.



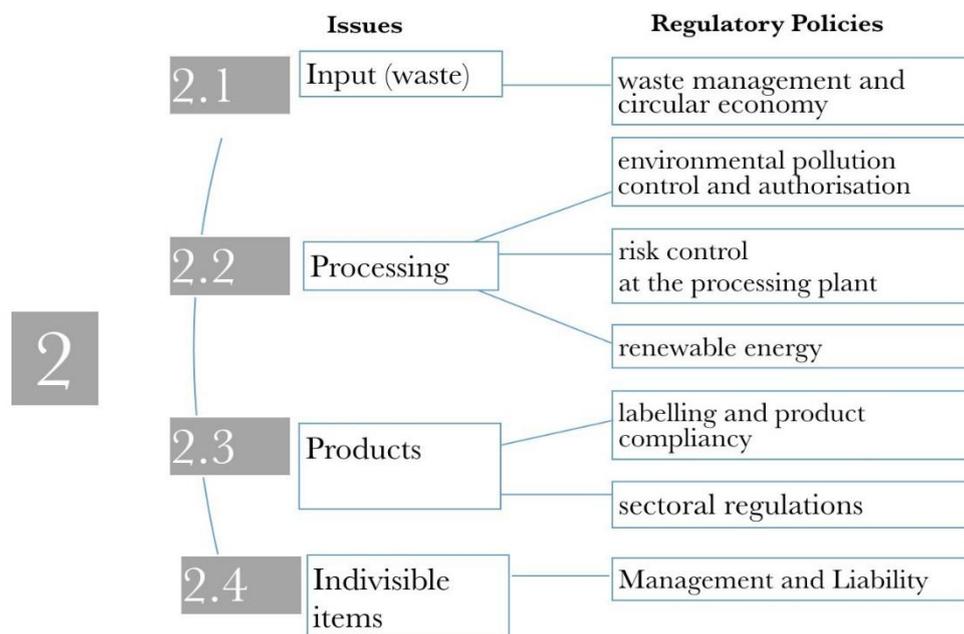
pollution	emissions to air liquid effluents fugitive emissions noise groundwater pollution odours Substances and preparations which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air/liquid	Oxides of nitrogen and other nitrogen compounds Carbon monoxide Volatile organic compounds Metals and their compounds Dust Cyanides Polychlorinated dibenzodioxins and polychlorinated dibenzofurans PAH
products	renewable energy biofuels advanced biofuels fertilisers organic fertilisers nutrient recovery	Bio-naphta crude oil green hydrogen electric power heat biochar FAME SAF/Jet Fuel
waste from the process	waste management	ash process water wastewater biochar off-specs products
risk and safety	explosion oil spill flammables material storage	high temperature hydrogen storage product storage

2 Catalogue Part A: principles and key provisions

The structure of this chapter includes the following items:

1. compliance to authorisations and permitting to handle inputs and recycling and recovery of input materials such as wastes. This entails all aspects concerning waste treatment and transport including end-of-waste provisions,
2. compliance to health, safety and environmental standards in the perimeter of the plant, this includes all environmental aspects related to processing and operational activities,
3. compliance of products handling: this includes all labelling and product standard to be secured by the operator,
4. indivisible items, such as management and liabilities of the operator.

Figure 4 - Structure of chapter 2.



2.1 Waste management and circular economy principles

Directive 2008/98/EC on waste (the “Waste Framework Directive” referred as WFD hereafter) specifies that the main objectives of the EU’s waste policy are to minimize the negative effects of the generation and management of waste on human health and the environment and to reduce the use of natural resources which are crucial for the transition to a circular economy and for guaranteeing the Union’s long-term competitiveness (Art.1).

The concept of the circular economy involves a systemic change that encompasses innovation and technology systems but also policies, society, business models and finance [1]. The idea is to create a regenerative system where products, components and materials are maintained at their highest value for as long as possible and resources can be productively recovered and reintegrated in the economy or provide nutrients to natural systems [2, 3].

The circular economy package [4] is a key pillar of the strategies on resource efficiency.

The actual package has included among other key measures the review of the eco-design directive to include measures to support the reparability, durability and recyclability in product requirements, testing programmes under Horizon 2020 to tackle planned obsolescence, requirements for dismantling, reusing



and recycling of electric products, actions to promote green procurement, quality standards for secondary products, action towards including individual responsibility under [Extended Producer Responsibility \(EPR\)](#) schemes and targeted measures for a number of priority streams such as plastics, food, critical raw materials, building and demolition, **biomass and bio-products**.

The package is accompanied by legislative proposal, indeed the only legislative action directly included in the package, to review waste directives that include provisions such as 65% EU recycling target for municipal waste by 2030, a 75% recycling of packaging waste by 2030, a landfill cap to 10% of total waste by 2030 and harmonization of definitions and calculation methods.

On 27th April 2018, it was issued a further revision of the WFD (Directive of the European Parliament and of the Council amending Directive 2008/98/EC on waste). The Council adopted in June 2018 the waste package, which sets out new rules for waste management and establishes legally binding targets for recycling:

Municipal waste 55% 60% 65% respectively by 2025, 2030 and 2035. (See <commentary> 2 WFD and the breaking news

, page 34).

The legislation contains a landfill reduction target, and sets minimum requirements for all [extended producer responsibility schemes](#). Producers of products covered by these schemes must take responsibility for the management of the waste stage of their products, and will be required to contribute financially. Mandatory extended producer responsibility schemes for all packaging have also been introduced. Member states shall endeavour to ensure that as of 2030, all waste suitable for recycling or other recovery, in particular in municipal waste, shall not be accepted in a landfill.

The newly proposed targets in the circular economy package should contribute to the shift from waste to 'waste as a resource' by boosting resource efficiency and maintaining products and materials and products longer in the productive cycle [5].

EU energy policy aims at reducing the use of natural resources, curbing European dependence on imported energy and reducing GHG emissions. In terms of these objectives, the EU waste energy policies can be seen as complementary. It is acknowledged that energy recovery from waste through incineration can be economically efficient and higher efficiency rates can be achieved through pyrolysis and gasification [6–8].

→ {Principle} 1 Key definitions of wastes, waste holder, and treatment

'Waste' pursuant to Article 3 of the Waste Framework Directive is "any substance or object which the holder discards or intends or is required to discard". A 'waste holder' in this sense is „the waste producer or the natural or legal person who is in possession of the waste". The Waste Framework Directive is further providing definitions for a multitude of subjects related to the various aspects of waste management and for creating consensus in view of the EU-wide communication on waste and a circular economy. These are for example definitions on what 'collection', 'separate collection', 'treatment', and 'recovery' mean. Article 2 also excludes certain substances, such as gaseous effluents or radioactive waste from the scope of the Directive, those are wastes regulated by separate Directives.

A key definition is that of [waste management](#) parsed into category of [operations](#) which are [collection](#), transport, [recovery](#) (including sorting), and [disposal](#) of waste, "waste management" including the supervision of such operations and the [after-care](#) of disposal sites, and including actions taken as a [dealer](#) or [broker](#) including the supervision of such and the after-care of disposal sites, and including actions.

As for recovery it is intended "any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or



waste being prepared to fulfil that function, in the plant or in the wider economy". Annex II of the WFD sets out a non-exhaustive list of recovery operations. However, a distinction is made between general recovery and "[material recovery](#)". The latter means any recovery operation, **other than energy recovery and the reprocessing into materials that are to be used as fuels or other means to generate energy**. It includes, *inter alia*, preparing for re-use, recycling and backfilling.

[Disposal](#) means "any operation which is not recovery even where the operation **has as a secondary consequence the reclamation of substances or energy.**" Annex I of the WFD sets out a non-exhaustive list of disposal operations.

[Recycling](#) means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. **It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for [backfilling](#) operations.**

This latter means any recovery operation where suitable non-hazardous waste is used for purposes of reclamation in excavated areas or for engineering purposes in landscaping. Waste used for backfilling must substitute non-waste materials, be suitable for the aforementioned purposes, and be limited to the amount strictly necessary to achieve those purposes.

<commentary> 1. [How will the withdrawal of UK affect the project?](#)

The withdrawal of the UK from EU (Brexit) could have an impact to the project in several disciplines. For example in case of waste shipment, or if it is necessary to send workers for building up or running the plant. Because there are no decisions made, predictions about the impact of Brexit are not useful now.

- In case of a deal Brexit it is possible that the project would not be affected at all
- In case of a no-deal Brexit, the project will probably be affected from it. (E.g. tolls for shipping wastes from or to the UK)

Risk will be considered in detail after clarification with Brexit (Deal or No-Deal) or if any action is made by the British or European parliament.

2.1.1 Waste classification

The [European Waste Catalogue](#) (EWC) is a list of waste types, established by the European Commission Decision 2000/532/EC1, which categorises wastes based on a combination of what they are, and the process or activity that produces them. It provides a standard framework for the comparison of waste data (statistics) across all member states. The EWC is divided into 20 chapters, most of which are industry-based, although some are based on materials and processes.

→ [Practical Details] 1 [How to read the six-digit codes](#)

Individual waste types are assigned a six-digit code: the first two digits specify the chapter, the next two specify the subchapter, and the last two are specific to the waste type.

If a specific waste has to be classified, the following steps have to be taken:

1. Identify the field of activity to which the waste producer belongs, i.e. chapters 1 to 12 or 17 to 20.
2. Identify the sub-chapter within the chapter which best characterises the source of the waste.
3. Within the sub-chapter, identify the waste category which best characterises the waste. The specific is always to be identified over the general.
4. If no appropriate waste category can be found in chapters 01 to 12 or 17 to 20, chapters 13, 14 and
5. should be examined as described above in steps 2 and 3 before resorting to waste categories XX YY 99



6. If only one waste category XX YY 99 comes into question, the waste should be identified with a waste category in chapter 16, in accordance with steps 2 and 3 above.
7. If a suitable waste category cannot be found in chapter 16, then XX YY 99 is to be used in the chapter and sub-chapter corresponding to the most appropriate source producing the waste.

Hazardous (special) wastes are signified by entries where the six-digit EWC code is marked by an asterisk (*). Hazardous waste entries can also have a non-hazardous 'mirror entry'. These will appear consecutively in the list, but one will be marked with an asterisk (*), normally with reference to 'containing hazardous substances', for example:

17 05 03* Soil and stones containing hazardous substances

17 05 04 Soil and stones other than those mentioned in 17 05 03.

→ [Practical Details] 2 Waste management activities and operations: R or D, R1 or R3

A waste operation (see definition above, →{Principle} 1 page 25) is defined by the types of wastes and by the activities carried out by the facility. A facility carrying out exclusively a recovery operation of -say – garden wastes, such as composting, will display recovery (R) code(s) in its permit, a facility accepting municipal sorted wastes carrying out exclusively a disposal (D) - say landfill operation will display (D) code(s) in its permit. Very often waste facilities can display more than 1 code, because some facility can carry out both classes of operation.

The specific codes of interest are:

- R1 Use principally as a fuel or other means to generate energy
- R2 Solvent reclamation/regeneration
- R3 Recycling/reclamation of organic substances, which are not used as solvents (including composting and other biological transformation processes). *This includes preparing for re-use, gasification and pyrolysis using the components as chemicals and recovery of organic materials in the form of backfilling².*
- R4 Recycling/reclamation of metals and metal compounds
- R5 Recycling/reclamation of other inorganic materials. This includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials.
- R9 Oil re-refining or other reuses of oil.

A key distinction has to be made between recovery (R) and disposal (D).

Once qualified as (R) the competent authority must establish if the main purpose of flexJET installation is to generate energy (R1) or to recycle and reclaim organic substances and to use organic substances components as chemicals (R3) by looking at the relevant definitions. The difference is relevant in terms of permitting.

[! CRITICAL POINT] 1. R3 versus R1 (concerns TCR)

The question of deciding whether a specific installation is (D) or (R) and within this category if R3 or R1 should be regarded as a critical point concerning TCR installation.

(D) categories as associated to incineration and landfilling

² This text has been amended in by the DIRECTIVE (EU) 2018/851 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2008/98/EC on waste. The former – original - text was "This includes gasification and pyrolysis using the components as chemicals." [typo in the original text, ndr]



R1 facilities are easily associated to co-incinerating facilities.

R3 facilities are easily associated to composting and mechanical-biological treatment facilities. Related environmental permitting and applied BAT are therefore different and less stringent from D to R3.

R3 facilities making use of gasification and pyrolysis and using the components as chemicals seem to be limited to some refinery using syngas as feedstock for its processes. The interpretation whether a TCR installation fall under a recovery category or another would depend on i.e. will be scrutinised by the competent authorities regarding to:

- the ratio of recovered materials over input material and consideration about the prevalence of material over energy recovery,
- whether TCR oil and hydrogen can be considered chemicals to feed other industries, such as refineries, including transport fuels,
- to which extent TCR (advanced) oil will be considered different from solid fuels such as the refuse-derived fuel (RDF), i.e. fuel derived from wastes³,
- whether biochar will not be incinerated and will not be used in landfills and/or as backfilling material,
- the nature of the technologies which are used to perform recovery operations.

The applicant has to be prepared to manage uncertainty due to the novelty of FlexJET technology with respect to conventional solutions.

→ {Principle} 2 Hazardous properties make hazardous wastes

Any waste, which displays one or more of the hazardous properties listed in Annex III to the WFD, is 'hazardous waste'. Among the properties listed are explosive, corrosive, carcinogenic, and eco-toxic, as defined in the Annex. However also EWC waste marked with an asterisk (*) shall be considered as hazardous waste. However, a Member State may consider waste as no-hazardous even though it is marked with an asterisk if it has evidence to show that that specific waste does not display any of the properties listed in Annex III. Member States are generally required to ensure that the production, collection, transportation, storage, and treatment of hazardous waste are carried out in conditions providing protection for the environment and human health. With some exceptions, hazardous waste may not be mixed, either with other categories of hazardous waste or with other waste, substances, or materials.

2.1.2 Permits and authorisation to treat and handle wastes

[KEY PROVISION] 1 All waste disposal and recovery operations subject to authorisation

Under Directive 2008/98/EC all waste disposal and recovery operations are subject to prior authorisation delivered by the competent national authorities.

Such permits shall specify at least the following:

- a) the types and quantities of waste that may be treated,
- b) for each type of operation permitted, the technical and any other requirements relevant to the site concerned,
- c) the safety and precautionary measures to be taken,
- d) the method to be used for each type of operation,
- e) such [monitoring and control](#) operations as may be necessary,
- f) such closure and after-care provisions as may be necessary.

³ In order to understand this distinction it has to be recalled that as for material recovery the following is excluded: energy recovery and the reprocessing into materials that are to be used as fuels or other means to generate energy



Permits may be granted for a specified period and may be renewable.

Where the competent authority considers that the intended method of treatment is unacceptable from the point of view of environmental protection, in particular when the method is not in accordance with Article 13, it shall refuse to issue the permit.

It has been established as condition of any permit covering incineration or co-incineration with energy recovery that the recovery of energy take place with a high level of [energy efficiency](#). (See further 2.2.2).

[KEY PROVISION] 2 [Mixing operations of wastes](#)

Member States shall take the necessary measures to ensure that hazardous waste mixed, either with other categories of hazardous waste or with other waste substances or materials, under conditions hereunder specified. Mixing shall include the dilution of hazardous substances.

(a) the mixing operation is carried out by an establishment or undertaking which has obtained a permit in accordance with Article 23, (b) the provisions of Article 13 are complied with and the adverse impact of the waste management on human health and the environment is not increased, and (c) the mixing operation conforms to best available techniques.

	<p>Authorisation for waste management facilities, transport and qualification of the Operators in Italy</p>
<p>Waste treatment permitting is falling under the provisions laid down in Article 208 of Environmental Protection Code. This permit authorises the realisation of the necessary plants and buildings (that is, their construction and compatibility with town and planning law) and the management of waste recovery, storage and/or disposal facilities. It can be granted by the region (unless allocated to a different authority) and lasts for ten years.</p> <p>Once a waste permit has been issued, operators of waste management and disposal activities are recorded in a special register (Albo Nazionale dei Gestori Ambientali). Companies producing waste to be disposed of must comply with various provisions of the Environmental Code, such as keeping a register recording the quantity and quality of waste produced and transferred.</p> <p>In accordance with the above mentioned EU regulations, Article 30 of Legislative Decree 22/97 had established an obligation to be registered for undertakings which collect and transport non hazardous waste produced by others, undertakings which collect and transport hazardous waste (excluding transport by original producers of hazardous waste not exceeding the quantity of 30 kg a day or 30 litres a day) and undertakings which perform site remediation and asbestos-containing materials remediation.</p> <p>In the reform framework of rules regarding waste management, Article 212 of Legislative Decree 152/06 established the "National Register of Environmental Managers", which supersedes the National Register of Waste Managers. The Decree establishes an obligation for dealers and brokers to be registered.</p> <p>In addition National legislation had provided an obligation to be registered for undertakings which perform site remediation and asbestos-containing materials remediation and establishments and undertakings which arrange for disposal or recovery of waste on behalf of others or manage mobile disposal and recovery units.</p> <p>Registration constitutes the permit to collect or transport waste or arrange for the disposal of waste on behalf of other (dealers or brokers).</p> <p>Registration authorizes to manage authorized facilities or to carry out activities authorized by other public administration.</p>	



Registration has a five-year validity and is subject to provision of financial guarantees.

In short, the National Register has the important function to select and qualify undertakings with an obligation to be registered, which, in order to be granted registration, must prove to comply with given technical and financial requirements.

The Register is available at the website <http://www.albonazionalegestoriambientali.it> since 3 November 2004 and contains business name, details, registration categories and classes, types of waste and relevant European waste codes of each undertaking.



2.1.3 Waste Shipment Regulation (Transboundary Movements of Wastes)

EU member states transboundary shipments of waste are regulated by Regulation (EC) No 1013/2006 on shipments of waste (WSR), which is based on the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal of 22 March 1989 and the Decision of the OECD-Council C(2001)107/Final on the Control of Transboundary Movements of Wastes Destined for Recovery Operations. The WSR transposes the procedural rules of both regulations into directly applicable European legislation.

The regulation applies:

- a) between Member States, within the Union or with transit through third countries,
- b) imported into the Community from third countries,
- c) exported from the Community to third countries,
- d) in transit through the Community, on the way from and to third countries.

[KEY PROVISION] 3 Transboundary movements

- shipments of hazardous waste are to be reduced to a minimum, consistent with environmentally sound and efficient management of such waste,
- in the case of shipments of waste for disposal, the principles of proximity, priority for recovery and self-sufficiency at Community and national levels should be taken into account,
- in case of shipments of waste destined for recovery it shall be sure that the waste management facilities receiving this waste apply best available techniques,
- waste from shipments which have been illegal or could not be completed as intended is to be taken back to the country of dispatch and disposed of in an alternative way,
- stipulates the possibilities for the shipment of waste as well as the conditions under which the import/ export of certain wastes in countries outside the EU are limited or forbidden,
- sets up different categories of wastes and groups them in lists (green, amber, red) which serve as the basis to determine shipment possibilities, limitations and the procedures applying,
- stipulates a common, compulsory notification system and standard consignment note for waste shipments,
- organizes supervision and control of shipments of waste in a way which takes account of the need to protect the environment and human health and promotes a uniform application of the regulation.

In the case of shipments of waste destined for disposal operations and waste not listed in Annex III, IIIA or IIIB destined for recovery operations, it is appropriate to ensure optimum supervision and control by requiring prior written consent to such shipments. Such a procedure should in turn entail prior notification, which enables the competent authorities to be duly informed so that they can take all necessary measures for the protection of human health and the environment. It should also enable those authorities to raise reasoned objections to such a shipment.

Based on the WSR a planned transboundary shipment of waste has to be accompanied by certain information or requires prior written notification and consent depending on the intended disposal method, the country of destination and the classification of the waste. Waste is defined in the Waste Framework Directive. Concerning this definition the Commission has issued an interpretative communication on waste and by-products.

Notification shall be effected by means of the following documents: (a) the notification document set out in Annex IA, and (b) the movement document set out in Annex IB.

[! CRITICAL POINT] 2. Transboundary shipment of waste within EU

If transported to the plant from other MS of the EU, the operator should take into account that, for example, flexJET feedstock (UCO) is included in the Amber listed waste (Annex IV, part II) with code B3065 Waste edible fats and oils of animal or vegetable origin (e.g. frying oils), provided they do not exhibit an Annex III characteristic. Shipments within the Union are therefore subject to the procedure of prior written notification



and consent and movement document. Page 1 of the form for the notification is reported in the figure below.

Figure 5: the notification document set out in Annex IA of the Regulation on Waste Shipment

1. Person who arranges the shipment: Name: Address: Contact person: Tel.: Fax: E-mail:		2. Importer/consignee Name: Address: Contact person: Tel.: Fax: E-mail:	
3. Actual quantity: kg: litre:		4. Actual date of shipment:	
5 (a) (?) First carrier: Name: Address: Contact person: Tel.: Fax: E-mail: Means of transport: Date of transfer: Signature:		5 (b). Second carrier: Name: Address: Contact person: Tel.: Fax: E-mail: Means of transport: Date of transfer: Signature:	
5 (c). Third carrier: Name: Address: Contact person: Tel.: Fax: E-mail: Means of transport: Date of transfer: Signature:			
6. Waste generator (?) Original producer(s), new producer(s) or collector: Name: Address: Contact person: Tel.: Fax: E-mail:		8. Recovery operation (or if appropriate disposal operation in the case of waste referred to in Article 3(4)): R-code/D code:	
7. Recovery facility <input type="checkbox"/> Laboratory <input type="checkbox"/> Name: Address: Contact person: Tel.: Fax: E-mail:		9. Usual description of the waste:	
10. Waste identification (fill in relevant codes): (i) Basel Annex IX: (ii) OECD (if different from (i)): (iii) EC list of wastes: (iv) National code:			
11. Countries/states concerned:			
Export/dispatch		Transit	
		Import/destination	
12. Declaration of the person who arranges the shipment: I certify that the above information is complete and correct to my best knowledge. I also certify that effective written contractual obligations have been entered into with the consignee (not required in the case of waste referred to in Article 3(4)). Name: Date: Signature:			
13. Signature upon receipt of the waste by the consignee: Name: Date: Signature:			
TO BE COMPLETED BY THE RECOVERY FACILITY OR BY THE LABORATORY:			
14. Shipment received at recovery facility <input type="checkbox"/> or laboratory <input type="checkbox"/> Quantity received: kg: litre: Name: Date: Signature:			

	Waste Management and transport and transboundary shipments of wastes
<p>In Germany, for the transport of non-hazardous waste, a registration is necessary (§ 53 KrWG), for the transport of hazardous waste, a permission is necessary (§ 54 KrWG).</p> <p>Articles 53 and 54 of the Waste Management Act (KrWG) promulgate a new regulation for companies that collect, transport, deal in, or act as middlemen in connection with waste. These articles eliminate the distinction between waste destined for disposal and waste destined for recycling, replacing these criteria with the potential hazards entailed by the waste in question. All transport operations involving non-hazardous waste are to be notified, and a permit is to be obtained for the transport of hazardous waste</p>	



(pursuant to Articles 53 and 54 of the Waste Management Act (KrWG), respectively), whereby the KrW-/AbfG law's provision remains in effect to the effect that transport permits issued for an unlimited term also qualify as Beförderungserlaubnis. Pursuant to Article 72(5) of the Waste Management Act (KrWG), notification and permit requirements will take effect on 1 June 2014 for companies that collect or transport waste as an ancillary activity, i.e. companies that do not specialize in waste collection and transporting.

The notification form pursuant to Article 53 of the Waste Management Act (KrWG) and a list of the authorizing bodies under Articles 53 and 54 of the Act are available from the websites of regional-state agencies known as Zentrale Koordinierungsstelle der Länder. A form must also be used to apply for a permit under Article 54 of the Act.

Transport permits are governed by the Beförderungserlaubnisverordnung until this regulation will be superseded by the Anzeige- und Erlaubnisverordnung regulation.

As from June 2012, any vehicle that transports waste must display the familiar A-Schild (Article 55). Previously, this requirement did not apply to the transport of non-hazardous waste.

In general, a permission issued by another member state or by a country that is party to the Agreement on the European Economic Area is equal to a German permission in case it is equivalent to the German permission (§ 54 para. 4 KrWG). One important point for the equivalence is the proof of expertise and technical qualification related to waste management. Both the certificates for registration and permission must accompany the transport.

The responsible competent authorities for registration and for the issuance of permission are the authorities of the Federal States. For applicants not based in Germany the competent authority is determined as follows: The authority of the Federal State where the district the transport is undertaken for the first time, is responsible (§ 7 para2 and § 9 para. 2 AbfAEV, respectively), as follows:

- Concerning transit through and shipment to Germany, the regional authority of the Federal State where the district the border crossing takes place, is responsible.
- Concerning shipment from Germany, the regional authority of the Federal State where the district of the place of dispatch is located, is responsible.

2.1.4 End-of-waste

It is possible for a waste to cease to be waste and to be turned into a new product. Products are precisely what the circular economy is all about: turning waste into usable products. While for a long time the issue of what the definition of waste covers was subject are only to case law of the CJEU, the WFD now offers the possibility to remove substances from the legal classification of waste (or define byproducts of the substance in question: which are not the legally classified as waste) at the European Union and national levels. For example, solid recovered fuels (SRF) has been removed from the classification of waste in certain Member States and it is therefore regarded in legal terms as a fuel product. In respect of power generation, this means that the incineration of SRF should be considered not waste incineration but the use of a secondary raw material, SRF, as fuel source for power generation.

The WFD incorporates the concept of end-of-waste (EoW) by setting out conditions whereby substances or objects which meet the waste definition can achieve, after undergoing a recovery operation (including recycling), a non-waste status and thus fall outside the scope of waste legislation.

[KEY PROVISION] 4 Conditions to be met for EoW

The cumulative conditions for specific waste streams are laid down in Article 6(1)(a) to (d) WFD. These are:



1. The substance or object is commonly used for specific purposes;
2. A market or demand exists for such a substance or objects.

These first two conditions are related. Compliance with these two criteria can be indicated by:

- The existence of firmly established market conditions related to supply and demand.
- A verifiable market price being paid for the material.
- The existence of trading specifications or standards.

In addition to criteria 1 and 2, article 6 require that

3. The substance or object fulfils the technical requirements for the specific purpose and meets the existing legislation and standards applicable to products.

Compliance with this criterion is secured if it can verified that

- technical specifications or technical standards exist and these are used for virgin materials for the same purpose;
 - the material is ready for final use and no additional waste treatment steps should be needed.
4. The use of the substance or object will not lead to overall adverse environmental or human-health impacts.
 - Compliance with this criterion can be indicated by comparing the use of the material under the relevant product legislation with the use of the same material under waste legislation ([quality assurance](#)). The following questions are also relevant: Is the product legislation sufficient to adequately minimise the environmental or human health impacts? Would releasing the material from the waste regime lead to higher environmental or health risks?

→ {Principle} 3 Uniform application and case-by-case decisions of EoW

By setting EoW criteria, the authorities have to ensure a high level of environmental protection. Releasing recovered materials from the scope of waste legislation should not, in any event, weaken environmental or health protection. To that end, and where appropriate, the Commission shall adopt implementing acts in order to establish detailed criteria on the uniform application of the conditions laid down to certain types of waste.

Those detailed criteria shall ensure a high level of protection of the environment and human health and facilitate the prudent and rational utilisation of natural resources. They shall include:

- a) permissible waste input material for the recovery operation,
- b) allowed treatment processes and techniques,
- c) quality criteria for end-of-waste materials resulting from the recovery operation in line with the applicable product standards, including limit values for pollutants where necessary,
- d) requirements for management systems to demonstrate compliance with the end-of-waste criteria, including for quality control and self-monitoring, and accreditation, where appropriate, and
- e) a requirement for a statement of conformity.

A Member State may decide on a [case-by-case basis](#), or take appropriate measures to verify, that certain waste has ceased to be waste on the basis of the conditions above mentioned and, where necessary, reflecting the requirements laid down in points (a) to (e), and taking into account limit values for pollutants and any possible adverse environmental and human health impacts.

<commentary> 2 WFD and the breaking news



Some of the latter illustrated provisions – i.e. those indicating the case-by-case principle and amendments to the interpretation of the recovery operation R3 have been added into the existing text through Directive (EU) 2018/851 30 May 2018 amending Directive 2008/98/EC on waste. This Directive is part of the so-called Circular Economy Package (CEP) recently published in the Official Journal (OJ L 150, 14 June 2018), and entered into force on 4 July 2018 and Member States should implement the directive within a two year period. In other words, this is matter subject to continuous revisions.

→ [Practical Details] 3. Why EoW criteria do easily apply to biofuels?

EoW condition	Conditions for Biofuel
✓ the substance or object is commonly used for specific purposes	This condition is easily verified, e.g. by checking copies of documents the operator gave to customers.
✓ a market or demand exists for such a substance or objects	This condition is obviously verified in this case.
✓ the substance or object fulfils the technical requirements for the specific purpose and meets the existing legislation and standards applicable to products	If the biofuel, comply with a standard such as the ASTM standard for Aviation Fuels, the criterion is met.
✓ The use of the substance or object will not lead to overall adverse environmental or human-health impact	Most likely, a REACH registration has to be filed. A registered substance may provide evidence to meet this condition (see <commentary> 12, page 59.) For small quantities. Member States can also set up Quality Protocols to verify this criterion.

As for biochar see Products Compliance, page 57.

<commentary> 3 End-of-Waste in Europe

The conditions meeting EoW criteria may vary throughout Europe. The interpretation and enforcement of the four main criteria of EoW have been implemented in national legislation and through specific implementation acts in different countries. As an example:

- in Italy EoW procedures can be established at different levels, by ministerial decree or by removing the residues of certain productions from the list of wastes, this may happen by establishing specific rules within a value chain (“accordi di filiera”),
- in UK quality protocols have been set, in order to ensure that EoW can be proved,
- Germany, has chosen the specific case way, by implementing the principle through specific ordinances, such as the one for phosphate recovery from WWTP.

In cases where EoW criteria have not been set at EU level, Member States may decide at national level whether certain waste has ceased to be waste. This can relate to classes of materials recovered from waste or to single-case decisions. In their decisions, Member States are bound by, the applicable directives and must take account of CJEU case law.

Member States have to observe the notification requirements in accordance with Directive 98/34/EC⁴. Any draft technical regulations by Member States on EoW criteria have to be notified so that they can be compliance-checked by the Commission against Article 6(1) WFD and as regards their impacts on the functioning of the Internal Market. This includes de facto technical regulations, such as administrative

⁴ Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services, OJ L 204, 21.7.1998, p. 37



provisions or voluntary agreements. Single-case decisions do not have to be notified, even though they may be based on general administrative provisions for which notification is mandatory.



Ensuring EoW through Quality Protocols (QP)– Example Biodiesel

In England, Wales and Northern Ireland there are several QPs available. They are voluntary end of waste frameworks for specific wastes and end uses based on the relevant end of waste case law.

Generally QPs:

- ensure the product made from waste does not pose an unacceptable risk to human health or the environment
- increase market confidence in the quality of products made from waste and their potential value
- encourage greater waste recycling and recovery.

If the waste derived product does not meet the requirements in the relevant QP or meet the end of waste test, it will still be waste so the operator must comply with waste management controls.

An example of QP applied to biodiesel for small quantities.

Waste derived biodiesel will be regarded as fully recovered and no longer subject to waste controls providing an operator can demonstrate:

- the operator used the correct waste input materials
- the operator stored and processed the waste correctly
- the biodiesel the operator produces meets BS EN 14214:2012, passes batch testing, and needs no further treatment before use
- it's only used as a fuel for either vehicle engines or heating fuel.

The only waste inputs the operator can use are [to adopt this QP, ndr]:

- **waste cooking oil** from restaurants, caterers and kitchens (European Waste Catalogue (EWC) code 20.01.25)
- rendered animal fat and waste cooking oil from preparing and processing animal carcasses, meat, fish and other foods of animal and vegetable origin (EWC code 02.02.99)
- waste oils originally edible, but no longer fit for consumption (EWC code 02.03.04)

The operator must **keep records** that include:

- the waste type
- its volume or weight
- the source of the waste
- delivery date
- waste acceptance method (demonstrating the waste the operator accepts is compatible with the allowed inputs)

The operator must **test the first batch** for which seeking quality protocol compliance. This is operator's evidence that the operator is making biodiesel to the correct standard from the start.

The operator must then batch test **once every 10 batches** and at least once a month.

The operator must also:

carry out operator's in-house testing of every batch, where permitted by BS EN 14214:2012 keep samples for at least 3 months in case anyone asks for further tests.



If a batch fails, the operator must continue to treat the batch as waste and apply waste management controls.

The operator must:

- Remove the batch from the process.
- Review methods and controls, make any changes needed, then test every subsequent batch and repeat if necessary until getting a batch test pass.
- Re-refine the failed batch with either allowed waste or non-waste material – either way, the operator must treat all of it as waste until getting a batch test pass.

If the operator blends quality protocol compliant biodiesel with:

- waste material, the whole mixed volume becomes waste and waste management controls applies
- non-waste material, such as virgin oil, the whole volume is non-waste – and will also remain biodiesel providing the blend meets BS EN 14214:2012.

Paperwork and records checklist

The operator must keep information about waste recovery process and biodiesel production methods for **2 years**. This includes where your products go to.

- Incoming waste: record of all waste accepted for biodiesel production
- Production data: results for each batch of tested biodiesel, any test failures, and adjustments made to production and control methods to achieve a test pass
- Outgoing biodiesel product: copies of documents you give to your customers. These should show:
 - date of product dispatch
 - quantity by weight or volume
 - biodiesel batch number
 - name and address of the customer
 - description of the receiving company's business
 - date of last BS EN 14214:2012 test

a copy of the quality statement – this should confirm you produced the biodiesel to the quality protocol standards and that it meets BS EN 14214:2012 Records must be legible and available to the Environment Agency on request.



End of Waste in Italy

In Italy the end-of- waste status can be achieved in three ways not considering European Regulation (this case is quite unlikely for this specific material). Environmental Protection Code, Legislative Decree n.152/2006.

- By Order of the Ministry of the Environment, according to art.184-ter(2) of the Environmental Protection Code according to art. 17(3) Law n.400/1988 . A specific case is the Ministerial Order 12th June 2002, n. 161 defining standards for secondary material recovery from wastes, namely this happened for Solid Recovered Fuel (SRF) a specific subset of the RDF Refuse Derived Fuel.
- By an authorization issued by the Region according to art. 208, 209, 210 of the Environmental Protection Code defining standards for secondary material recovery from wastes.
- By a sectorial agreement among economic parties, local authorities and the Ministry of the Environment according to art. 206 of the Environmental Protection Code (e.g. plastic recovery from packaging).

The general approach in Italy can take as reference the way adopted as for the compost. Compost obtained from source separated feedstock (wastes) has the status of EoW, indeed it is a product according



to Fertilizer Law.



2.2 Environmental and safety aspects related to the operational activities (IPPC)

2.2.1 The Industrial Emissions Directive (IED)

The Industrial Emissions Directive (IED), Directive 2010/75/EU is a European pivotal piece of regulation, which is likely to affect future FlexJET installation because:

- it addresses waste disposal and recovery operations and other operations meeting FlexJET key words
- it is considered to be the blueprint for many specific, sectoral regulation which are applied to national level and also at the level of local authorities such as regions and commonalities.

The Directive came into force on 6th of January 2011 and served to re-cast seven existing Directives, so called [sectoral directives](#), related to industrial emissions into a single legislative instrument. It lays down rules on integrated prevention and control of pollution arising from industrial activities and rules designed to prevent or, where that is not practicable, to reduce emissions into air, water, and land and to prevent the generation of waste, in order to achieve a high level of protection of the environment taken as a whole. The Directive is based on the previous on the former and abrogated Directive 96/61/EC concerning [Integrated Pollution Prevention and Control](#) (IPPC). As for “IPPC plants” still in Member States are intended those activities which were enlisted in annex I of that Directive and which are now enlisted in Annex I of the IED: The IPPC Directive set out the main principles for the permitting and control of installations based on an integrated approach and the application of Best Available Techniques (BAT) to achieve a high level of environmental protection, taking into account the costs and benefits. The sectoral directives laid down specific provisions, including minimum emission limit values (ELVs) for large combustion plants, waste incineration, activities using organic solvent and titanium dioxide production.

The IED aims to achieve significant environmental and public health benefits by reducing emissions across the EU Member States, in particular, through better application of BAT. It introduced minimum provisions for the inspection of industrial installations, the review of permits, reporting on compliance and protection of soil.

The actual IED is composed of eight-four articles grouped in seven chapters and eight Annexes. Chapter I contains common provisions applying to all industrial activities covered by the IED. Chapter II covers the activities set out in **Annex I**, that is, essentially the same as previously covered by the IPPC Directive. Chapters III to VI contain requirements for large combustion plants, waste incineration plants, solvents installations, and titanium dioxide installations, respectively. Chapter VII deals with competent authorities, reporting, committee, penalties, and final provisions.

→ {Principle} 4 Pollution, integrated approach and other key definitions

Many IED definitions apply to FlexJET and would be required to become familiar with most of them.

By ‘pollution’ is meant the *direct or indirect introduction, as a result of human activity, of substances, vibrations, heat, or noise into air, water, or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment*. The Directive is based on the concept of [integrated approach](#) to prevention and control of emissions into air, water and soil, to waste management, to energy efficiency and to accident prevention.

By [operator](#) is understood: *any natural or legal person who operates or controls in whole or in part the installation or plant, or, where this is provided for in national law, to whom decisive economic power over the technical functioning of the installation or plant has been delegated*. (Art 3). Many of these definitions, as they are key to FlexJET technology, are also reported in Table 2: definitions, page 14.



The Directive reports the concept of **substantial change**: *a change in the nature or functioning, or an extension, of an installation or combustion plant, waste incineration plant or waste co-incineration plant which may have significant negative effects on human health or the environment*. This term is key as we might expect that FlexJET plants might integrate in existing plants. It can be expected that in some cases the introduction of such a technology will imply a *substantial change*.

<commentary> 4 Substantial change or variation

This definition means that whether any particular change proposed by an operator would constitute a “substantial change” is something that can only be determined given the facts of the case. This requires consideration of all impacts of any proposed change rather than just the net environmental effect. According to the UK Environmental Agency, the potential impacts of proposals on all possible receptors should be examined to inform a judgement on whether, either in combination or in any individual case, there may be a significant negative effect. Such judgements should take account of not only releases of polluting substances, but also other pollutants (heat, noise and vibrations) as well as alternative types of potential impacts such as increased waste production, energy consumption or the risk of accidents.

Some changes bringing about net benefits may have some constituent negative effects. For example, changing a fuel may lead to reductions in some releases but increases in others. If any potential negative effect is identified, the local authority must consider whether it judges this “significant”. Local authorities should make this judgement by considering whether the effect is of such significance that it justifies requiring the operator to submit proposals that will be subject to consultation with the public consultees. This should be assessed having regard to:

- a) the extent of the potential impact (including geographical area and size of the affected population),
- b) any effects on specifically protected areas, species or other assets of particular significance,
- c) the transboundary nature of the impact,
- d) the magnitude and complexity of the impact,
- e) the probability of the impact, and
- f) the duration, frequency and reversibility of the impact.

[KEY PROVISION] 5 IED (IPPC) permits (Art. 3-5)

Some industrial and waste management activities are inherently higher risk due to their nature, the hazardous properties of the materials used or the scale on which they are undertaken. The activities whose operations could potentially have a significant environmental impact are prescribed in Annex 1 to the IED and are required to hold a permit in accordance with the IED. Member States must therefore ensure that no installation in Annex 1 such as a large combustion plant, waste incineration plant, or waste co-incineration plant, as deemed in the Directive, is operated without a permit. This includes waste recovery pyrolysis based plants.

A permit may cover two or more installations or parts of installations operated by the same operator on the same site if the Member State so decides. It may also cover several parts of an installation operated by different operators.

Prescribed activity descriptions often refer to “**capacity**”, e.g. the activity 5.2 “disposal or recovery of waste in waste incineration plants or in waste co-incineration plants: (a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour”.

Where more than one competent authority or more than one operator is involved or more than one permit is granted, the conditions of, and the procedures for the granting of, the permit shall be fully coordinated in order to guarantee an effective integrated approach by all authorities. (Arts 3–5.)

Without prejudice to the obligation to hold a permit, requirements for certain categories of installations or plants may be laid down in the form of **general binding rules** such as emission limit values (ELV) and



sectoral specific binding rules. The permit must then include a reference to these rules (Art 6).

Operators will submit permit applications containing the information necessary for the competent authority to set permit conditions which are based on the assessment of the effects of certain public and private projects on the environment and on the principle set in the Seveso III Directive (see 2.2.6, page 55) when submitting permit applications).

→ [Practical Details] 4. The definition of capacity in the IED-installations.

The European Commission provided guidance on interpretation and determination of capacity under the IPPC⁵ Directive, and this is still applicable to the IED. In all cases, capacity refers to [potential capacity](#) and not historical or actual production levels or throughput. This means that the design capacity of the installation will usually be the key issue, and this should be based on the maximum operating hours possible. The coherent meaning of “capacity” is the maximum capacity to which the installation is limited technically or legally. That is to say, it is the capacity of the installation to operate 24 hours a day, provided that the equipment is not technically or legally restricted from operating in that way. Conversely, technical restrictions can influence capacity, such as chemical reaction or firing times, or essential cleaning stages between batches.

[KEY PROVISION] 6. Annex I: IED Activities – Permit Preparation (Art. 12)

The IED contains relatively detailed requirements for permit applications [9]. In addition to such rather obvious things as a description of the installation, its activities, and sources of emissions, such applications also must include, among others, a description of the nature and quantities of foreseeable emissions from the installation into each medium as well as identification of significant effects of the emissions on the environment, measures for the prevention, preparation for reuse, recycling, and recovery of waste generated by the installation, the proposed technology and other techniques for preventing or, where this is not possible, reducing emissions from the installation, and measures planned to monitor emissions into the environment. In addition, it must describe further measures planned to comply with the general principles of the basic obligations of the operator and the main alternatives to the proposed technology, techniques, and measures studied by the applicant in outline. All this must also be summarised in a non-technical manner. An application must also, when relevant, include information on the state of soil and groundwater contamination by relevant hazardous substances, that is, a so-called [baseline report](#).

[KEY PROVISION] 7 Permit conditions in the IED (Art. 14)

When a permit is issued it must include all measures necessary for compliance with the general principles and with applicable EQS, that is, Articles 11 and 18. There are also more specific requirements that permits must meet. Among them are that they must include ELVs for polluting substances listed in Annex II, and for other polluting substances, which are likely to be emitted from the installation concerned in significant quantities, appropriate requirements ensuring protection of the soil and groundwater and measures concerning the monitoring and management of waste generated by the installation, suitable emission monitoring, measures relating to conditions other than normal operating conditions such as [start-up and shut-down operations](#), leaks, malfunctions, momentary stoppages, and definitive cessation of operations, and requirements concerning the periodic monitoring of soil and groundwater in relation to relevant hazardous substances likely to be found on site.

[! CRITICAL POINT] 3. FlexJET in Annex I?

FlexJET technology may fall under the activity [5.2](#). “disposal or recovery of waste in waste incineration plants or in waste co-incineration plants: (a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour” (Annex I). However Annex I provisions and IED principles will still be relevant if:

- FlexJET technology is taking place in a IPPC installations, such as those enlisted here below

⁵ http://ec.europa.eu/environment/archives/air/stationary/ippc/pdf/capacity_guidance.pdf

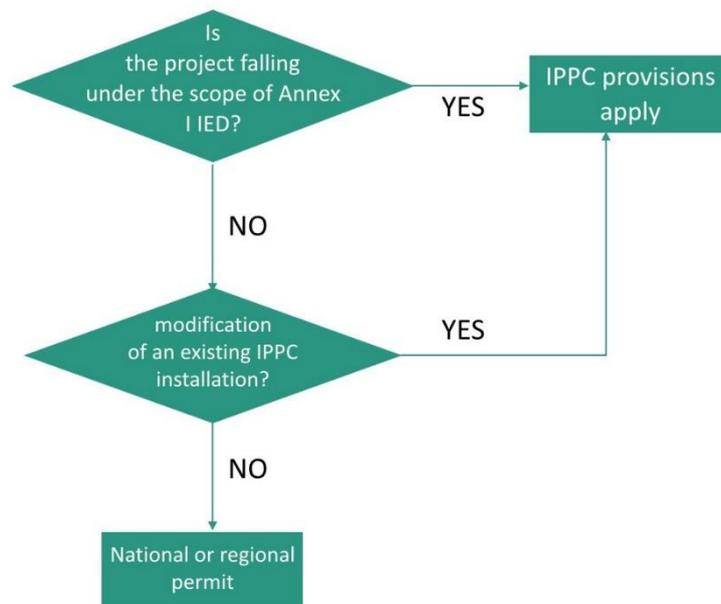
- national and/or regional authorities decide to derive similar IPPC provisions for installations below IPPC thresholds. In the latter case, typically permit is emitted provided BAT are applied.

There are other activities included in Annex I, which might make FlexJET activities to be considered in the scope of Annex I at a future industrial scenario, these are:

- 4.1 Production of organic chemicals, such as [...] oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters and mixtures of esters, acetates, ethers, peroxides and epoxy resins,
- 4.2 Production of inorganic chemicals, such as: (a) gases, such as ammonia, chlorine or hydrogen chloride, fluorine or hydrogen fluoride, carbon oxides, sulphur compounds, nitrogen oxides, **hydrogen**, sulphur dioxide, carbonyl chloride,
- 4.3 Production of phosphorous-, nitrogen- or potassium-based fertilisers (simple or compound fertilisers).

[<commentary> 5. IED and Annex I relevance](#)

Figure 6: relevance of IED (IPPC) provisions in environmental permitting



IED is relevant to FlexJET future technology because it can be adopted in waste treatment plants and chemical plants, which may fall under the EU IED installations (See 1.5 Operational boundaries).

It is also noteworthy that a permit can apply to only a component of an installation and not to the whole. Moreover, it has to be considered that country IPPC like regulation for sub threshold plants can envisage IED- like provisions for these installations.

[KEY PROVISION] 8. Reconsideration of the permit conditions in the IED (Art. 21)

Permit conditions must be periodically reconsidered by the competent authority and, where necessary to ensure compliance with the Directive, updated. Within four years of publication of BAT (see 2.2.2) conclusions relating to the main activity of an installation, all the permit conditions for the installation concerned must be reviewed and, if necessary, updated to ensure compliance with the Directive, in particular the provisions on ELVs. While it is new BAT conclusions relating to the main activity of an installation that trigger the obligation to reconsider the permit, that reconsideration shall also take into account all new or updated BAT conclusions applicable to the installation that have been adopted since the permit was granted



or last reconsidered. In this way, *horizontal* BAT conclusions as well as those relating to other than the main activity also affect the content of permits. If an installation is not covered by any of the BAT conclusions, the permit conditions shall be reconsidered and, if necessary, updated where developments in BAT allow for significant reduction of emissions. There is also a general obligation to reconsider and, where necessary, update permit conditions in certain situations. These are when the pollution caused by the installation is of such significance that the existing ELVs of the permit need to be revised or new. Such values need to be included in the permit, when the operational safety requires other techniques to be used, and where it is necessary to comply with a new or revised Environmental Quality Standards EQS.

[KEY PROVISION] 9. The pyrolysis gasification exemption principle in IED

Article 42(1) provides that: “This Chapter [Chapter IV addressing co-incinerating and large combustion plants ndr] shall not apply to gasification or pyrolysis plants, if the gases resulting from this thermal treatment of waste are purified to such an extent that they are no longer a waste prior to their incineration and they can cause emissions no higher than those resulting from the burning of natural gas.”

This is key provision because:

- a) exempt applicants from all special provisions laid down in Chapter IV (here not reported)
- b) it set binding rules to issues permits for pyrolysis based plants.

As an example of the latter, such provision was adopted in the legislation of most EU countries and contributed to review existing permits, as the following case in UK shows.

<commentary> 6. Positive impact of pyrolysis gasification exemption principle

This principle represents an advantage for existing plants, because large combustion plants, incinerating and co-incinerating activities undergo stricter regulations established in Chapter IV and can benefit from conversion.

	Exemplary application of the pyrolysis gasification exemption in UK
<p>A key learning can be found in a UK Environment Agency permitting decisions “variation for Huntingdon Green Energy Generation Facility” operated by Energy 10 Limited. This was a decision to revise, among others, the pyrolysis activity schedule reference implying certain obligations for activities related to “pyrolysis of other carbonaceous material” [10].</p> <p>The variation number is EPR/CP3034CD/V003. The application was duly made on 20/08/14 and response came from the UK Agency in August 2015.</p> <p>The primary activity at the site of the applicant is an integrated two-stage pyrolysis system which pyrolyses waste in a conversion vessel to produce synthesis gas which is burnt in an engine. The plant is designed to process a maximum quantity of 6 tonnes per hour.</p> <p>The pyrolysis activity has been reclassified from according to the “Local Authority Integrated Pollution Prevention and Control” (LA-IPPC) under case 5.1 A(1)(b) non-hazardous waste incineration activity to a 1.2 A(1)(j)(iv) activity involving pyrolysis of other carbonaceous material. The Industrial Emissions Directive (IED) article 42 states that chapter IV on waste incineration and co-incineration shall not apply to gasification or pyrolysis plants, if the gases resulting from this thermal treatment of waste are purified to such an extent that they are no longer a waste prior to their incineration and they can cause emissions no higher than those resulting from the burning of natural gas. There are two elements to this, the syngas must be no longer a waste and cause emissions no higher than those resulting from burning of natural gas.</p> <p>The syngas at the Energy 10 Limited Huntingdon site was considered to meet end of waste status in March 2014 provided that the syngas actually meets the specification outline in the variation application EPR/CP3034CD/V003 during operation. The LA could ascertain that information submitted in support of the permit variation application</p>	



indicated that combustion of the syngas would result in emissions no higher than from natural gas burning.

The application was submitted as a normal variation and determined as a substantial variation. The addition of new listed activities to the permit classified the application as **substantial**.

The competent authority decided therefore that, *the activity would not fall within chapter IV [of the IED, ndr] and is reclassified. **The IED Chapter IV emission limit values (ELVs) and monitoring requirements no longer apply to the emissions to air from emission point A1, which includes emissions from the gas engine burning the syngas and the pyrolysis burners.** The facility was previously subject to the IED Chapter IV ELVs and monitoring requirements through its previous classification as a non-hazardous waste incinerator. The ELVs incorporated through this variation are subject to different sampling requirements **but continue to deliver a high level of protection for the environment and human health.** We are satisfied that the ELVs included the permit reflect **BAT** for this type of plant.*

This document is instructive to understand how the public authority intervenes also on other aspects.

[! CRITICAL POINT] 4. ANNEX III – Target parameters

The following “indicative list of the main polluting substances to be taken into account if they are relevant for fixing emission limit values air” included in Annex III of the IED is relevant because typify BAT and sought parameters from local authorities.

1. Sulphur dioxide and other sulphur compounds
2. Oxides of nitrogen and other nitrogen compounds
3. Carbon monoxide
4. Volatile organic compounds
5. Metals and their compounds
6. Dust
7. Asbestos (suspended particulates, fibres)
8. Chlorine and its compounds
9. Fluorine and its compounds
10. Arsenic and its compounds
11. Cyanides
12. Substances and preparations which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air
13. Polychlorinated dibenzodioxins and polychlorinated dibenzofurans.

→ {Principle} 5. Polluter pays principle

When assessing the level of significance of the pollution of soil and groundwater caused by the operator which would trigger the obligation to return the site to the state described in the baseline report, Member States should take into account the permit conditions that have applied over the lifetime of the activity concerned, the pollution prevention measures adopted for the installation, and the relative increase in pollution compared to the contamination load identified in the baseline report. Liability regarding pollution not caused by the operator is a matter for relevant national law and, where applicable, other relevant Union law (see also 2.4.1)

[KEY PROVISION] 10. Baseline, closure, remediation and other provisions.

To make operators to be held responsible for on the quality of soil and groundwater, the IED introduces two linked requirements. One is that operators must prepare and submit a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013. This applies to activities which involve the use, production, or release of relevant hazardous substances



that may contaminate the soil and groundwater at the site of the installation.

The report must contain information on soil and groundwater measurements that reflect the state at the time the report is drawn up. It should by that means permit a quantified comparison between the state of the site described in the report and the state of the site upon definitive cessation of activities, in order to ascertain whether a significant increase in pollution of soil or groundwater has taken place. The second part of the obligation, which applies upon definitive cessation of the activities, is to assess the state of soil and groundwater contamination by relevant hazardous substances used, produced, or released by the installation. Where the installation has caused significant pollution of soil or groundwater by relevant hazardous substances compared to the state established in the baseline report, the operator shall be required by the permit to take the necessary measures to address that pollution so as to return the site to the state described in the report. The technical feasibility of such measures may be taken into account. However, if the contamination of soil and groundwater at the site poses a significant risk to human health or the environment as a result of the permitted activities carried out by the operator before the permit for the installation is updated for the first time after 7 January 2013 then the operator shall be required to take the necessary actions so that the site, taking into account its current or approved future use, ceases to pose such a risk. (Art 22.)

[commentary](#) 7. Crude oil and SAF as hazardous substances

It has to be considered, in this context, that the fuels generated by FlexJET will be considered as hazardous substances.

The IED contains many other provisions applying to the FlexJET plants. These includes among others, inspections and public participation.

2.2.2 Best Available Technologies (BAT)

Best Available Techniques (BAT) are defined in the framework of the Industrial Emissions Directive as the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing in principle the basis for ELVs designed to prevent and where that is not practicable, generally to reduce emissions and the impact on the environment as a whole. It is considered as the main reference for determining standards under the environmental permitting (EP) regulations in the field of the IPPC in most of EU countries. It is based on the principle of the [exchange of information](#) laid down in Article 13 of the IED.

→ {Principle} 6. Exchange of information and flexibility as for the BAT

Central to this approach is the general principle given in Article 11 that operators should take all appropriate preventative measures against pollution, in particular through the application of best available techniques enabling them to improve their environmental performance.

The permit conditions including emission limit values must be based on the Best Available Techniques (BAT). In order to define BAT and the BAT-associated environmental performance at EU level, the Commission organises an exchange of information with experts from Member States, industry and environmental organisations. This work is co-ordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies at the EU Joint Research Centre in Seville (Spain). This process results in BAT Reference Documents (BREFs), the BAT conclusions contained are adopted by the Commission as Implementing Decisions. The IED requires that these BAT conclusions are the reference for setting permit conditions.

The IED allows competent authorities some [flexibility](#) to set less strict emission limit values. This is possible only in specific cases where an assessment shows that achieving the emission levels associated with BAT described in the BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to the geographical location or the local environmental conditions or the



technical characteristics of the installation. The competent authority shall always document its justification for granting such derogations. However, the contrary is also possible, as Article 193 TFEU guarantees Member States the right to maintain or introduce more stringent environmental measures.

BAT is a dynamic concept and so the review of BREFs is a continuing process. For example, new measures and techniques may emerge, science and technologies are continuously developing and new or emerging processes are being successfully introduced into the industries. In order to reflect such changes and their consequences for BAT, this document will be periodically reviewed and, if necessary, updated accordingly.

The JRC prepares the revision by collecting evidence data on emissions and techniques used, publishing proposals, organising meetings where all parties can express their opinions and pulling together and incorporating the representations made by industry, environmental organisations and the member states. A formal draft of the BAT conclusions is then published for a further extensive round of comments, leading to the final revised BREF.

→ {Principle} 7. BAT, BREF, BATC, BAT-AELs

The term “best available techniques” is defined in Article 2(11) of the Directive as “the most effective and advanced stage in the development of activities and their methods of operation which indicate the Practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole.” Article 2(10) goes on to clarify further this definition as follows:

‘techniques’ includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned,

‘available techniques’ are those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator,

‘best’ means most effective in achieving a high general level of protection of the environment as a whole.

‘BAT reference document’ (BREF) are document, resulting from the exchange of information, drawn up for defined activities and describing, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques, giving special consideration to the criteria listed in Annex III.

‘BAT conclusions’ (BATC) means a document containing the parts of a BAT reference document laying down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures.

REF or ‘reference document’ or ‘reference report’ means a document, which is not a BREF, used as the main reference for a specific horizontal task or topic in the Sevilla process conducted by the European Integrated Pollution Prevention and Control Bureau (EIPPCB) and the JRC.

The BAT are the basis for BAT-associated emission levels (**BAT-AELs**) which again form the basis for the emission limit values (ELVs) stated in permits. Only the ELVs are legally binding and not the BAT by themselves.

→ [Practical Details] 5. BAT suiting FlexJET

Concerning the SABR-TCR plant, the Reference Documents are:



- Best Available Techniques (BAT) Reference Document for the Production of Large Volume Organic Chemicals [25] published in 2017; for instance, this includes also the transesterification process.
- BAT Reference Document (BREF) for Waste Incineration ([WI](#)) published August 2006 [11] have been revised and a working draft has been published October 2017 and submission of the final draft BREF to the IED Article 13 forum was in 2018. The scope is including energy recovery categorized as R3 “Recycling/reclamation of organic substances which are not used as solvents”. Pyrolysis and Gasification are in scope. Therefore, this BREF is the FlexJET key BAT for TCR plant:
- BAT Reference Document (BREF) for Refining of Mineral Oil and Gas [26] published in 2015. For instance, this includes Hydrogen-consuming processes.
- REF on Monitoring of Emissions to Air and Water from IED Installations ([ROM](#)), published July 2018 [13]. This REF is useful as it is laying down appropriate methods and systems to monitor many of the key aspects included in FlexJET plants.
- BREF for Waste Treatment ([WT](#)) published June 2006 have been revised and a working draft has been published May 2017, submission of the final draft BREF to the IED Article 13 forum was in 2017 [12]. BREF for Waste Treatment, despite the name is addressing common process steps such as reception, storage, handling, blending and mixing, cleaning and washing and the mechanical treatment of waste such as shredding, biological treatment of waste such as anaerobic digestion, and physio-chemical treatments (PCT), such as treatment of excavated contaminated soil re-refining of waste oil, treatment of water-based liquid waste and re-activation of carbon, combustion and pyrolysis is explicitly excluded. **It has to be considered as a complementary to FlexJET core of technologies, which are covered also by the above-mentioned BREFs.**

The reference web site where to find updated materials is:

<http://eippcb.jrc.ec.europa.eu/reference/>

Outside Europe as for terminology and country approach can be found through OECD [14].

Official vs. Draft editions contain key differences. As an example, the current official WI document (version 2006) refers mainly to incineration of waste, however the non-official yet published draft addresses also co-incineration.

Formal draft of (B)REFs have no legal value. They only reflect work in progress and are available for information only to those interested in the exchange of information under Article 13(1) of the IED.

However in the light of the principle stated in art. 193 TFEU competent authorities can decide to take more stringent measures for areas not covered by the BAT and as a consequence to make reference to published drafts. In view of the adoption of the already submitted draft, hereafter the main provisions and applicable details are captured and commented. **Also, as BREF 2017 report most recent data and comparison the information and considerations reported here below make reference to the most updated – yet not official – versions.**

2.2.3 BREF for Waste Incineration

The BREF is organised in the following chapters:

- I. General Information in Waste Incineration
- II. Applied Processes and Techniques
- III. Current Emissions and Consumptions Levels (including emissions to air, water, solid residues, energy consumption and production, noise, and other resources used)
- IV. Techniques to consider in the determination of BAT



- V. Best Available Techniques (BAT) Conclusions
- VI. Emerging Techniques
- VII. Concluding remarks and recommendations for the future work

Annexes (relevant section: Gasification and Pyrolysis system costs for MSW) the considered potential impacts of waste incineration installation are:

- emission to air and water
- production of waste
- noise and vibrations
- energy consumption and production
- fugitive emissions
- hazardous substances

→ [Practical Details] 6. Specific definition of the BAT and emissions levels

The BREF adopt specific definitions, which has to carefully taken into consideration to understand the BAT-AELs. E.g.: by “Hg” is intended “The sum of mercury and its compounds, expressed as Hg” TVOC Total volatile carbon, expressed as C (in air).

Emission levels associated with the best available techniques (BAT-AELs) for emissions to air refer to concentrations, expressed as mass of emitted substances per volume of flue-gas under the following standard conditions: dry gas at a temperature of 273.15 K and a pressure of 101.3 kPa, and expressed in the units mg/Nm³, µg/Nm³, ng I-TEQ/Nm³ or ng WHO-TEQ/Nm³. The reference oxygen levels used to express BAT-AELs in the BAT are shown in the table below.

Activity	Reference oxygen level (OR)
Incineration	11% vol
Bottom ash treatment	No correction for the oxygen level

The BREF WI covers the following activities of interest for FlexJET and specified in Annex I to Directive 2010/75/EU:

The activity known as “Disposal or recovery of waste in waste **incineration** plants” and specific activities:

- a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour,
- b) for hazardous waste with a capacity exceeding 10 tonnes per day,

The activity known as “Disposal or recovery of waste in waste **co-incineration** plants”:

- a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour,
- b) for hazardous waste with a capacity exceeding 10 tonnes per day;

whose main purpose is not the production of material products and:

- which combust only waste, other than waste defined in Article 3(31)(b) of Directive 2010/75/EU, or
- where more than 40 % of the resulting heat release comes from hazardous waste, or
- which combust mixed municipal waste.

Emission and consumption data were mainly derived from the general data collected at individual sites in 15 Member States and in Norway in accordance to the principle of the exchange of information. Other sources of aggregated data and site-specific data were received from Member States and Industry. Data presented in the WI Draft BREF intended to illustrate the current emission levels found in the sector, with



the related consumption levels for energy and water, and including data and details on the wastes used as well as the residues produced.

→ **{Principle} 8. Definition of pyrolysis**

The BREF WI refers to three main types of thermal waste treatment relevant to this BREF:

- incineration full oxidative combustion (by far the most common process),
- pyrolysis thermal degradation of organic material in the absence of oxygen,
- gasification partial oxidation

Different processes are featured as in the table below.

Table 10: Typical reaction conditions and products from pyrolysis, gasification and incineration processes.

Acronym	Pyrolysis	Gasification	Combustion
Reaction temperature (oC)	250 – 700	500 – 1600	800 - 1450
Pressure (bar)	1	1 – 45	1
Atmosphere	Inert/nitrogen	Gasification agent: O ₂ , H ₂ O	Air
Stoichiometric ratio	0	<1	T>1
Products from the process Gas phase:	H ₂ , CO, hydrocarbons, H ₂ O, N ₂	H ₂ , CO, CO ₂ , CH ₄ , H ₂ O, N ₂	H ₂ , CO, CO ₂ , CH ₄ , H ₂ O, N ₂
Solid phase:	Ash, coke	Slag, ash	Slag, ash
Liquid phase:	Pyrolysis oil and water		

<commentary> 8. Why definitions in BREF WI matter to FlexJET

The definition of pyrolysis for wastes are the typical description of processes and values and ranges expected by the competent authorities when dealing with this sort of projects.

It has to be considered that not all kind of installation are considered in the BREF/REF. BREF WI address a general category of installations including the manifold variations of actual existing technologies.

BAT apply here because they address waste thermal treatment and in particular the energy recovery of waste through pyrolysis/gasification. Most of the main stages of an incineration process and of the purposes of such a treatment can be associated to a FlexJET technology.

They matter because:

- FlexJET technology may be adopted in current installations performing incineration or co-incineration,
- FlexJET installation can be easily associated to co-incinerating processes, especially considering that transesterification, pyrolysis, and gasification processes are in the scope of the BAT,
- BAT can be used voluntarily to compare FlexJET performance against current waste (digestate/FMW) co-incinerating or incinerating plants.

Therefore, the definition of pyrolysis have to be used to compare the language and the preparation of a



permit.

→ {Principle} 9. Key aspects of pyrolysis of wastes

In BREF words, pyrolysis and gasification plants follow a similar basic structure to waste incineration installations, but differ significantly in detail. The main differences are as follows:

- Pre-treatment, may be more extensive to provide a narrow profile feedstock. Additional equipment is required for handling/treating/storing the rejected material
- loading, greater attention required to sealing
- thermal reactor, to replace (or in addition to) the combustion stage
- product handling, gaseous and solid products require handling, storage and possible further treatments
- product combustion, may be a separate stage and include energy recovery by combustion of the products and subsequent gas/water/solid treatments and management

Both pyrolysis and gasification are said *to differ from incineration in that they may be used for recovering the chemical value of the waste (rather than its energetic value). The chemical products derived may in some cases then be used as feedstock for other processes. However, when applied to wastes, it is more common for the pyrolysis, gasification and a combustion-based process to be combined, often on the same site as part of an integrated process. When this is the case, the installation recovers the energy value rather than the chemical value of the waste, as would a normal incinerator would.*

It is expected that *in some cases, the solid residues arising from such processes contain pollutants that, in an incineration system, would be transferred to the gas phase, and then, with efficient flue-gas cleaning, be removed with the FGC residue.*

Pyrolysis plants for waste treatment are expected to have the following basic process stages:

- I. Preparation and grinding: the grinder improves and standardises the quality of the waste presented for processing, and so promotes heat transfer.
- II. Drying (depends on process): a separated drying step improves the LHV of the raw process gases and increases the efficiency of gas-solid reactions within the rotary kiln.
- III. Pyrolysis of wastes, where in addition to the pyrolysis gas a solid carbon-containing residue accumulates which also contains mineral and metallic portions.
- IV. Secondary treatment of pyrolysis gas and pyrolysis coke, through condensation of the gases for the extraction of energetically usable oil mixtures and/or incineration of gas and coke for the destruction of the organic ingredients and simultaneous utilisation of energy.

Pyrolysis and gasification processes are expected to export some of the energetic value of the incoming waste with the substances they export, e.g. syngas, chars, oils. In many cases, these products are either directly or subsequently burned as fuels to utilise their energy value, although they may also be used for their chemical value as a raw material, after pre-treatment if required.

[KEY PROVISION] 11. General BAT for Waste Incineration and flexJET feedstock

The BATs for Waste Incineration and flexJET feedstock are listed in the BREF WI final draft 2018, 5.1 BAT conclusions, page 472-497. [15]
(http://eippcb.jrc.ec.europa.eu/reference/BREF/WI/WI_BREF_FD_Black_Watermark.pdf)

BAT 1. In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) (see 2.4.2 and APPENDIX II EMS RECOMMENDATIONS, page 96)



In order to prevent the occurrence of accidents and to reduce the environmental consequences when accidents occur, BAT is to set up and implement an accident management plan (see BAT 1). (see § 2.2.6)

BAT 2. BAT is to determine the gross electrical efficiency and/or the gross total heat efficiency of the incineration plant by carrying out a performance test at full load (1), according to EN standards, after the commissioning of the plant and after each modification that could significantly affect the gross electrical efficiency and/or the gross total heat efficiency of the plant. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

BAT 3. BAT is to monitor key process parameters relevant for emissions to air and water including those given below.

<i>Stream</i>	<i>Parameter(s)</i>	<i>Monitoring</i>
Flue-gas from incineration	Flow, oxygen content, temperature, pressure, water vapour content (1)	Continuous measurement
Waste water from flue-gas treatment	Flow, pH, temperature	
Wastewater from bottom ash treatment	Flow, pH, temperature	

BAT 4. BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

Substance/ Parameter	Process	Standard(s) ⁶	Minimum Monitoring frequency	Monitoring associated with
HCl	Incineration	Generic EN standards	Continuous	BAT 28
HF	Incineration	Generic EN standards	Continuous	BAT 28
SO ₂	Incineration	Generic EN standards	Continuous	BAT 28
Dust	Bottom ash treatment	EN 13284-1	Once p. year	BAT 27
Dust	Incineration	Generic EN standards and EN 13284-2	Continuous	BAT 26
NO _x	Incineration	Generic EN standards	Continuous	BAT 29
N ₂ O	Incineration in fluidised bed furnaces,	EN 21258	Once p. year	BAT 29
NH ₃	When SNCR and/or SCR is used	Generic EN standards	Continuous	BAT 29
TVOC	Incineration	Generic EN standards	Continuous	BAT 30
CO	Incineration	Generic EN standards	Continuous	BAT 29

⁶ Generic continuous standards for measurements are EN 15267-1, EN 15267-2, EN 15267-3, and EN 14181. These standards have been revised and updated in the REF MON (see [2.2.4 REFs on Monitoring of Emissions to Air and Water from IED Installations \(ROM\)](#))



PCDD/F	Incineration	No EN standard available for long-term sampling, EN 1948-2, EN 1948-3	Once every month ⁷	BAT 29
Dioxin-like PCBs	Incineration	No EN standard available for long-term sampling, EN 1948-2, EN 1948-4	Once every month ^{8 9}	BAT 29
PAH	Incineration	Generic EN standards	Continuous	BAT 29
Hg(II)	Incineration	Generic EN standards	Continuous	BAT 29
Sb+As+Cr+Co +Cu+Pb+Mn+ Ni+V	Incineration	Generic EN standards	Continuous	BAT 29
Cd+Tl	Incineration	Generic EN standards	Continuous	BAT 29

BAT 5. BAT is to appropriately monitor emissions from the incineration plant during OTNOC. The monitoring can be carried out by direct emission measurements or by monitoring of surrogate parameters if this proves to be of equivalent or better scientific quality than direct emission measurements. Emissions during start-up and shutdown while no waste is being incinerated may be estimated based on at least one measurement campaign per year carried out during a planned start-up/shutdown operation.

BAT 6. BAT is to monitor emissions to water from FGC and/or bottom ash treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

BAT 7. BAT is to monitor the total organic carbon content of bottom ashes/slugs and/or their loss on ignition in accordance with EN 13137 and/or EN 15169. The minimum monitoring frequency is once every three months.

BAT 8. addresses incineration of hazardous waste containing POPs is here omitted

BAT 9. In order to improve the overall environmental performance of the incineration plant, as part of the waste stream management plan (see BAT 1), BAT is to use all of the techniques (a) to (d) given below, and, where relevant, also techniques (e) and (f):

- a) Determination of the types of waste that can be incinerated
- b) Set-up and implementation of waste characterisation and pre-acceptance procedures
- c) Set-up and implementation of waste acceptance procedures
- d) Set-up and implementation a waste tracking system and inventory

⁷ The monitoring frequency of once every month refers to monitoring carried out by long-term sampling. For incineration plants incinerating exclusively non-hazardous waste and for incineration plants where PCDD/F emission levels are proven to be sufficiently stable, the monthly long-term sampling of PCDD/F emissions can be replaced by periodic measurements with a minimum monitoring frequency of once every six months. In this case the relevant standard for sampling is EN 1948-1.

⁸ The monitoring frequency of once every month refers to monitoring carried out by long-term sampling. For incineration plants burning exclusively non-hazardous waste and for incineration plants where PCB emission levels are proven to be sufficiently stable, the monthly long-term sampling of PCB emissions can be replaced by periodic measurements with a minimum monitoring frequency of once every six months. In this case the relevant standard for sampling is EN 1948-1.

⁹ Where emissions of dioxin-like PCBs are demonstrated to represent less than 20 % of the toxic equivalent of PCDD/F expressed as WHO-TEQ, the monitoring of PCBs does not apply.



- e) Waste segregation
- f) Verification of waste compatibility prior to mixing or blending.

BAT 10. In order to improve the overall environmental performance of the bottom ash treatment plant, as part of the waste stream management plan (see BAT 1), BAT is to set up and implement an output quality management system.

BAT 11. In order to improve the overall environmental performance, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 10) including the elements given below.

As for municipal solid waste (e.g. food market waste):

- Radioactive detection
- Weighing of the waste deliveries
- Visual inspection
- Periodic sampling and analysis of key properties/substances (e.g. calorific value, water and ash content)

BAT 12. In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given below.

	Technique	Description
a.	Impermeable surfaces and segregated drainage	Depending on the risks posed by the waste in terms of soil or water contamination, the surface of the waste reception, handling and storage areas is concrete-based or made impermeable to the liquids concerned, and fitted with segregated drainage.
b.	Adequate storage capacity	Measures are taken to avoid accumulation of waste, such as: the maximum waste storage capacity is clearly established and not exceeded, taking into account the characteristics of the wastes (e.g. regarding the risk of fire) and the treatment capacity, the quantity of waste stored is regularly monitored against the maximum allowed

BAT 13. is addressing clinical wastes: it is omitted

BAT 14. In order to improve the overall environmental performance, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques such as [only most appropriate are reported here, ndr] advanced control system.

BAT 15. In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant’s settings, e.g. through the advanced control system, as and when needed and practicable, based on the characterisation and control of the input waste (see BAT 12).

BAT 16. In order to improve the overall environmental performance of the incineration plant, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation, preventive maintenance) to limit as far as practicable shutdown and start-up operations.

BAT 17. In order to reduce emissions to air and water, BAT is to ensure, by appropriate design, operation

and maintenance, that the flue-gas cleaning system and the waste water treatment plant are used at optimal capacity and availability.

BAT 18. In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and/or to water from the incineration plant during OTNOC, BAT is to set up and implement a [risk-based OTNOC management plan](#) as part of the environmental management system (see BAT 1) that includes all of the following elements:

- identification of potential OTNOC, of their root causes (e.g. failure of emission abatement systems, including identification of equipment critical to the protection of the environment ('critical equipment')) and of their potential consequences, and regular review and update of the list of identified OTNOC following the periodic assessment below,
- appropriate design of critical equipment (e.g. compartmentalisation of the bag filter, supplementary burners to heat up the flue-gas and obviate the need to bypass the bag filter on start-up, etc.),
- set-up and implementation of a preventive maintenance plan for critical equipment, monitoring and recording of emissions during OTNOC and associated circumstances (see BAT 6),
- periodic assessment of the emissions occurring during OTNOC (e.g. frequency of events, duration, amount of pollutants emitted) and implementation of corrective actions if necessary.

BAT 19. Not relevant

BAT 20. In order to increase the energy efficiency of the incineration plant, BAT is to use a combination of the techniques given below [only most appropriate are reported here, *ndr*].

	Technique	Description	Applicability
b.	Reduction of the flue-gas flow	Flue-gas flow is reduced through, e.g. flue-gas recirculation. A smaller flue gas flow reduces the energy demand of the plant	For existing plants. The applicability of flue-gas recirculation may be limited due to technical constrains.
c.	Minimisation of heat losses	Heat losses are minimised through: <ul style="list-style-type: none"> • thermal insulation of furnaces and boilers, • recovery of heat from the cooling of slags and bottom ashes 	Generally applicable

BAT 21. In order to prevent or reduce diffuse emissions, including **odour emissions**, from bulk waste storage areas including tanks and bunkers and from waste pre-treatment areas, BAT is to enclose those areas, keep them under negative pressure, and use the extracted air as combustion air for incineration. When the incinerator is not available (e.g. during maintenance), BAT is to minimise the amount of waste in storage and/or to use an alternative abatement technique (e.g. a wet scrubber).

BAT 22. In order to prevent diffuse emissions of **volatile compounds** from the handling of gaseous and liquid wastes, BAT is to feed them into the furnace by direct injection.

BAT 23. In order to improve the environmental performance of the incineration plant and to reduce emissions to air, BAT is to optimise the combustion performance, the flue- gas flow through the FGC system, and the injection of reagents by using flow modelling.

BAT 24. Not relevant

BAT 25. In order to reduce emissions to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques: bag filter, electrostatic precipitator, dry sorbent injection, wet scrubber. BAT-associated emission levels (BAT-AELs) for emissions to air of



dust, metals and metalloids from incineration. (The associated monitoring is in BAT 5.)

[commentary](#) **9. Slags and bottom ashes=char?**

Some of these BATs might be transposed from slags and bottom ashes to char especially considering gasification of the char. See also BAT 27.

Parameter	BAT-AEL (mg/Nm ³)	Averaging period
Dust	2–5	Daily Average
Cd + Tl	0.01–0.02	Average over the sampling period
Sb + As + Pb + Cr + Co + Cu+ Mn + Ni + V	0.05–0.3	Average over the sampling period

BAT 26. In order to reduce dust emissions to air from the treatment of slags and bottom ashes, BAT is to carry out these activities in enclosed equipment under negative pressure and to treat the extracted air with a bag filter. Corresponding BAT-AELs are 2-5 mg/Nm³ averaging over the sampling period.

BAT 27. addresses HCl, HF and SO₂ to air and is omitted

BAT 28. addresses peak emission of HCl, HF and SO₂ to air and is in accordance to BAT 27 omitted

BAT 29. In order to reduce NO_x emissions to air while limiting the emissions of CO and N₂O from the incineration of waste and the emissions of NH₃ from the use of SNCR and/or SCR, BAT is to use a combination of the techniques given below.

<i>Parameter</i>	<i>BAT-AEL (mg/Nm³) New Plant</i>	<i>BAT-AEL (mg/Nm³) OldPlant</i>	<i>Averaging Period</i>
NO _x	50-120 ¹⁰	50-120 ¹⁰¹⁰¹¹	Daily Average
CO	10-50	10-50	
NH ₃	2-10 ¹⁰	3-10 ¹⁰¹²	

BAT 30. In order to reduce emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below [a sample is displayed here]

- Optimisation of the incineration process
- Control of waste feed
- Flue-gas quenching
- Dry sorbent injection

BAT-associated emission levels (BAT-AELs) for emissions to air of TVOC, PCDD/F and dioxin-like PCBs from incineration are reported therein.

BAT 31. In order to reduce mercury emissions to air from the incineration of waste, BAT is to use

¹⁰ The lower end AEL range can be achieved when using SCR

¹¹ The higher end AEL range is 180 mg/Nm³ where SCR is not applicable

¹² For existing plants fitted with SNCR without wet abatement techniques, the higher end of the BAT- AEL range is 15 mg/Nm³



one or a combination of the techniques given below.

BAT-associated emission levels (BAT-AELs) for emissions to air of mercury are reported therein. As an indication, the half-hourly average mercury emission levels will generally be 15–40 µg/Nm³ for existing plants and 15–35 µg/Nm³ for new plants.

BAT 32. In order to prevent the contamination of uncontaminated water and to reduce emissions to water, BAT is to segregate waste water streams and to treat them separately, depending on the pollutant content.

BAT 33. In order to reduce water usage and to prevent or reduce the generation of wastewater from the incineration plant, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Waste-water-free FGC techniques	Use of FGC techniques that do not generate waste water	Generally applicable
b.	Recycling of boiler drain water	Recycling of boiler drain water (e.g. for its use in a wet scrubber, or a quench system)	Generally applicable
c.	Recycling of waste water from the wet scrubber	The waste water originating from the wet scrubber is treated and recycled to the wet scrubber	only applicable to plant fitted with a wet scrubber

BAT 34. In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.

- Primary techniques:
 - Optimisation of the incineration process (see BAT 14) and/or of the FGC system (e.g. SNCR/SCR, see BAT 29(f))
- Secondary techniques:
 - Preliminary and primary treatment
 - Physico-chemical treatment
 - Final solids removal

BAT 35. In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.

BAT 36. In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.

- Screening and sieving
- Crushing
- Aeraulic separation
- Recovery of ferrous and non-ferrous metals
- Ageing
- Washing

BAT 37. In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques [a sample is given here]:

- Appropriate location of equipment and buildings



- Operational measures
- Low-noise equipment
- Noise attenuation
- Noise control-infrastructure

[<commentary> 10. BATs for Transesterification and Hydro-treatment.](#)

The BATs regarding transesterification are listed as the ones above in BREF – LVOC, 13.1 General BAT conclusions, page 587-597. [25]
 (http://eippcb.jrc.ec.europa.eu/reference/BREF/LVOC/JRC109279_LVOC_Bref.pdf)

The BATs regarding hydrotreatment and –cracking are listed in BREF – Refining of Mineral Oil and Gas, 5.1 General BAT conclusion for the refining of mineral oil and gas, page 591-598. [26]
 (http://eippcb.jrc.ec.europa.eu/reference/BREF/REF_BREF_2015.pdf)

2.2.4 REFs on Monitoring of Emissions to Air and Water from IED Installations (ROM)

The ROM summarises general and commonly available information collected by the European IPPC Bureau from various sources, such as international and national standards, as well as scientific publications. The monitoring of emissions to air and water represents an important element in preventing and reducing pollution from industrial installations and in ensuring a high level of protection of the environment taken as a whole.

This document covers the following topics:

- general aspects of monitoring such as:
 - monitoring objectives,
 - monitoring approaches including direct measurements and indirect methods,
 - quality assurance, including personnel and laboratory qualifications, use of EN, SO and other standards, as well as measurement uncertainty,
- monitoring approaches for other than normal operating conditions,
 - monitoring of emissions to air (including odours, diffuse and fugitive emissions, biomonitoring) and water (including toxicity tests), covering:
 - measurement planning,
 - measurement frequency,
 - continuous and periodic measurement methods,
 - measurement, expression and documentation of peripheral parameters/reference quantities,
 - data treatment,
 - reporting,
 - costs of monitoring,
 - monitoring using indirect methods such as surrogate parameters, mass balances and Predictive Emission Monitoring Systems (PEMS).

Table 11: a sample of the information contained in the REF MON [13]

Technique	Description	Notes
Carbon monoxides	EN 15058:2017 is the standard reference method (SRM) for the measurement of carbon monoxide using non-dispersive infrared spectrometry (NDIR).	Interferences from other absorbing gases, in particular from water and carbon dioxide, as well as detector instability and drift are suppressed, e.g. by measuring at a specific wavelength, by employing dual cell monitors and/or by using gas filter correlation (GFC)



Dust - general	The SRM for the measurement of dust is EN 13284-1:2017. It is based on isokinetic sampling (see Section 4.3.3.6), filtration with a plane filter, and gravimetry.	Deposits upstream of the filter in the sampling equipment are also recovered and weighed. The sampling is carried out at an appropriate temperature to minimise the effects of thermally unstable dusts (e.g. at the stack temperature or at least the recommended temperature of 160 °C). Dust measurements in waste gases saturated with water vapour are more difficult than in dry waste gases and lead to higher LoDs
Dust - general PM10 and PM2.5	EN ISO 23210:2009 allows the simultaneous determination of the concentrations of PM10 and PM2.5 in waste gases.	The method is based on the use of a two-stage cascade impactor which separates the particles into three groups with aerodynamic diameters greater than 10 µm, between 10 µm and 2.5 µm and smaller than 2.5 µm. The separated particles are deposited on collecting plates and back-up filters and subsequently quantified by gravimetry. Particle-size distributions cannot be determined when the waste gas is saturated with water vapour due to the presence of droplets

[<commentary> 11. Helping competent authorities to define monitoring requirements](#)

The document represents a practical guidance for the application of the BAT conclusions on monitoring in order to help competent authorities to define monitoring requirements in the permit of IED installations. Even though the plant is not subject to the IED Directive, the following reports and documents need to be considered for the implementation of an Environmental Monitoring Plan (EMP).

2.2.5 Information and Public Participation

The European Pollutant Release and Transfer Register (E-PRTR) is the Europe-wide register that provides easily accessible key environmental data from industrial facilities in European Union Member States and in Iceland, Liechtenstein and Norway. It has been established by the Regulation (EC) No 166/2006.

The register contains data reported annually by some 30,000 industrial facilities covering 65 economic activities across Europe. For each facility, information is provided concerning the amounts of pollutant releases to air, water and land as well as off-site transfers of waste and of pollutants in wastewater from a list of 91 key pollutants including heavy metals, pesticides, greenhouse gases and dioxins for the year 2007 onwards. Some information on releases from diffuse sources is also available. As for 'off-site transfer', it has meant the movement beyond the boundaries of a facility of waste destined for recovery or disposal and of pollutants in wastewater destined for wastewater treatment.

[→ {Principle} 10. Obligation to report release of pollutants for transparency matter](#)

The register shall include information on releases of pollutants, practical transfers of waste, and pollutants in wastewater, as specified in the regulation. It shall also include information on releases of pollutants from diffuse sources, where available. The Regulation obliges operators, which meet certain criteria to report annually on release and transfers of pollutants to their respective competent national authority. The register contributes to transparency and public participation in environmental decision-making. It implements for the European Union the UNECE (United Nations Economic Commission for Europe) PRTR Protocol to the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.

[\[KEY PROVISION\] 12. Information on releases of pollutants, off-site transfers of waste, and pollutants in wastewater](#)

The releases of pollutants and practical transfers of waste exceeding 2 tonnes per year or of non-hazardous waste exceeding 2 000 tonnes per year that must be reported by the operators of the facilities carrying out the activities listed in Annex I. When preparing the report, the operator concerned shall use the best



available information, which may include **monitoring data, emission factors, mass balance equations, indirect monitoring or other calculations, engineering judgements** and other methods in line with Article 9(1) and in accordance with internationally approved methodologies, where these are available.

The operator of each facility concerned shall keep available for the competent authorities of the Member State the records of the data from which the reported information was derived for a period of five years, starting from the end of the reporting year concerned. These records shall also describe the methodology used for data gathering.

[! CRITICAL POINT] 5. Annex I: activities triggering E-PTPR

Enlisted among the installations there are those in the scope of the incineration of non-hazardous waste of the Waste Incineration Directive (WID) 2000/76/EC including also thermal treatment processes such as **pyrolysis**, gasification or plasma processes, with a capacity of **3 tonnes per hour**.

Other installation where FlexJET technology can be added such as “Urban waste-water treatment plants with 100.000 population equivalents”, “paper and wood production and processing” and “chemical installations” are in the scope of the Regulation.

<commentary> 12. Need to monitor and communicate environmental information

Despite the specific thresholds set by the Regulation, the principle of transparency and information to the public has to be taken account also for below-threshold plants. Local authorities tends to shape proper and specific – country based – procedure in the same way as for local IPPC plants.

2.2.6 Risk Control at the processing plant

Most of the IPPC authorisation and permitting systems across EU are based on “the need to prevent accidents and to minimise the consequences for the environment”. This is an obligation for all Local-Authorities IPPC installations. As an example according to DEFRA [10] local authorities should include such conditions in permits which require specific measures to be taken to prevent/reduce accidents and to mitigate the consequences of any accidents that might occur. This might, in some cases, take the form of a requirement for a plan or list of contingency measures or arrangements, covering some or all of the installation, to be submitted for the authority’s approval, and to be reviewed and updated at a given frequency. The extent of such conditions will be dependent on the level and type of risks involved. Authorities should also include conditions, as appropriate, requiring that operators investigate and undertake remedial action immediately in the event of an abnormal incident or accident which may cause pollution, notify the authority without delay of such an incident or accident, and promptly record the events and actions take.

As a template of a bespoke accident plan, see the model proposed in the BAT APPENDIX III Accident Management Plan, page 98.

2.2.7 The Seveso III Directive 2012/18/EU on Prevention of Major Industrial Accidents

The Directive lays down rules for the prevention of major **accidents** involving dangerous substances and the limitation of their consequences for human health and the environment, with a view to ensuring a high level of protection throughout the Union in a consistent and effective manner (Art 1). In doing so it also implements the UNECE Convention on Transboundary Effects of Industrial Accidents within EU law.

→ {Principle} 11. Establishment classification in The Seveso Directive and key definitions

The Directive applies to **establishments**, meaning the whole location under the control of an operator where **dangerous substances** are present in one or more installations, including common or related infrastructures or activities. The **operator** is any natural or legal person who operates or controls an establishment or installation or, where provided for by national legislation, to whom the decisive economic



or decision making power over the technical functioning of the establishment or installation has been delegated. (Arts 2 and 3.)

All covered establishments are classified as either lower-tier establishments or upper-tier establishments according to Annex I and depending on the quantities of hazardous substances present at the establishment. Some activities and establishments are exempted from the scope of the Directive, including military establishments, hazards created by ionising radiation originating from substances, and the transport of dangerous substances and directly related intermediate temporary storage. (Arts 3–4.)

[KEY PROVISION] 13. Accident prevention

Operators shall be required to take, and to prove to a competent authority at any time that they have taken, all necessary measures to prevent major accidents and to limit their consequences for human health and the environment. They must also send a notification to the competent authority containing information on, *inter alia*, the quantify and physical form of the dangerous substance or substances concerned, the immediate environment of the establishment, and factors likely to cause a major accident or to aggravate the consequences thereof. Operators must furthermore draw up a document that sets out a major accident prevention policy (MAPP) and ensure that the policy is properly implemented. The MAPP shall be proportionate to the major accident hazards and be designed to ensure a high level of protection of human health and the environment. (Arts 7 and 8.)

To reduce the risk of so-called **domino effects**, competent authorities shall identify all establishments where the risk or consequences of a major accident may be increased because of the geographical position, the proximity of such establishments, and presence of dangerous substances. The identified establishments must exchange information to enable them to take account of the nature and extent of the overall hazard of a major accident in their MAPPs, safety management systems, safety reports, and internal emergency plans, as appropriate. (Art 9.)

Following the same principle stated in the [key provision] 5 a major accident, the operator shall be required to inform the competent authority as soon as practicable and to provide it with information on the circumstances of the accident and the dangerous substances involved. Following such an accident the competent authority must ensure that any urgent, medium-term, and longterm measures which may prove necessary are taken and take appropriate action to ensure that the operator takes any necessary remedial measures. (Arts 16–17.)

The Directive includes provisions on information that must be made available to the public, including an explanation in simple terms of the activity or activities undertaken at the establishment and general information about how the public concerned will be warned, if necessary, as well as adequate information about the appropriate behaviour in the event of a major accident.

[! CRITICAL POINT] 6. Sustainable Aviation Fuels in scope of the Seveso

“Low-tier establishment” those where dangerous substances are present in quantities equal to or in excess of the quantities listed in column 2 of part 1 or in column 2 of part 2 of Annex I (see).

Table 12: An extract of the Annex I of the Seveso III Directive pointing to the qualifying quantify for alternative fuels present in lower and upper-tier plants.

Column 1	Column 2	Column 3
Dangerous substances	Qualifying quantity (tonnes)	for the application of
	Lower-tier requirement	Upper-tier requirement



Petroleum products and alternative fuels a) Gasolines and naphthas b) Kerosenes (including jet fuels) c) Gas oils (including diesel fuels, home heating oils and gas oil blending streams) d) heavy fuel oils e) alternative fuels serving the same purpose and with similar properties as regards flammability and environmental hazards as the products referred to in points (a) to (d)	2500	25 000
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2.3 Products Compliance

As stressed in the WFD the definition of material recovery should be introduced to cover forms of recovery other than energy recovery and other than the reprocessing of waste into materials used as fuels or other means to generate energy. It includes preparing for re-use, recycling and backfilling and other forms of material recovery such as the reprocessing of waste into secondary raw materials for engineering purposes in such as construction of roads or other infrastructure. Depending on the specific factual circumstances, such reprocessing can fulfil the definition of recycling if the use of materials is based on proper quality control and meets all relevant standards, norms, specifications and environmental and health protection requirements for the specific use.

The output of a FlexJET installation can include the following array of products:

- SAF
- TCR crude oil
- green hydrogen
- electric power
- heat
- biochar

Before accessing the market, products should meet a certain number of standards to be moved and transported or before reaching the end user.

Compliance to the international standards by ASTM are required for the fuels to be used as aviation fuels in aircrafts turbines:

- ASTM D1655 - Standard Specification for Aviation Turbine Fuels: This specification covers the use of purchasing agencies in formulating specifications for purchases of aviation turbine fuel under contract and describes the quality of aviation turbine fuel from production to the aircraft. www.astm.org/Standards/D1655.htm
- ASTM D4054 - Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives: This practice covers and provides a framework for the Original Equipment Manufacturer (OEM) evaluation and approval of new fuels and new fuel additives for use in commercial and military aviation gas turbine engines. www.astm.org/Standards/D4054.htm
- ASTM D7566 - Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons: This specification covers the manufacture of aviation turbine fuel that consists of conventional and synthetic blending components. Aviation turbine fuel manufactured, certified, and released to all the requirements of Table 1 of this specification (D7566), meets the requirements of Specification D1655 and shall be regarded as Specification D1655 turbine fuel. This specification defines the minimum property requirements for aviation turbine fuel that contain synthesized hydrocarbons and lists acceptable additives for use in civil operated engines and aircrafts. www.astm.org/Standards/D7566.htm



Even if the SAF fuel including the TCR oil is not produced from HEFA route, the aim of the project is to produce a fully equivalent jet fuel compliant with ASTM D7566 Standards.

The European policies hinge on two main tools relevant to FlexJET: the REACH and the CLP.

REACH is a regulation of the European Union, adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals. It applies to all chemical substances, not only those used in industrial processes but also in day-to-day lives, for example in cleaning products, paints as well as in articles such as clothes, furniture and electrical appliances. Therefore, the regulation has an impact on most companies across the EU. REACH places the burden of proof on companies. To comply with the regulation, companies must identify and manage the risks linked to the substances they manufacture and market in the EU. They have to demonstrate how the substance can be safely used, and they must communicate the risk management measures to the users.

CLP provisions take place once the hazardous properties of a substance or mixture have been identified, they need to be classified accordingly. Manufacturers, importers, downstream users and distributors, as well as producers and importers of certain specific articles, must communicate the identified hazards to the other actors in the supply chain, including to consumers.

REACH, CLP and EOW are intertwined measures impacting mostly the downstream side of FlexJET as illustrated in the following sections.

2.3.1 Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

REACH is the European Community Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (EC 1907/2006). The regulation was published on 18 December 2006 and the law entered into force on 1 June 2007. The title of the Regulation is concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and establishing a European Chemicals Agency. The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. Its legal basis is an article corresponding to Article 114 TFEU on the functioning of the internal market.

Certain other EU legislation takes precedence over REACH, since that legislation is not to be prejudiced by the application of REACH. This is particularly significant since it applies with respect to all EU workplace and environmental legislation. (Art 2.) The consequences of this are discussed further presently.

The REACH Regulation places greater responsibility on industry to manage the risks from chemicals and to provide safety information on the substances. Manufacturers and importers are required to gather information on the properties of their substances, which will allow their safe handling, and to register the information in a central database run by the [European Chemicals Agency \(ECHA\)](#) in Helsinki. One of the main reasons for developing and adopting the REACH Regulation was that a large number of substances have been manufactured and placed on the market in Europe for many years, sometimes in very high amounts, and yet there was insufficient information on the risks that they posed to human health and the environment. REACH was set up to ensure that industry had the information necessary to manage its substances safely.

REACH consists of 141 articles and 17 annexes.

The structure of the document is divided in XV titles

- I. GENERAL ISSUES
- II. REGISTRATION OF SUBSTANCES
- III. DATA SHARING AND AVOIDANCE OF UNNECESSARY TESTING
- IV. INFORMATION IN THE SUPPLY CHAIN
- V. DOWNSTREAM USERS



- VI. EVALUATION
- VII. AUTHORISATION
- VIII. RESTRICTIONS ON THE MANUFACTURING, PLACING ON THE MARKET AND USE OF CERTAIN DANGEROUS SUBSTANCES AND PREPARATIONS
- IX. FEES AND CHARGES
- X. AGENCY
- XI. CLASSIFICATION AND LABELLING INVENTORY XII INFORMATION
- XII. COMPETENT AUTHORITIES XIV ENFORCEMENT
- XIII. TRANSITIONAL AND FINAL PROVISIONS

Moreover a number of additional bylaws and guidance documents has been issued by the ECHA for specific purposes, for FlexJET purposes the most relevant are:

- Guidance on registration [16]
- Guidance on Identification and naming of the substance [17]
- Guidance on waste and recovered substances
- Intermediate Guidance
- Guidance on Scientific Research and Development (SR&D) and Product and Process Orientated Research and Development (PPORD) [18]

→ {Principle} 12. Substances, mixtures, articles NOT adversely affecting human health or the environment

The Regulation lays down provisions on substances, defined as chemical elements and their compounds, obtained by a manufacturing process or in their natural state, mixtures, *i.e.* mixtures or solutions composed of two or more substances. These provisions relate to manufacture, placing on the market, and use of substances and mixtures. To a limited extent, REACH also regulates substances in articles. An 'article', as opposed to a substance or a mixture, is an object which during production is given a special shape, surface, or design which determines its function to a greater degree than does its chemical composition (Arts 1 and 3). REACH is based on the principle that it is for manufacturers, importers, and [downstream users \(DU\)](#), to ensure that they manufacture, place on the market, or use such substances that do not adversely affect human health or the environment. The Regulation also makes explicit that its provisions are under-pinned by the precautionary principle.

→ {Principle} 13. Substance identification

The REACH Regulation focuses on substances. Although the provisions of the Regulation apply to the manufacturing, placing on the market or use of substances on their own, in mixtures or in articles, the registration requirements apply only to substances. Unambiguous and clear substance identification is an essential preliminary step in order to comply with the requirements for substances falling within the scope of the REACH and CLP Regulations and to establish whether they fulfil the requirements for exemptions from certain provisions of these Regulations. To identify a substance each company needs to use specific identification parameters defined in Annex VI of the REACH Regulation which will be required for the different REACH and CLP processes. These will be necessary not only for companies but also for authorities in order to carry out their duties.

A substance is defined in REACH by Article 3 and in CLP by Article 2 as:

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

The term covers both substances obtained by a manufacturing process and substances in their natural state and which can both include several constituents within the substance which have to be taken into



account as far as possible when identifying the substance for REACH and CLP purposes.

For REACH and CLP purposes a substance may contain:

- one or more main [constituents](#): constituent(s) that make(s) up a significant part of that substance and are therefore used in substance naming and identification, the main constituent(s) should clearly be other than the following two.
- [impurities](#): all the unintentional constituents coming from the manufacturing process or from the starting material(s). These could be the result of secondary or incomplete reactions occurring during the production and are present in the final substance even if not sought by the manufacturer.
- [additives](#): all the constituents which are intentionally added to stabilise the substance and only for this purpose.

The reader has to carefully consider the difference between a substance and a [mixture](#). A mixture consists of several different substances. **Each individual component substance in a mixture needs to be identified, and when required registered according to REACH and/or notified according to CLP either by the substance manufacturer or by the importer of the mixture.**

→ [Practical Details] 7. [Well defined or UVCB?](#)

When the composition of the substance can be quantitatively and qualitatively defined and the registrant is able to provide a chemical specification of the constituents, the substance will be considered as a “[well defined substance](#)”. The registrant will be able to identify all the constituents, covering the composition up to 100%.

There are substances for which the number of constituents is high, or the composition is to a significant extent unknown, or the variability of composition is large or unpredictable. In these cases a clear identification based on the chemical composition only is not possible and these will need to be considered as a substances of

[Unknown or Variable composition, Complex reaction products or Biological materials \(UVCB\)](#).

Four main sub-types of UVCB have been defined:

- UVCB sub-type 1 where the source is biological and the process is synthesis. The biological material is modified by means of a (bio)chemical process resulting in new constituents;
- UVCB sub-type 2 where the source is chemical or mineral and new molecules are synthesized by means of (bio)chemical reactions;
- UVCB sub-type 3 where the source is biological and the process is a refinement, and new molecules are intentionally generated;
- UVCB sub-type 4 where the source is chemical or mineral and the process is a refinement, without intentional chemical reactions.

→ [Practical Details] 8. [Requirements for identification of a substance in REACH](#)

The full identification of a substance under REACH requires the following information:

- **chemical composition of the substance**, considering, where appropriate, impurities and additives besides main constituent(s) and respective typical concentrations and concentration ranges,
- **chemical identity of the constituent(s)** by means of IUPAC name plus other identifiers when available, e.g. [EC number](#), [CAS number](#). For UVCB substances information on the source and manufacturing process is also necessary,
- **molecular and structural information**, this must be defined, when available and appropriate, by



molecular and structural formula, information on optical activity, ratio of isomers, molecular weight or molecular weight range,

- **Spectral and analytical data** sufficient to confirm the structure and the composition of the substance.

The data to enable a substance to be identified are listed in section 2 of REACH Annex VI. As a general rule, all this information is required regardless of the substance type. However, if it is not technically possible or not Scientifically necessary to give a particular piece of information, a reasoned justification should be given to enable the Scientific validity to be assessed. **Known constituents which are relevant for the classification of a substance have always to be fully identified for both REACH and CLP purposes.**

→ [Practical Details] 9. [EC Inventory and CAS Number and Name](#)

The EC-number, *i.e.* the EINECS, ELINCS or NLP number, is the official number of the substance within the European Union. The EC-number can be obtained from the official publications of EINECS, ELINCS and NLP and of the European Chemicals Agency

There are three separate inventories established by the previous chemicals regulatory framework. These are the [European Inventory of Existing Commercial Chemical Substances \(EINECS\)](#), the European List of Notified Chemical Substances (ELINCS) and the No-Longer Polymers (NLP) list.

Directive 67/548/EEC introduced a notification requirement for so-called new substances, which were substances not appearing on the European Inventory of Existing Commercial Chemical Substances (EINECS). The EINECS list contains, in principle, all substances on the Community market on 18 September 1981.

This inventory comprises about 100 000 substances identified by a chemical name (and a description for certain types of substances), a CAS number and seven digit number called the EINECS number.

Notifications made in accordance with Directive 67/548/EEC contain much of the technical dossier information which the REACH Regulation aims to have assembled by registrants through the registration requirement. This is the reason why such notifications are regarded as registrations. Notified substances according to Directive 67/548/EEC are generally referred to as NONS (Notification of New Substances) in the context of REACH. EINECS numbers always start with 2 or 3 (2xx-xxx-x, 3xx-xxx-xx).

Substances notified and placed on the market after 18th September 1981 are listed in the [European List of New Chemical Substances \(ELINCS\)](#)⁶. This inventory (list) comprises all substances notified until 31 May 2008 in accordance with Directive 67/548/EEC and its amendments. These substances are so called “new substances”, as they were not placed on the Community market by 18 September 1981. An ELINCS number was allocated to a substance by the European Commission after review by the Member States Competent Authorities (MSCAs). In contrast to EINECS, ELINCS does not include a CAS number in its entries but the notification number allocated by MSCA, the trade name (if available), the classification and the IUPAC name for classified substances. The ELINCS numbers are also seven digit numbers starting always with 4 (4xx-xxx-x).

Polymers were excluded from reporting to EINECS and were subject to special rules and because of a mis-alignment of definition are called no-longer-polymers. An NLP number always starts with 5 (5xx-xxx-x).

There are also other non-official inventory references aka **Index Number** adopted by ECHA whose numbers start with 5-8.

The **Chemical Abstracts Service (CAS)**, a division of the American Chemical Society (ACS), assigns a CAS name and number to every chemical which enters the CAS registry database. The names and numbers are assigned in sequential order to unique substances identified by CAS scientists. Every



substance registered at the Chemical Abstracts Service has a name according to the CAS-nomenclature, which the ACS adopts after recommendations of the ACS committee on nomenclature (see references in Appendix II).

The molecular formula (identifies each type of element by its chemical symbol and identifies the number of atoms of each element found in one discrete molecule of the substance. This information is only displayed if the substance is well-defined, if such information is available in ECHA's database and if it is not claimed confidential.

Information can be examined also through [Infocard](#), a specific ontology developed by ECHA to display substances properties.

→ [Practical Details] 10. [Is my substance the same as yours? Sameness of a substance](#)

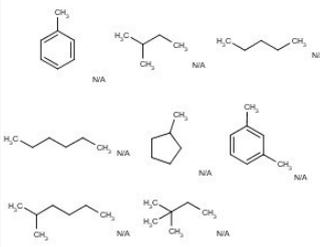
Existing substances can be traced on the [ECHA website](#).

Under REACH, registrants of substances having the same EC identifier have to be part of the same "joint submission" and submit certain information together. **Different manufacturers/importers having substances with the same EC identifier always need, nevertheless, to verify that the rules set out in the parent Guidance for identifying and naming their substances confirm that they have the same substance and that they can share the hazard data relevant for that substance.**

For well-defined substances, the rules described in section of this document, for mono-constituent substances and for multi-constituent substances are applied.

The consequence of defining a substance as UVCB is that any significant change of source or process would be likely to lead to a different substance. As a consequence FlexJET derived oil will generate new substances. See →[Practical details] 12. Exploiting information from other assessments "

Table 13: An example of an extract of an infocard: gasoline

IUPAC name or other international chemical name	1,3-xylene, 2,2-dimethylbutane, 2-methylbutane, 2-methylhexane, hexane, methylcyclopentane, pentane, toluene
Molecular structure	
Boiling point range or cut off	30 - 260 °C @ 101.325 kPa
kinematic viscosity (in mm ² /s)	1
EC number CAS number Mol. Formula Index Number	289-220-8 86290-81-5 C ₅₀ H ₉₈ 649-378-00-4
Type of Substance	UVCB



Origin	Petroleum product
Registered compositions:	102
of which contains:	0 impurities relevant for classification 0 additives relevant for classification

→ {Principle} 14. No data, no market

The cornerstone of REACH is the so-called ‘no data, no market’ provision according to which substances (on their own, in mixtures, or in articles) may not be **manufactured in the EU or placed on the market** unless they have been registered, provided that no specific exemption applies (Art 5). It should be noted that registration is thus a requirement not only for the placing on the market but also for the manufacturing of chemical substances within the EU, even if the substances are manufactured solely for export.

[KEY PROVISION] 14. REACH exemptions

Exempted from the Regulation’s scope are amongst others radioactive substances, isolated intermediates, and

the **carriage of dangerous substances** by rail, road, inland waterway, sea, or air (Art.2). The latter being in the scope of the CLP.

The definition of non-isolated intermediate deserve here special attention:

an intermediate that during synthesis is not intentionally removed (except for sampling) from the equipment in which the synthesis takes place. Such equipment includes the reaction vessel, its ancillary equipment, and any equipment through which the substance(s) pass(es) during a continuous flow or batch process as well as the pipework for transfer from one vessel to another for the purpose of the next reaction step, but it excludes tanks or other vessels in which the substance(s) are stored after the manufacture;

Wastes, as defined in what is now Directive 2008/98/EC on waste, is not a substance, mixture, or article, as understood by REACH. But exposure assessments for chemical substances must nonetheless include the waste stage of the substance’s life cycle.

ANNEX V lays down exemptions from the obligation to register in accordance with article 2(7)(b). Exempted from the registration requirement are substances, typically of natural origin, listed in Annex IV (among them glucose, water, nitrogen, and carbon dioxide), since they are considered to cause minimum risk due to their intrinsic properties, and those listed in Annex V such as minerals, ores, natural gas, crude oil, and coal, provided that they are not chemically modified, as registration is hold inappropriate or unnecessary for these substances (Art 2.7). Also exempted are substances which result from a chemical reaction that occurs incidental to storage of another substance, mixture or article.

Also substances already registered in EINECS are to be considered exempted from registration as they are considered already notified.

[KEY PROVISION] 15. Exemption of recovered substance already registered

The REACH Regulation exempts from registration substances which are recovered in the EU, provided a number of conditions are met. Recycling is a form of recovery and therefore covered by this exemption. Recalling here the Error: Reference source not foundError: Reference source not found (page Error: Reference source not found), FlexJET can be considered as a recovery operation. However a recovered



substance will only fall within the scope of the REACH Regulation when a decision has been taken as for end of waste criteria . The REACH Regulation sets the following conditions which have to be respected in order to benefit from the exemption from registration:

- (1) **The same substance must have been registered.** This means that if, for some reason, the same substance has not been registered at manufacturing or import stage, the recovered substance has to be registered. The legal entity performing the recovery should check whether a registration exemption applies to the recovered substance. If this is the case, then that exemption can of course be invoked.
- (2) **The substance must be the same** (the sameness of the substance must be assessed according to the criteria defined in [17]. For example, if the substance itself was modified in the recovery and the modified substance has not been registered, then the recovered substance has to be registered.
- (3) (The legal entity that did the recovery must have available.

→ [Practical Details] 11. Hydrogen exempted

In Annex V hydrogen is exempted

[KEY PROVISION] 16. PPORD exemption

One of the main objectives of the REACH Regulation is to increase and promote innovation by providing encouragement to innovate for research-orientated companies. To achieve this objective, REACH foresees a number of exemptions. For example, substances used in Scientific research and development (SR&D) are exempt from authorisation and restrictions which might otherwise apply even to substances manufactured or imported at below 1 tonne per annum [18]. All substances manufactured or imported at below 1 tonne per annum are in any case exempt from registration. However, the REACH Regulation further promotes innovation by also allowing substances manufactured or imported at above 1 tonne per annum to be exempted from registration under certain conditions, i.e. when they are used in [product and process orientated research and development \(PPORD\)](#). This PPORD exemption is limited to a specified time and to listed customers. The duration of the exemption may be extended by a further specified period if justified.

For this purpose, the manufacturer or importer or producer of articles shall notify the Agency of the following information:

- (a) the identity of the manufacturer or importer or producer of articles as specified in section 1 of Annex VI,
- (b) the **identity of the substance**, as specified in section 2 of Annex VI,
- (c) **the classification of the substance** as specified in section 4 of Annex VI, if any,
- (d) the estimated quantify as specified in section 3.1 of Annex VI,
- (e) the list of customers referred to in paragraph 1, including their names and addresses. The notification shall be accompanied by the fee required in accordance with Title IX. The period set out in paragraph 1 shall begin at receipt of the notification at the Agency.

In order to understand the meaning of such an exemption through the REACH provisions the conditions depicted in Table 14 will apply. Obligations will be illustrated hereafter.

Table 14: Summary of the obligations for substances used in SR&D and PPORD

Type of obligation	Substance used in SR&D	Substance used in PPORD
Registration	not required	temporarily not required
Authorisation	not required	required for a substance listed in Annex XIV and used in PPORD, unless exempted, cf. the column “Exempted (categories of) uses” in Annex XIV.
Restriction	NA	applies to the use of substance in PPORD, unless it is explicitly exempted in Annex XVII



Classification, labelling and packaging according to CLP	required , even if a substance or mixture falls within the definition of SR&D given in Article 3(23), unless it is not placed on the market.	required for substances used in PPORD or mixtures containing them, irrespective of whether these substances or mixtures are made available to the listed customers or not.
Notification to the Classification and Labelling Inventory	required if the substance (or a mixture containing it) is classified as hazardous and it is placed on the market	required if the substance (or a mixture containing it) is classified as hazardous and it is placed on the market,
Information in the supply chain	depending if substance is hazardous	depending if substance is hazardous
Downstream user (DU) obligations	normal obligations of a DU apply as for any substance generally	DU is included as a listed customer in a PPORD notification submitted by the supplier – specific provisions apply
Compliance with conditions imposed by ECHA	NA	required for any conditions imposed by ECHA in accordance with Article 9(4)

[! CRITICAL POINT] 7. One tonne or more

The volume threshold according to which only those who manufacture or import a substance, either on its own or in mixtures, in quantities of one tonne or more per year need submit a registration to ECHA (Art 6). A substance can thus be manufactured and imported by any number of actors without being registered as long as none of them reaches the one tonne/year threshold.

[KEY PROVISION] 17. Registration

The information to be included in the registration varies depending on the volumes of the substance that the individual registrant imports or places on the market. However, all registrants must submit a technical dossier containing information on, *inter-alia*:

- the identity of the manufacturer/importer
- the manufacture and use(s) of the substance,
- its classification and labelling,
- guidance on how it may be used safely.

All the physicochemical, toxicological, and ecotoxicological information that is relevant and available to the registrant must also be included in the technical dossier, regardless of volume. But depending on the volume, specific minimum requirements apply as shown here.

substances manufactured or imported in quantities of	Specific provisions
1-10	the information specified in Annex VII
10-100	Annex VIII information to be added
100-1000	Annex IV information to be added
>1000	Annex X information to be added

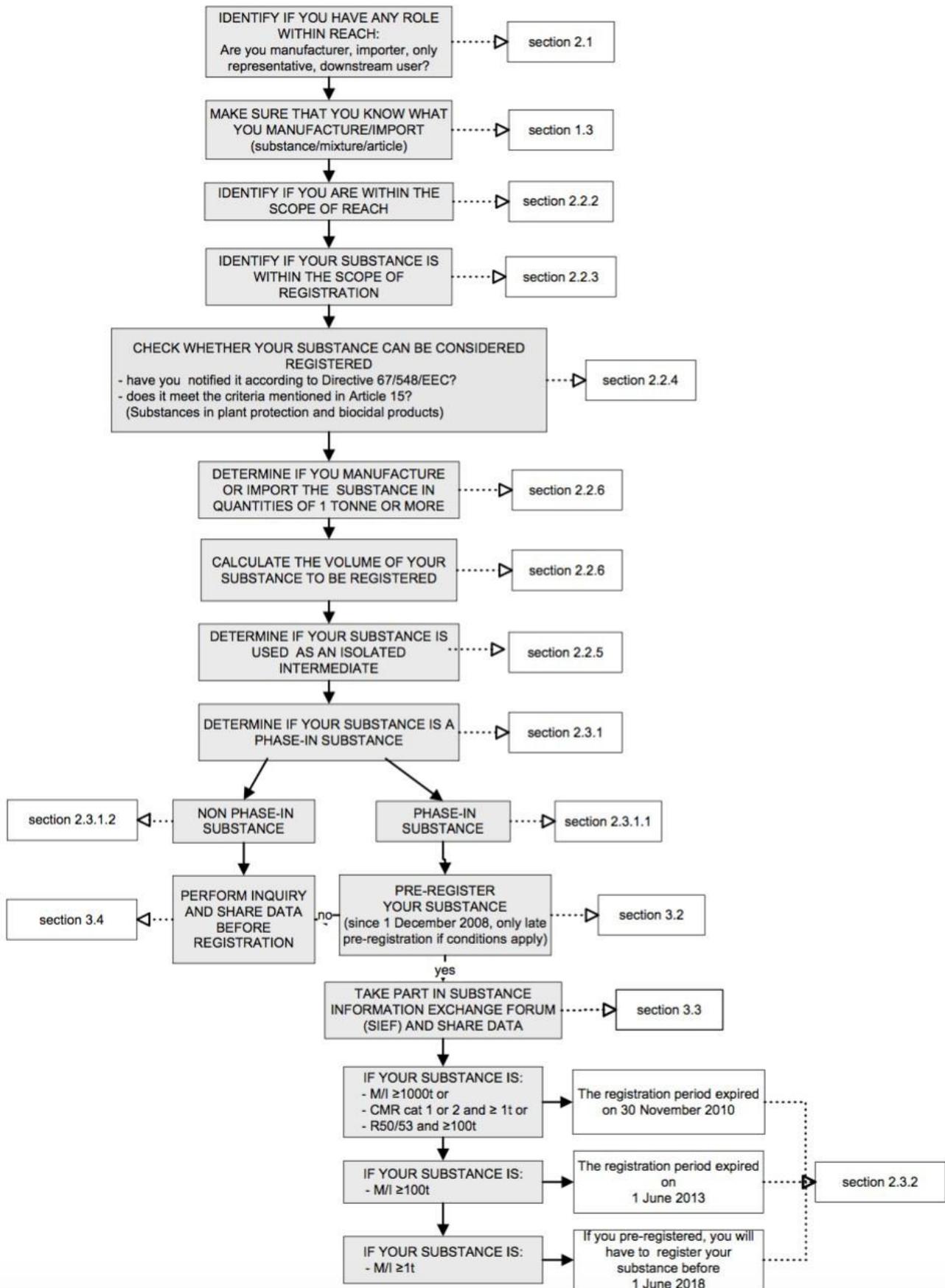
When a registration reaches ECHA, the agency carries out a completeness check to ascertain that all the elements required have been provided and assigns a registration number to the substance concerned. Unless the agency informs the registrant, within three weeks after the submission date, that her registration is incomplete, the registrant may start or continue (for so-called [phase-in substances](#)) to



manufacture or import the substance or article in question. (Arts 20, 21, and 41.). A panoramic detail of the registration phase is given in Figure 7. Phase-in substances are already existing substances either listed in EINEC, or it was manufactured in the Community, or in the countries acceding to the European Union on 1 January 1995, on 1 May 2004, on 1 January 2007 or on 1 July 2013, but not placed on the market by the manufacturer or importer, either it was placed on the market in the Community, or in the countries acceding to the European Union as a NPL.



Figure 7: Steps within the registration process and link to the structure of the Registration Guidance





[! CRITICAL POINT] 8. Chemical safety report for mixtures

For all substances subject to registration in quantities of 10 tonnes or more per year per registrant, a chemical safety assessment must be performed and a chemical safety report completed. Specific rules apply to mixtures. A chemical safety assessment of a substance shall include a human health hazard assessment, a physicochemical hazard assessment, an environmental hazard assessment, and a [persistent, bioaccumulative, and toxic \(PBT\)](#) and [very persistent and very bio accumulative \(vPvB\)](#) assessment. If the substance is assessed to be a PBT or vPvB, or if it fulfils the criteria for certain hazard classes or categories, the chemical safety assessment shall also include exposure assessment, including the generation of exposure scenarios, exposure estimation, and risk characterisation.

As FlexJET technology is likely to derive from variable qualities of feedstock and with small variations of the process such a chemical safety report should be envisaged.

→ [Practical Details] 12. Exploiting information from other assessments

As stated under REACH, 'Available information from assessments carried out under other international and national programmes shall be included. Where available and appropriate, an assessment carried out under Community legislation (e.g. risk assessments completed under Regulation (EEC) No 793/93) shall be taken into account in the development of, and reflected in, the chemical safety report. Deviations from such assessments shall be justified' (Annex I Section 0.5). Registrants may rely on existing assessments in meeting the information requirements given in the Annexes VIII - X as long as they are in legitimate possession or have permission to refer to the full study reports that have been summarised in the registration dossier. Therefore, registrants need to take into account and to use these already available assessments to prepare their registration dossier. This includes in particular assessments carried out under other EU programmes such as the Existing Substances Risk Assessment Programme, assessments of active substances under the Biocidal Products Regulation or the Plant Protection Products Regulation when such substances are covered by REACH. Another important source of information is the OECD HPV (Organisation for Economic Co-operation and Development High Production Volume) Chemicals Programme where a lot of similarities exist with REACH. Those similarities should be taken into account when preparing a registration dossier where a dossier for the OECD HPV Chemicals Programme is available. To reduce duplicative testing and save the government and industry resources the OECD has developed the Mutual Acceptance of Data (MAD) system, which allows participating countries (including non-members) to share the results of various non-clinical tests done on chemicals using OECD methods and principles. Further information on MAD system is available at <http://www.oecd.org/env/ehs/mutualacceptanceofdatamad.htm>.

<commentary> 13. Boards and Consortia to face common REACH challenges – EBB Example

The European Biodiesel Board (EBB) has established an EBB Biodiesel REACH Consortium in order to facilitate the EU biodiesel industry to meet the requirements under REACH and ensure proper registration of biodiesel and related substances. The Consortium currently gathers 55 members. Among the members are producers, situated both inside and outside EU borders, as well as importers of biodiesel.

The EBB Biodiesel REACH Consortium aims at the cost-effective preparation of the registration dossiers for the substances covered under the EBB Biodiesel REACH Consortium Agreement, before November 30th, 2010.

The Consortium actions involve:

- Sharing of technical expertise and knowledge
- Providing legal and technical guidance to its Members
- Evaluating the existing data for the relevant substances and identifying data gaps
- Securing access to laboratory facilities and initiating the placement of tests
- Completing a Chemical Safety Report for all common intended uses
- Agreeing on Classification and Labelling



- Leading its Members towards a successful registration of their substances in the most cost-effective way

Sameness of substances

The EBB Biodiesel Consortium members have already performed a comprehensive review of substance sameness to verify their consolidation under more 'generic' entries.

Data Gap Analysis

The EBB Biodiesel REACH Consortium has undertaken and finalised a comprehensive literature search for the substances covered under the EBB Biodiesel REACH Consortium Agreement, as well as for the individual carbon chains that are constituents of the substances. A corresponding initial data-gap analysis has been carried out, to indicate that for the 'generic' entries to be employed for registration there is enough relevant data available to fulfil the majority of information requirements for REACH Annexes VII and VIII. The Consortium is at present finalizing the data gap analysis and is expected to have concluded on the tests to be performed by the end of July 2009.

Status of Substances / Exemption Possibilities under REACH

The EBB Biodiesel REACH Consortium has already prepared Guideline documents regarding the status of the following substances under REACH:

Glycerine produced during biodiesel manufacture
Gums produced during oil refining

Acid oils produced during Glycerine purification

The Consortium is at present elaborating further Guideline documents, whereby the status under REACH of Soapstocks, Acid Oils and FaOy Acids from Oil Refining will be assessed. Guideline documents will be produced for all the above substances, providing justification for possible exemptions according to the substances composition.

[KEY PROVISION] 18. Downstream users obligations (DU)

The assessment is to address not only the manufacturers' or importers' own uses and the uses for which they place their substances on the market, but also uses which their customers ask them to address. The chemical safety report must be kept available and up to date by the registrant. A general requirement is that all registrants must identify and apply the appropriate measures to adequately control the risks identified in the chemical safety assessment. (Art 14.) Also, downstream users—that is, natural or legal persons established within the EU, other than the manufacturer or the importer, who use a substance, either on its own or in a mixture, in the course of their industrial or professional activities—are required, with certain exceptions, to prepare a chemical safety report for any use outside the conditions described in an exposure scenario or for any use the supplier advises against (Arts 3 and 37).

[KEY PROVISION] 19. Information in the supply chain

Rules pertaining to information in the supply chain are a part of REACH. Suppliers of a substance or a mixture in many cases must provide the recipient with a so-called safety data sheet. E.g. where the substance meets the criteria for classification as hazardous or if it is a PBT or vPvB substance. An obligation is placed on each actor in the supply chain to communicate information to the next actor or distributor up that chain. The obligation to communicate covers new information on hazardous properties, regardless of the uses concerned, and any other information that might call into question the appropriateness of the risk management measures identified in a SSD supplied to that actor. Distributors must pass on such information to the next actor or distributor up the supply chain. In this way the information should also reach the manufacturers and importers who have the primary responsibility to assess the risks of their substances and communicate appropriate safety and management measures.

→ [Practical Details] 13. Safety Data Sheet (SDS)



Guidance on how to use the substance safely, a key requirement in the Registration is contained in the [Safety Data Sheet \(SDS\)](#).

The SDS (formerly Material Safety Data Sheet, MSDS) is a written or printed material concerning a hazardous chemical that is prepared by the manufacturer or the company importing the product describing the physical and chemical properties of the product according to specific guidelines. The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) contains a standard 16-section specification for safety data sheets (APPENDIX I), here below summarised.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

SECTION 2: Hazards identification

SECTION 3: Composition/information on ingredients

SECTION 4: First aid measures

SECTION 5: Firefighting measures

SECTION 6: Accidental release measure

SECTION 7: Handling and storage

SECTION 8: Exposure controls/personal protection
SECTION 9: Physical and chemical properties
SECTION 10: Stability and reactivity

SECTION 11: Toxicological information

SECTION 12: Ecological information

SECTION 13: Disposal considerations

SECTION 14: Transport information

SECTION 15: Regulatory information

SECTION 16: Other information

Safety data sheets have been made an integral part of the system of the REACH. The original requirements of REACH for SDSs have been further adapted to take into account the rules for safety data sheets of the Global Harmonised System (GHS) and the implementation of other elements of the GHS into EU legislation that were introduced by Regulation (EC) No 1272/2008 (CLP) via an update to Annex II of REACH.

[KEY PROVISION] 20. Authorisation and substitution

A novelty in REACH, compared to previous EU chemicals legislation, is that substances may be subjected to an authorisation requirement. The substances that can qualify for authorisation requirement are so-called 'substances of very high concern' (SVHCs). These are substances meeting the criteria for classification as carcinogenic, mutagenic, or toxic for reproduction (CMR), PBT or vPvB substances, and substances identified on a case-by-case basis for which there is Scientific evidence of probable serious effects that cause an equivalent level of concern, as with CMR or PBT/vPvB substances. (Art 57.)

Figure 8: a sample of the pictorial representation of the so-called 'properties of concern' section for certain substance properties that are regarded as critical for human health and/or the environment

**C**

This substance was identified as a carcinogen (i.e. classified in Carcinogenicity categories 1A or 1B) in the EU harmonised classification and labelling and/or in a REACH registration dossier.

M

This substance was identified as mutagenic (i.e. classified in Mutagenicity categories 1A or 1B) in the EU harmonised classification and labelling and/or by a REACH registration dossier.

[! CRITICAL POINT] 9. Is SAF SVHC free?

SAF should be verified and protocols to avoid the presence of SVHC ascertained. The presence of such substances can trigger further provision and consequent major burden to the applicant.

[KEY PROVISION] 21. Restrictions on manufacturing of dangerous substances

Restrictions may be imposed on the manufacturing, placing on the market, and use of dangerous substances and preparations. Restrictions can take many forms, including total bans, concentration limits, and limitation to professional use. Restrictions shall be decided, by amending Annex XVII, when there is an unacceptable risk to human health or the environment arising from the manufacture, use, or placing on the market of substances, which needs to be addressed on an EU-wide basis. Any such decision shall take into account the socio-economic impact of the restriction, including the availability of alternatives. (Arts 68–73.)

2.3.2 Classification, Labelling and Packaging (CLP)

The Regulation (EC) No 1272/2008 CLP is a very extensive and copious legislative act. It counts more than 2000 pages including annexes. The underpinning principles are the same as REACH:

- informed circulation of the commodities in the single market
- harmonised classification according to GHS rules
- provisions extend down in the supply chain to downstream users
- burden is placed on manufacturers, importers, and downstream users
- specific provisions and exemptions apply depending on hazard level.

→ {Principle} 15. Hazard categories risk management and packaging standards

When relevant information (e.g. toxicological data) on a substance or mixture meets the classification criteria in CLP, the hazards of a substance or mixture are identified by assigning a certain hazard class and category. The hazard classes in CLP cover physical, health, environmental and additional hazards. CLP sets detailed criteria for the labelling elements: pictograms, signal words and standard statements for hazard, prevention, response, storage and disposal, for every hazard class and category. It also sets general packaging standards to ensure the safe supply of hazardous substances and mixtures. In addition to the communication of hazards through labelling requirements, CLP is also the basis for many legislative provisions on the risk management of chemicals.

2.3.3 Export and Import of Dangerous Chemicals

Since 1998 the Rotterdam Convention the export of certain hazardous chemicals has been regulated on the [prior informed consent \(PIC\)](#) procedure for certain hazardous chemicals and pesticides in international trade. Only chemicals listed in an Annex to the Convention are subject to the PIC requirement. It is not

allowed for a Party to export a listed chemical to another Party that has indicated that it does not consent to import. A chemical that is banned or severely restricted domestically by a Party of export but not included in the PIC procedure is instead subject to a requirement to send an export notification to the importing Party before the

first export in any calendar year. Regulation (EU) No 649/2012 has three objectives: to implement the Rotterdam Convention, to promote shared responsibility and cooperative efforts in the international movement of hazardous chemicals in order to protect human health and the environment from potential harm, and to contribute to the environmentally sound use of hazardous chemicals.

Mixtures containing a listed substance in a concentration that triggers labelling obligations under Regulation (EC) No 1272/2008 are also subject to notification. Even some articles require an export notification. This is the case with articles that either contain substances listed in Part 2 or 3 of Annex I in unreacted form, or mixtures containing such substances in a concentration that triggers labelling obligations under Regulation (EC) No 1272/2008.

Table 15: a common harmonised pictogram

	<p>Health hazard (GHS07) May cause respiratory irritation May cause drowsiness or dizziness May cause an allergic skin reaction Causes serious eye irritation Causes skin irritation Harmful if swallowed Harmful in contact with skin Harmful if inhaled Harms public health and the environment by destroying ozone in the upper atmosphere</p>
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2.3.4 Voluntary biochar product standards

Voluntary product standards are already known from a variety of products. They can be either public, such as the Ecolabel, either private e.g. the forest product standard Forest Stewardship Council (FSC) or Roundtable on Roundtable on Sustainable Biomaterials (RSB).

They aim to guarantee the sustainability and/or the quality of a product, thus enabling the consumers to better differentiate between products by voluntarily using these standards. Voluntary standards have been developed also for biochar. The following information came from the work of Meyer, Genesio et al. [19]

Biochar Standard of the International Biochar Initiative (IBI-BS) is a non-profit association based in the United States. The IBI standard requires biochar products to have an organic carbon content of at least 10% and to have a hydrogen-to-organic carbon ratio (which is, *inter alia*, an indicator for biochar stability) of less than 0.7. The following product properties have to be declared:

- moisture content,
- total ash content,
- total nitrogen content,
- pH-value,
- electrical conductivity (as a measure for the salinity of the product),
- CaCO₃ content and particle size distribution.

The standard requires thresholds for heavy metals and organic pollutants including polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins (PCDDs) and



polychlorinated dibenzofurans (PCDFs). In addition, a germination inhibition assay has to be passed by the tested biochar products.

The IBI-BS defines both sampling and analysis procedures. The biochar producers must keep records of biochar feedstocks including [chain of custody](#) and test results. With the exception of hazardous municipal solid waste, no feedstocks are excluded from biochar production. There are no requirements regarding the sustainability of the feedstock or of the conduct of the biochar production process itself. The standard does not demand a greenhouse gas (GHG) balance for the product.

The **European Biochar Certificate (EBC)** in another private scheme established at EU level, it makes a differentiation between two different biochar grades, each with its own threshold values and ecological requirements: “basic” and “premium”.

Table 16: overview of voluntary biochar standards, country legislation, ecolabel and revised fertiliser Directive proposal

Substance mg/kg dm	U.M.	Voluntary Product Standards			National Legislation		EU	
		IBI-BS	EBC Basic	EBC premium	Germany	Italy	Ecolabel	Strubias
Organic Carbon content	%	≥10	≥50	≥50	≥80	≥20		≥50
PAH (US EPA 16)	mg/kg dm	≤300	≤12	≤4	-	≤6	≤20	≤6
PCBs	mg/kg dm	≤1	≤0.2	≤0.2	-	≤0.5		≤0.2
PCDD/F toxic. equiv. (I-TEQDF)	ng/kg dm	≤17	≤20	≤20	≤30	≤9		≤20
Cr (total)	mg/kg dm	≤1200	≤90	≤80	-	-	≤100	(1)
Cu	mg/kg dm	≤6000	≤100	≤100	-	≤230		(1)
Hg	mg/kg dm	≤17	≤1	≤1	≤1	≤1	≤1	(1)
Thalium	mg/kg dm	-	-	-	≤1	-	-	-
Zn	mg/kg dm	≤7400	≤400	≤400	-	≤500	≤300	(1)

(¹) parameters will be most likely regulated at Product Function Categories (PFCs) level in the Revised Fertiliser Regulation for which no limit values are proposed at Component Material Category (CMC) level.

2.3.5 Heat and power requirements: the Renewable Energy Directive provisions

FlexJET is to produce also heat and power. Especially the later and any final form of energy derived from FlexJET products, such as biochar or hydrogen are subject to certain non-binding conditions to be eligible for subsidies and accounted as Renewable Energy Sources. Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/ EC and 2003/30/EC [(notified as 2009] OJ L 140/16 in the Official Journal), set specific provisions for energy recovered for wastes.

→ {Principle} 16. Sustainability criteria for biofuels

The sustainability criteria for biofuels and bioliquids (Art 17) aim to ensure that biofuels and bioliquids (in the following, ‘biofuels’) qualify for the incentives promoted by the Directive only when it can be guaranteed that they do not originate in biodiverse areas or when it can be demonstrated that the production of the raw



material does not interfere with the protection of rare, threatened, or endangered ecosystems or species. A certain effect in terms of emissions savings must also be achieved. To be considered sustainable, biofuels must achieve greenhouse gas savings of at least 35% in comparison to fossil fuels. This savings requirement rises to 50% in 2017. In 2018, it rises again to 60% but only for new production plants.

- All life cycle emissions are taken into account when calculating greenhouse gas savings. This includes emissions from cultivation, processing, and transport.
- Biofuels cannot be grown in areas converted from land with previously high carbon stock such as wetlands or forests.
- Biofuels cannot be produced from raw materials obtained from land with high biodiversity such as primary forests or highly biodiverse grasslands.

[KEY PROVISION] 22. Biofuels from wastes fulfil RED

Biofuels and bioliquids produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues, fulfil the sustainability criteria set out in paragraph 2 of article 17.

<commentary> 14. The revised RED and new accounting rules!

The Commission's November 2016 proposal for a revised Renewable Energy Directive includes updated sustainability criteria for biofuels used in transport and bioliquids, and solid and gaseous biomass fuels used for heat and power. Annexes V and VI include updated greenhouse gas emission accounting rules and default values. This might be important for FlexJET.

2.4 Indivisible Items

2.4.1 Environmental liability

Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage (ELD) establishes a framework based on the polluter pays principle to prevent and remedy environmental damage. The polluter pays-principle is set out in the Treaty on the Functioning of the European Union (Article 191(2) TFEU). As the ELD deals with the "pure ecological damage", it is based on the powers and duties of public authorities ("administrative approach") as distinct from a civil liability system for "traditional damage" (damage to property, economic loss, personal injury).

→ {Principle} 17. Environmental damage

The Directive defines "environmental damage" as damage to protected species and natural habitats, damage to water and damage to soil. Operators carrying out dangerous activities listed in Annex III of the Directive fall under strict liability (no need to prove fault). Operators carrying out other occupational activities than those listed in Annex III are liable for fault-based damage to protected species or natural habitats. The establishment of a causal link between the activity and the damage is always required. Affected natural or legal persons and environmental NGOs have the right to request the competent authority to take remedial action if they deem it necessary.

	Application of the ELD in Italy
<p>The Environmental Liability Directive (ELD) 2004/35/EC was transposed in Italy in 2006. The process of transposition was guided by a twofold objective: integrating EU legislation with the prior national rules, and coordinating environmental damage prevention and remediation rules with any other relevant provisions.</p> <p>In Italy, environmental damage prevention and remediation legislation has been implemented via specific assessments by the competent authorities which, in many cases, required technical assessments of the damage incurred. These assessments have required the adaptation of methods to take account of the</p>	



regulatory changes made in 2006 concerning both the preliminary and final assessments of liability and damage. In particular, the preliminary assessment carried out by the competent authority has been adapted to the new scope, by identifying ad hoc criteria for selecting the cases covered by the new national environmental damage prevention and remediation legislation and identifying the operator.

The preliminary technical assessment, must now distinguish between *imminent threat of damage* and *actual damage*. On the basis of information on damaged resources and services provided by experts and according to the relevant operator, the competent authority, the Ministry of Environment and Protection of Land and Sea (MEPLS) can determine which type of liability applies to each case, and identify the appropriate actions to be taken. Usually, this further step requires a second (and final) technical assessment.

Where damage was (totally or partially) un-remedied due to the operator's failure to take appropriate action, financial obstacles might arise, owing to the high costs of remedying especially serious instances of environmental damage. In these cases, application difficulties may also concern primary remediation measures. In the case of Italy, it should also be considered that as a consequence of the broad scope of the national provisions, the cases of damage to which the "polluter pays" principle applies are many, increasing significantly the caseload to be handled by the competent authority. In the event of imminent threat of damage the difficulties described may also concern preventive measures. The national lawmakers had foreseen these implications on the basis of the experience gained with prior legislation. This is why provisions were established to enable MEPLS to seek compensation via administrative measures or judicial redress when the actual recovery or the adoption of complementary or compensatory remediation measures are entirely or partly omitted, impossible or too expensive, or in any case implemented only partially or incorrectly. In these cases, the party causing the damage is required to pay an equivalent amount by way of compensation to the State.

As noted, the amounts demanded by MEPLS as compensation are estimated on the basis of the measures to be taken to remedy the damage. Thus, they refer to specific primary complementary or compensatory remediation measures, and are paid into a fund dedicated to the following environmental actions, under Article 317(5) of Legislative Decree No 152/2006:

- a) urgent actions for the delimitation, characterisation and safeguarding of polluted sites, assigning priority to those areas for which the compensation for environmental damage was paid,
- b) decontamination, remediation and environmental recovery of those areas for which the compensation for environmental damage was paid,
- c) remediation and environmental recovery actions under the national programme for the remediation and environmental recovery of polluted sites,
- d) activities of research centres in the field of greenhouse gas emission reduction and global climate change.

This additional mechanism was introduced in order to boost the financial feasibility of damage remediation measures, hence to improve the effectiveness of damage remediation.

2.4.2 Eco-Management

When considering permitting of new installations and new technologies, one must consider potential option to demonstrate environmental management capabilities. Local authorities will place the onus on an **operator** to assess the effects of their operations, to explore ways of improving them, and to make proposals for the local authority's consideration. This also applies to substantial changes. To obtain a permit, an operator should demonstrate how he/she would manage the installations in a way that will meet the requirements of the environmental permitting regulations. This should cover the full range of activities that the operator wants the permit to cover. At this regard, operators should consider the adoption of an environmental management system to demonstrate the capacity thereof.

→ [Practical Details] 14. Standardised and non-standardised EMSs

An Environmental Management System (EMS) can take the form of a standardised or non-standardised



("customised") system.

An environmental management system (EMS) is a worldwide tool potentially applicable by any kind of organization in order to improve the management of their environmental aspects and reach a continuous improvement of environmental performance. There are two main reference standards that set requirements for an EMS: the international standard ISO 14001 designed by the private body called International Organization for Standardization (ISO), and the Eco Management and Audit Scheme (EMAS) regulated by the European Regulation EC 1221/2009. The success of both standards relies on their highly flexible requirements, which allows any organization to set up an EMS according to its internal characteristics and to identify the most effective solutions to improve their performance [20].

Implementation and adherence to an internationally accepted standardised system such as EN ISO 14001:1996 can give higher credibility to the EMS, especially when subject to a properly performed external verification. EMAS provides additional credibility due to the interaction with the public through the environmental statement and the mechanism to ensure compliance with the applicable environmental legislation. However, non-standardised systems can in principle be equally effective provided that they are properly designed and implemented.

E.g., the non-standard EMS proposed by BAT of WI is reported in EMS RECOMMENDATIONS at page 96.

Main achieved environmental benefits

Implementation of and adherence to an EMS focuses the attention of the operator on the environmental performance of the installation. In particular, the maintenance of and compliance with clear operating procedures for both normal and abnormal situations and the associated lines of responsibility should ensure that the installation's permit conditions and other environmental targets and objectives are met at all times. Environmental management systems typically ensure the continuous improvement of the environmental performance of the installation. The poorer the starting point is, the more significant short-term improvements can be expected. If the installation already has a good overall environmental performance, the system helps the operator to maintain the high performance level.

Both EMAS and ISO14001 require that the management system include safeguards for legal compliance and a commitment to continuous improvement in environmental performance. The increased transparency of external certification required by EMAS and ISO 14001, should therefore help to establish and maintain the operator's competence and the adequacy of the installation's management. EMAS additionally requires verified reporting of environmental performance and environmental regulators to be consulted before operators can be registered under the Scheme. Recognised quality assurance schemes may also be relevant, and local authorities may also take account of non-certified systems to the extent that these fulfil an equivalent role in safeguarding legal compliance and continuous improvement of environmental improvement. Operators should maintain the standards of their management systems and competence throughout the installation's life. Local authorities may impose permit conditions to ensure this.

3 Catalogue Part B: permitting routes

3.1 From plan to installation

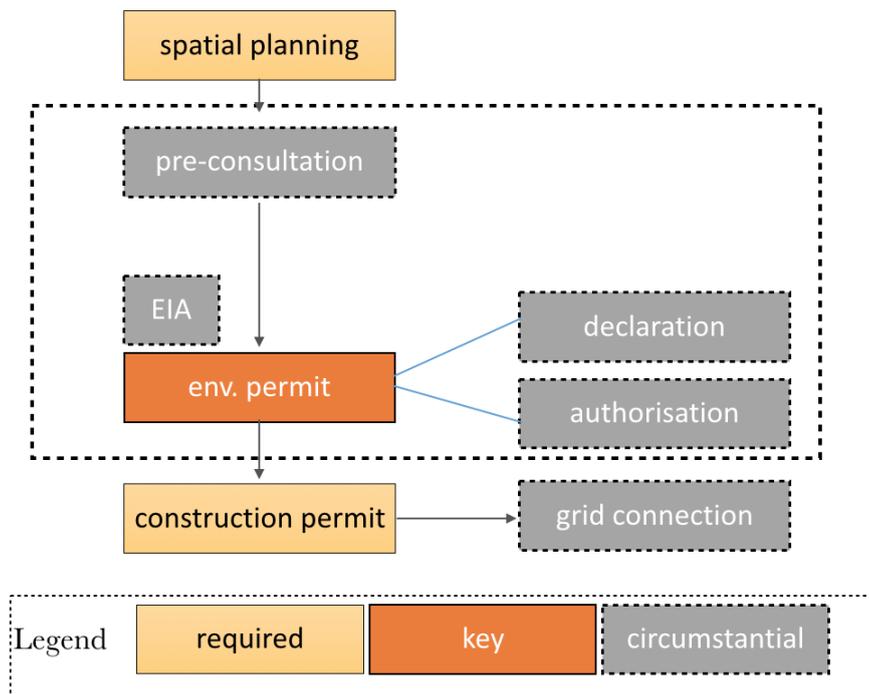
From the project of a generic industrial installation to its realisation, there are different steps and phases to be understood:

- spatial planning imply the consent of the local authorities for the specific use of the project in a given, specific area,
- environmental permit is a written authorisation to perform an activity having impact on the environment,
- construction permit is the written authorisation and procedure which lead to the construction of the facility.

In the figure here below is represented a possible route. In this case, the environmental permit is defined as “key” because it determines the failure or the success of the overall procedure.

A number of circumstances can activate other steps, notably an Environmental Impact Assessment can be triggered, depending on size and geographical position. This Assessment is prejudicial with respect to the release of the environmental permit.

Figure 9: typical permitting routes in Italy and France



Healey (reference indicated in [21]) defines spatial planning as a set of governance practices for developing and implementing strategies, plans, policies and projects, and for regulating the location, timing and form of development. The EU compendium of spatial planning systems and policies defines the term simply as the “methods used largely by the public sector to influence the future distribution of activities in space” [22].

Spatial Planning and Environmental Permitting depends on unwritten value proper to a country and specifically by the degree of de/centralisation of powers.

Table 176 shows a classification of countries into four distinct types of governance models. The classification draws on early typologies of governance models by the ESPON project 2.3.2 (Governance of Territorial and Urban Policies from EU to Local Level) and the EU Compendium of Spatial Planning and Policies [21].

Table 17: Governance structure in OECD Countries

Centralised unitary states	Decentralised unitary states	Regionalised unitary states	Federal States
Ireland Israel Japan	Czech Republic Denmark Estonia Finland France Greece Hungary Iceland Korea Luxembourg Netherlands New Zealand Norway Poland Slovak Republic Slovenia Sweden Turkey United Kingdom	Chile Italy Portugal Spain	Australia Austria Belgium Canada Germany Mexico Switzerland USA

The majority of OECD countries operate the unitary system of governance with varying degrees of (de)centralisation. In centralised unitary states, power resides mainly with the central government. Although sub-national government structures and departments exist, they generally wield less power than the power delegated from the central government.

In *decentralised unitary states*, substantial powers have either been allocated to local authorities (as is the case of Denmark, Finland, Norway, Netherlands, Sweden) or there is an on-going devolution of substantial powers to local authorities and elected regional authorities (as is the case of United Kingdom, Czech Republic, New Zealand and Slovak Republic). Following the devolution of powers to Scotland, Wales and Northern Ireland, the United Kingdom is increasingly becoming decentralised and heading towards a quasi-federal state.

Power is shared between national and regional governments in Federal states with each having autonomy in some spheres and being able to make laws.

3.1.1 Types of building permits procedures and land planning exemptions

According to their category, construction works can be exempted from or follow a building.

- 1) **Exemptions:** construction works that have to meet the planning demands and the technical requirements but are exempt from the permit procedure. The legislation of some countries contains explicit exemption clauses to include biomass initiatives in the land use plan without changing it. As an example, anaerobic digestion installations are integrated and permitted in agricultural use areas.
- 2) **Building notice:** construction works that have to be notified to the building authority but can be carried out without a building permit.
- 3) **Light procedure:** construction works that require a building permit but compliance of building



design with building regulations is only ensured for part of the technical requirements.

4) **Regular procedure:** construction works that require a building permit and compliance of building design with building regulations is ensured for all the technical requirements.

5) **Regularization:** construction works that have been built without the required building permit or contrary to the terms and conditions specified in the building permit, but may be legalised.

In Germany, a type approval may be asked for structures built according to the same design at different places (e.g. prefabricated houses). This implies testing the structural stability as well as sound-, thermal-, damp- and fire-proofing, among other tests. Type approval by one federal state is recognized by all the others, so local building authorities are exempt to check, as part of the permit procedure, whether the structure meets the requirements relating to the type approval functions.

3.1.2 Pre-consultation or mandatory scoping

Scoping is generally the first step in an authorization process, consisting of a consultation between the developer and all the authorities involved in permitting the proposed project, who are represented in the coordinating body (a meeting of the competent departments and authorities). The group will come to consensus on what permits are required from which authority, what documentation is required from the developer and what its contents should be, and the timeline for all activities. This step results in a far more orderly and coordinated permitting procedure, and authorities very rarely ask for additional documents to what has already been required in the scoping document

During a pre-consultation, an applicant for a building permit can address the building authority to discuss the intended construction work and ask for information about specific demands that should be taken into account when further developing the building design (e.g. possible use of the lot, allowable building lines, admissible heights, maximum building mass, admissible derogation from rules). Pre-consultation provides designers with thorough information to develop a building at a particular plot and may give developers the certainty that planning demands will remain unchanged during a certain period [23].

In almost all EU countries, pre-consultation is voluntarily. It is regulated by law, takes place frequently, and the tasks and responsibilities of parties involved, the planning demands, as well as the aesthetics and technical requirements are usually discussed.

In some EU countries, local authorities are bound to agreements or information provided during pre-consultation (e.g. Belgium, Cyprus, Hungary, Italy, Latvia, Portugal and Sweden). In other EU countries, information provided during pre-consultation is accurate and objective. Although advice and opinions about the merits of a proposal are given in good faith, they are not binding to the local authority or the applicant (e.g. Austria, Denmark, France, Malta, the Netherlands and England & Wales).

3.1.3 Planning permit and building procedure

Control of planning demands (i.e. aspects linked to the use and location of construction works) and technical requirements of the building and the plot may be done in separate or combined procedures. If there is a separate procedure, a distinction between the planning permit and the building permit is usually made.

In approximately half of the EU countries, there is a combined permit procedure for planning demands and technical requirements. In these countries, a planning permit is not required before applying for a building permit. Pre-consultation and phasing the procedures can be used to get detailed planning information and reach informal agreements. In the other half of the EU countries, there is a separate permit procedure for planning demands and technical requirements. A planning permit is the basis for the development of a design, but it does not bind the building authority to grant a building permit, since it only states that designs presented at this phase are in compliance with the planning demands. The planning permit does not authorise the beginning of construction works.

Table 18: separation of planning and building permits in 21 EU countries as for 2012, full dots are indicating the prevalent case while empty dots are indicating options and particular cases, modified after [23]

	AT	BE	BG	CZ	DK	EE	FI	FR	DE	HU	IE	IT	NL	PL	PT	RO	SK	SI	ES	SE	UK
separate				•				o		o	•			•		•	•		•	•	•
combined	•	•	•	o	•	•	•	•	•	o		•	•		•				•		

	Integrated permitting regime in Germany
<p>In Germany there is generally an integrated permitting regime for industrial facilities, through an emission control permit (Emission Control Act permit) (section 4, Emission Control Act). This permit has a "concentrative effect", that is, it includes most of the permitting elements necessary to conduct and operate an industrial facility (for example, building permits, nature protection permits, occupational safety and health permits). The primary purpose of section 13 of the Emission Control Act is to co- ordinate and expedite the administrative permitting procedure. For material industrial activities, an Emission Control Act permit must be obtained (section 4, paragraph 1, Emission Control Act), including for:</p> <p>The construction and operation of new installations that are particularly likely to have harmful effects on the environment, because of their nature or operation, or any other reason.</p> <p>Fundamental alterations to existing installations of the nature mentioned in the previous bullet point. The competent body to which permit applications are made varies for different types of facilities. It can also differ from one state to another, since Germany, as a federal republic with 16 federal states, does not have a central administrative organisation.</p> <p>Each federal state has its own laws regulating the organisation of its administration. However, as a rule, the mid-level administrative bodies of the federal states, usually called Landratsamt or Regierungspräsidium, have permitting authority. Permit applications must be made to the relevant competent authority for the facility's proposed location.</p> <p>A permit application initiates the permitting procedure, which regularly includes a public hearing. Certain third parties (municipalities, specialised agencies and neighbours) are invited to comment. The procedure ends with the written permit being issued or denied.</p> <p>Emission Control Act permits are usually unlimited in time, but some other permits are limited (such as, certain water extraction permits). When a facility holding an Emission Control Act permit is modified, the necessary amending permit can lead to new standards or requirements (for example, monitoring requirements) being incorporated into the original permit for the facility. An Emission Control Act permit becomes invalid if the operations covered by the permit are not carried out during any period of three years. This is also true for most other environmental permits and licences.</p> <p>If an operator does not comply with the permitting regime, as a minimum, the relevant competent authorities can request immediate legal compliance, including immediate submission of a permit application. If this is not done, the authorities can order the immediate closure of the relevant facility.</p> <p>The competent environmental authorities can also impose administrative fines against individuals, associations, or other legal entities. In addition, the competent police authorities (Staatsanwälte) can prosecute individuals for any environmental criminal offence committed as a result of non-compliance. The most important criminal offences that can arise out of non-compliance include:</p> <ul style="list-style-type: none"> • Illegal pollution of bodies of water. • Pollution of the air that causes harm to health. • Waste disposal that threatens the environment. 	



Unauthorised operation of installations that are potentially damaging the environment. Creation of serious dangers to health by the release of noxious substances.

3.1.4 Relevant features associated to building permits

Phasing - In some countries phasing is allowed. Phasing the building permit means the possibility to divide the building permit application into phases. This possibility can be particularly useful for complex construction works, since it avoids developing a fully worked out design before the preliminary design has been checked and approved.

Submission demands determine the documentation that must be submitted when an application for a building permit is made. In detail, they describe the documents required to process the application and assess the building design (e.g. drawings, specifications, photographs of existing situation, photomontage of proposal, structural calculations and declarations). In all EU countries, there are statutory submission demands to apply for a building permit.

Site inspections. To ensure that the construction work is carried out in compliance with the approved building plans, the building permit and the building regulations, inspections on the building site are conducted by public or private parties (or a combination). In all EU countries, public building inspectors, from building authorities, have right of access to building sites and are entitled to carry out inspections. They can examine construction works and can request explanations and documents. During site inspections, all parts of the construction work can be inspected. Usually, for each examination the public building inspector provides a report. If construction works take place without a building permit or do not comply with the approved design, they can be suspended until the relevant local authority takes a decision regarding demolition or continuation. Should this happen, the developer may be also sanctioned to pay an administrative fine and the relevant indemnities for damages caused.

Completion. Once the construction work has been completed, the building authorities are usually notified (i.e. completion notification). Several documents may be required for completion, such as, the building design with the works actually carried out, reports of site inspections, the construction log book, and liability declarations by the contractor, building surveyor or designer. In these declarations, signatories attest that the construction work has been carried out in accordance with the approved design and, where applicable, changes comply with the applicable legal and regulatory requirements.

In almost all EU countries, a building can be taken into use after a use permit or a completion certificate is granted. There are some exceptions to this rule. As an example, in France, buildings may be taken into use after notice of the contractor that the construction work is completed.

Procedure time.

In the majority of the EU countries there are fixed procedure times in which the permit has to be issued (Table 18). The building authorities may extend the maximum procedure time for special situations (e.g. listed buildings, buildings located outside the development boundary of a local plan, complex buildings and major cities) in several countries (e.g. Czech Republic, France, Italy, France, Malta, Portugal and England & Wales). In other countries the maximum procedure time may be shorter if designs are certified by a design auditor (e.g. Bulgaria) or if the procedure is operated by approved inspectors (e.g. England & Wales).

Table 19: average procedure times in 20 EU countries and UK in 2010 based on [23]

	AT	BE	BG	CZ	DK	EE	FI	FR	DE	HU	IE	IT	NL	PL	PT	RO	SK	SI	ES	SE	UK
--	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----



Time (weeks)	8 to 24	11	6 to 11	4 to 8		3 to 6		8 to 12	8	8	12	10 to 18	12	9	25 to 31	8		8	8	•	2 to 8
Time is not set					•		•								•		•	•		•	

	construction permits in Germany
<p>A building permit (Baugenehmigung) is required for the construction, alteration, demolition, or change in use of a building. The building permit is granted if the project complies with the planning and building regulation law as well as with all other applicable laws (such as environmental laws).</p> <p>An application for a building permit must be submitted to the local building authority or the building supervisory authority (Bauamt).</p> <p>The application must include a detailed plan of the project, accompanied by necessary supporting documentation such as site plan, construction drawings, building specifications, and, where applicable, documentation regarding heating, noise prevention, and fire protection plans. The documentation required for the application must also be presented to adjacent property owners.</p> <p>German law recognizes the principle of procedural merger. In order to simplify and coordinate the permit procedure, the “juncture control” permit application procedure also includes the building permit process. Repeated procedures are therefore avoided and there is only one contact partner for the applicant.</p>	

3.1.5 Environmental Impact Assessment (EIA)

The Directive CE 2011/92/EU deals with the assessment of the effects of certain public and private projects on the environment. This is a procedure, which is crosscutting and connected to the permitting procedure.

→ {Principle} 18. EIA for projects likely to have significant impact on the environment

Member States shall adopt all measures necessary to ensure that, before development consent is given, projects likely to have significant impact on the environment because of their nature, size, or location are made subject to a requirement for development consent and an assessment with regard to their effects on the environment. By ‘project’ is understood the execution of construction works or of other installations or schemes as well as other interventions in the natural surroundings and landscape, including those involving the extraction of mineral resources.

The determination of whether a particular project is ‘likely to have significant effects on the environment’ is fundamental since there are only those projects that are required to undergo an EIA. This determination, often referred to as ‘screening’, is facilitated by the listing, in Annex I, of projects which are always considered to have significant environmental effects, thereby making an EIA compulsory.

As for projects listed in Annex II, the Member States must determine whether they shall be made subject to an EIA either through a case-by-case examination or by setting thresholds or criteria, or a combination of both methods.

[KEY PROVISION] 23. FlexJET in Annex II EIA

Waste disposal installations for the incineration, chemical treatment are subject to national EIA. This is because FlexJET is assimilated to a recovery installation and not a disposal one. By “environmental impact assessment” means a process consisting of:



- (i) the preparation of an [environmental impact assessment report](#) by the developer,
- (ii) the carrying out of consultations
- (iii) the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer, and any relevant information received through the [consultations](#),
- (iv) the reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination, and
- (v) the integration of the competent authority's reasoned conclusion into any of the decisions.

Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least:

- (a) a description of the project comprising information on the site, design, size and other relevant features of the project,
- (b) a description of the likely significant effects of the project on the environment,
- (c) a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment,
- (d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment,
- (e) a non-technical summary of the information referred to in points (a) to (d), and
- (f) any additional information (specified in Annex IV of the Directive) relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected.

Where the obligation to carry out assessments related to environmental issues arises simultaneously from the Directive and from other Union legislation, such as the Water Framework Directive, the WFD, of the European, the IED and others, Member States should be able to provide for coordinated and/ or joint procedures fulfilling the requirements of the relevant Union legislation.

	<h3>The case of France</h3>
<p>In accordance to European regulations, an EIA is required in case the project is supposed to have significant impact on the environment. The value for this limit depends upon size, feedstock, technology and vary throughout Europe. In some countries, the thresholds are determined by law. In others, a specific part of the procedure, referred to as EIA screening (EIA scoping), is included to establish if an EIA should be conducted and if such is the case, the applying procedure. Usually, this task is mandated by the regulatory authorities to a dedicated commission or task force (EIA commission). In case an EIA is required, the duration of the procedure is extended vastly. The reason is that a series of activities must be performed serially rather than in parallel and the applicant has to await the guidelines of the EIA commission prior to further steps such as performing the actual assessment. The EIA procedure includes active public participation, in most countries it includes at least passive public participation. However, (higher) appeal is only possible to the successive environmental permit.</p> <p>Important amendments to what used to be called 'impact studies' (now referred to as 'environmental assessments') entered into force in early 2017. Under Article R.122-2 of the Environmental Code, some facilities classified for environmental protection purposes (ICPEs) are systematically subject to such environmental assessments, others are subject to these assessments on a case-by-case basis (depending on the categories of project and/or of ICPE, their nature, size or location). This will apply mostly to ICPEs that are subject to authorisation (they never apply to those that are subject to declaration and rarely to those that are subject to registration).</p> <p>Scope of assessment</p>	



What environmental factors and risks fall within the scope of the impact assessment report?

The environmental assessment shall present all items listed under Article R.122-55, II of the Environmental Code (derived from Directive 2011/92/EU on the assessment of the effects of certain

public and private projects on the environment) including, among other things, descriptions of:

- the project,
- the 'reference scenario' (the initial environmental situation),
- the elements that may be affected by the project,
- the main environmental impacts of the project, both direct and indirect, including in case of major accidents or disasters,
- the main alternatives and an indication of the main reasons for the choice of the project, taking into account its effects on the environment and human health,
- the avoidance, reduction and, if possible, compensation measures, and – ideally – the contemplated monitoring of such measures, and

forecasting methods or other reliable data used in order to identify and assess the main environmental effects, among other things.

The environmental assessment does not include other studies that may also be potentially required, depending on the project, such as hazard studies, Natura 2000 impact studies, water studies or renewable energy feasibility study.

Assessor

Who conducts assessments?

The environmental assessment is prepared by the applicant and specifically forwarded by the prefect to the relevant environmental authority, which is selected according to criteria set out in Article R.122-6 of the Environmental Code. The relevant authority will be:

- the ministry in charge of the environment,
- a specific section of a specific environmental council,
- the regional environmental authority, or
- the regional prefect.

The environmental authority's opinion should be issued within a month, but is neither conclusive (it is not a go/no-go opinion) nor binding.

Publication

Are the results of impact assessments publicly available?

The whole application for an environmental authorisation, including the environmental assessment, goes through a public hearing. From January 1 2018, applicants will need to provide a digital version of the environmental assessment, as well as all of the files containing the raw data used. This should facilitate inclusion in the national database of environmental assessments that has existed since 2007.

Challenge

Can the results of an impact assessment be contested? If so, what procedure applies?

An administrative court will suspend an environmental authorisation upon request by a third party when such request is based on the absence of an environmental assessment. Case law on impact studies (the predecessors to environmental assessments) used to consider that significant deficiencies in such studies amounted to an absence of



such studies.

3.1.6 Environmental permits

Some facilities could harm the environment or human health unless they are controlled. The Environmental Permitting regime requires operators to obtain an environmental permit for some facilities, the registration of exemptions for certain waste facilities, and ongoing supervision by regulators [10].

The aim of the regime is to:

- protect the environment and human health,
- deliver permitting and compliance effectively and efficiently in a way that provides increased clarity and minimises the administrative burden on both the regulator and the operators of facilities,
- encourage regulators to promote best practice in the operation of regulated facilities, and
- continue to fully implement European legislation.

The environmental permit controls the emissions to the environment, primarily to the atmosphere. The duration of this permit usually is much longer than that of other types of permits.

In some countries, for some types of installations, usually very small plants, no environmental permit but only a construction permit is required. Some (small) types of installations are exempted from permitting by national decrees.

In Austria and Belgium the threshold for power plants is 300 kW, for example. In Italy biomass plants below 200 kW do not require an environmental permit.

In Germany, for biogas plants smaller than 350 kW. Depending on the size of the project, usually denoted in MW boiler capacity, the authority is the municipality or the region in case of small and medium sized installations and the region, the province or even the Ministry of Environment (e.g. Italy, for power plants exceeding 300 MW) in case of larger plants.

The first step includes the submission of the applicants' documentation. Within a few weeks, the authorities review and either consider the application complete (in a legal sense) or call for additional information. Following a valid application, a draft permit is prepared for informing and consulting various public and institutional stakeholders to gather facts and opinions (public consultation, consultation phase). Following international guidelines, the length of the consultation period typically is 30-45 days. An essential feature of this phase is whether the public is consulted actively or passively. Within a few weeks, the authorities include the consultation comments and objections in a final version of the permit. The preparation of the permit typically consumes a few months in case of integrated permits and a few days or weeks otherwise.

[commentary 15. Intertwined IED and EIA](#)

An environmental permit may include an Environmental Impact Assessment (EIA) or an Integrated Pollution Prevention and Control (IPPC) procedure, or some other country specific procedure. Since these activities occur serially, the environmental permit in case of an EIA may easily require a few years.

Grant of the environmental Permit

Local authorities may follow the approach commonly adopted for the local authority pollution control regimes, whereby the key aspects of the process description are set down in the permit, together with all the major control parameters, including any limit values. This approach has the advantage of setting down in one document all the main requirements imposed on the operator. It may be clearer for the operator, for enforcement purposes, and for the public. If this approach is adopted, however, the permit must cover all the salient parameters and descriptions. So, if the permit did not specify that it was for the operation



of a plant up to a certain capacity threshold, the operator might be able to exceed that threshold without breaching the permit and without seeking further approval. Authorities may, alternatively, decide to rely on information in the application as forming part of the permit – such as the installation description and intended control measures. If this is done, the permit must make clear which aspects of the application are to be treated as permit conditions.

	Permitting regime for industrial activities in France
<p>Three main types of permit or permitting regime for industrial activities exist in France:</p> <ul style="list-style-type: none"> • authorisation (for most potentially polluting activities), • registration or declaration (for less potentially polluting ones). <p>Those activities are designated as 'ICPEs' (facilities classified for environmental protection purposes). They are listed in a nomenclature that contains approximately 275 entries or rubrics. Each rubric sets out capacity or volume thresholds and defines the corresponding permitting regime. When an industrial project includes several ICPE activities that are individually subject to different regimes, the application shall be filed for the most stringent type of permit. ICPE permits are 'integrated permits' as they cover all potential sources of nuisance or impact on all environmental media at a given facility. As of 2014, approximately 450,000 facilities were subject to a declaration, 12,000 to a registration and 32,000 to an authorisation.</p> <p>Issuing authority</p> <p>The local prefect is the authority issuing permits, with the support of environmental services – that is, mainly the Regional Directorates for the Environment, Planning and Housing for ICPE applications.</p> <p>There are no permit fees per se. However, a general tax on polluting activities is levied upon delivery of an environmental authorisation (under €3,000 for 2017, the fee may be cancelled in 2018).</p> <p>Appeal</p> <p>ICPE permits can be challenged before the administrative courts:</p> <ul style="list-style-type: none"> - by applicants/operators within two months of receipt of the signed permit, or - by any interested third party within four months of publication or public posting of the permit. <p>An informal appeal to a higher administrative authority (recours gracieux or recours hiérarchique) can also be made within two months, in which case the above periods for action before the administrative courts are extended by two further months.</p> <p>The principle is that permits have an unlimited validity. Exceptions include:</p> <p>facilities that are expected to operate for less than a year (e.g., pilot schemes) – the permits are issued for six months, renewable once;</p>	

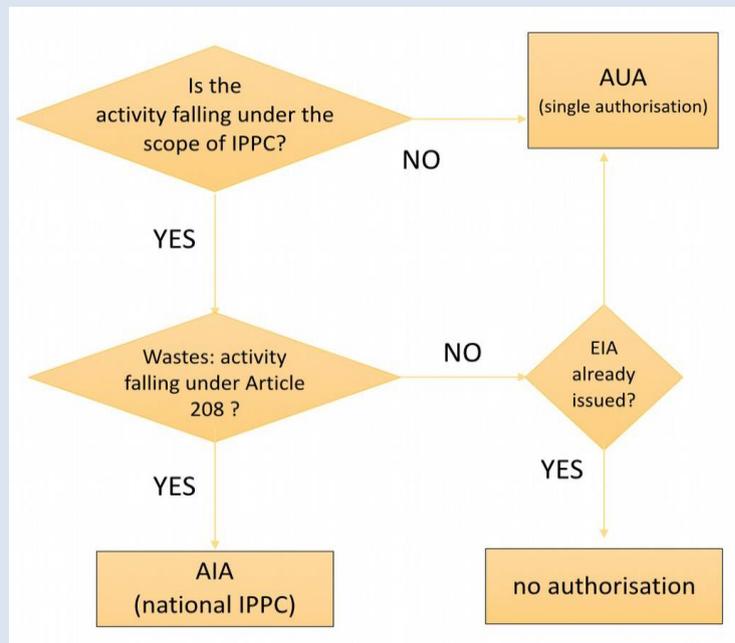
	Environmental permitting configuration in Italy
<p>As part of an ongoing process of administrative simplification, the various separate environmental permits have mostly been replaced by "all inclusive" permits, which are the:</p> <ul style="list-style-type: none"> • Integrated Pollution Prevention and Control permit (IPPC) known as "Autorizzazione Integrata Ambientale" (AIA), 	

- Environmental single permit “Autorizzazione Unica Ambientale” (AUA).

AIA is required for any entity wishing to carry out activities falling under the scope of national IPPC legislation (Part II, Annex VIII, Legislative Decree 152/2006 of the Environmental Protection Code) and integrate the separate permits relating to:

- air emissions,
- wastewater discharges,
- treatment of waste under Article 208 of the Environmental Protection Code,
- disposal of equipment containing PCBs-PCTs,
- use of sewage sludge in agriculture,
- wastewater discharges regulated by the Venice Waterway Magistrate (subject to certain conditions).

Unlike the other comprehensive permits, the IPPC permit adopts an integrated approach, where all environmental aspects are considered simultaneously, together with site-specific issues. The relevant authority must apply emission limit values based on best available techniques (BAT).



Environmental single permit “Autorizzazione Unica Ambientale” (AUA). Operators carrying out activities which are not envisaged by Part II of the Environmental Protection Code (Annex VIII) and therefore fall outside of the scope of IPPC legislation, must apply for an AUA (regulated under Presidential Decree 59/2013). This permit replaces the separate environmental permits relating to:

- wastewater discharges,
- air emissions,
- noise pollution,
- agronomic use of livestock manure and of oil mills' vegetable water,
- use of sewage sludge in agriculture,
- in some cases, the notifications concerning simplified waste treatment authorisation procedures.

It applies to all operators who need to obtain separate environmental permits for different proposed activities and are not required to apply for an IPPC permit or for a **waste treatment single permit**. Because their activity falls neither under the scope of Part II, Annex VIII (see above) nor under the scope of Article 208 regulating the realisation and management of waste recovery, storage and/or disposal facilities as described below.



The permit is not required when the environmental impact assessment (EIA) replaces the single separate permits under an applicable specific law.

Unlike the process for the IPCC permits, each authority must separately grant its consent to the specific activity proposed. Operators must apply for an AUA through the municipality Business Desk (Sportello unico per le attività produttive) (SUAP) who then forwards the request to the appropriate environmental authorities (who would have been required to grant the separate permits under the old regime). The AUA, which lasts for 15 years, will normally be granted by the province unless regional law allocates this competence to a different authority.

The following permits regulate both environmental and other aspects of the activity, such as those requiring building permits:

Waste treatment single permit. This permit authorises the realisation of the necessary plants and buildings (that is, their construction and compatibility with town and planning law) and the management of waste recovery, storage and/or disposal facilities. It can be granted by the region (unless allocated to a different authority) and lasts for ten years (Article 208, Environmental Protection Code).

Single permit for installations producing energy from renewable sources. This permit, required under Legislative Decrees 387/2003 and 28/2011, is issued by the region or, in some specific cases, by the Ministry of Economic Development or by the Ministry of Transportation.

Approval of environmental remediation projects. This is required under Article 242 of the Environmental Protection Code. In some specific residual cases, additional special permitting regimes contained in national or regional law must be co-ordinated with the permitting regimes above or even overlap with them. These include the:

- Notifications prescribed within simplified waste treatment authorisation procedures under Articles 214 and 216 of the Environmental Protection Code.
- Accession to general air emissions permits under Article 272 (concerning less harmful emissions).
- Wastewater discharge authorisation in certain circumstances (for example, industrial wastewaters merging with household wastewaters, urban wastewaters, and wastewaters discharged into surface water where the latter is managed by a remediation company (Consorzio di bonifica) or similar entities).

(Based on the text prepared by Mara Chilosi, Andrea Martelli and Alessia Miranti, Chilosi Martelli Studio Legale Associato, published by Practical Law, Thomson Reuters, uk.practicallaw.thomsonreuters.com, accessed June 2018)

3.1.7 Other permits

Operational Permit

After construction, in some countries (e.g. Bosnia-Herzegovina, Macedonia, Montenegro) an operational permit, also referred to as activity permit, start-up permit or exploitation permit, is required to license the project developer to exploit the facility [24].

Production Permit

A production permit in order to license electricity and/or heat production is required. The duration of the procedure to obtain this permit is relatively short as well and major problems are not reported. The authority usually is the energy regulatory office. With the production permit may come a distribution permit, i.e. the license to distribute electricity or heat to end-consumers.

Grid Connection

A permit or license to access the grid may be required, in particular in case the government owns the grid. The authority may be the local grid operator: Distribution System Operator (DSO) or Transmission System Operator (TSO).

In Italy and Germany, network operators must connect electricity generation plants to their grid following transparent and non-discriminatory technical and economic conditions (section 17, Energy Industry Act).



Grid operators are obliged to give priority access to renewable energy plants in the operation of their grids. They are also obliged to give priority dispatch to electricity from renewable sources. Plant operators may request their grid operator to expand the grid if the connection of a plant requires this expansion.



4 Conclusion and Validation

European regulations affect FlexJET installations at industrial scale when considering involved activities, feedstock and size (see Operational boundaries, page 22).

It has to be stressed that as “FlexJET technology” and “FlexJET installations” is meant respectively the set of the technologies and the expected configuration of the mature technology (at TRL 9) and the typical installation at industrial scale arising from the main components of the current project.

As for “project” it has to be intended the project for a planned “FlexJET installation” at industrial scale placed in the future.

None of the considerations hereafter included is addressing the current implementation of the project FlexJET, which is at the stage of research & development and demonstration implying different and specific provisions. As an example if one would like to retrofit an existing co-incinerating process for FlexJET-feedstock by changing it with FlexJET technology then specific provisions would apply.

The following table is aiming at summarising the main findings.

EU piece of regulation	Provisions	Critical points and interpretation	Fulfilment and consequences
2008/98/EC Waste Framework Directive (WFD) art.7	A list of waste is established including hazardous waste and shall take into account the origin and composition of the waste and, where necessary, the limit values of concentration of hazardous substances.	FlexJET feedstock is classified as non-hazardous waste coded as <ul style="list-style-type: none"> • 20 01 25 “edible oil and fat” • 20 03 02 “waste from markets” • 20 01 08 “biodegradable kitchen and canteen waste” • 19 06 06 “digestate from anaerobic treatment of animal and vegetable waste” 	Inputs of waste to be tracked and recorded
2008/98/EC Waste Framework Directive (WFD) art.18	Mixing operation [key provision] 2	Mixing of FlexJET feedstock with other materials can be carried out if a permit has been established and adverse impact on the environment is not increased and mixing conform the best available techniques (2.2.3).	If mixing of wastes is required, it has to be planned in accordance with WFD art. 18
2008/98/EC Waste Framework Directive (WFD) art. 23	Member States shall require any establishment or undertaking intending to carry out waste treatment to obtain a permit from the competent authority and lays down specific exemptions. (see chapter)	As FlexJET configuration plant is identified as an establishment carrying out waste treatment it undergoes permit issued by the competent authority.	FlexJET facilities and related undertakings are subject to waste treatment permits.
2008/98/EC Waste Framework Directive (WFD) art. 4	The following waste hierarchy shall apply as a priority (a) prevention, (b) preparing for re-use, (c) recycling, (d) other recovery, e.g. energy recovery, and (e) disposal. See →[Principle] 1 , page 26, →→ [Practical Details] 2 Waste management activities and operations: R or D, R1 or R3 ., page 28, [Critical Point] 1 page 28	Position of FlexJET installation will depend on the prevalence of energy recovery above the material recovery. Pyrolysis of wastes can be considered as a recovery operation categorized as R3 “Recycling/reclamation of organic substances which are not used as solvents” or R1 “Use principally as a fuel or other means to generate energy”.	Permits and waste handling must make reference to this categories.



EU piece of regulation	Provisions	Critical points and interpretation	Fulfilment and consequences
2008/98/EC Waste Framework Directive (WFD) Art. 6	Certain specified waste shall cease to be waste when it has undergone a recovery, including recycling, operation and complies with specific criteria. See 2.1.4 and 2.3.4	SAF, hydrogen, biochar and all products derived wastes through FlexJET technology must meet the EoW criteria in order to consider them as products to be placed on the market.	FlexJET derived SAF is not a wastes if responding to ASTM standard (see Products Compliance, page 61). Green hydrogen is not a waste if complying with technical standards. Biochar from wastes to be treated as a waste or EoW procedures and routes to be followed.
2008/98/EC Waste Framework Directive (WFD) recital	When applying the waste hierarchy Member States shall take measures to encourage the options that deliver the best overall environmental outcome. This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste.	As FlexJET technology can be considered as an energy recovery prevalent, a higher ranking can be achieved if material recovery can be demonstrated.	Biochar EoW options to be attentively considered as soon as this route is available.
Waste Shipment Regulation 1013/2006	Where the notifier intends to ship waste as referred to in Article 3(1)(a) or (b), he/she shall submit a prior written notification to and through the competent authority of dispatch and, if submitting a general notification, comply with Article 13	FlexJET feedstock is in the Waste Subject to the Export Prohibition in Article 36. (Annex V) <ul style="list-style-type: none"> • UCO: Part 1 / List B (B3065) • FMW: Part 2 (not marked with an asterisk) (19 06 06) • Digestate: Part 2 (not marked with an asterisk) (20 01 08 / 20 03 02) and therefore, only covered by export prohibition if they are contaminated (Annex V, 3 (a), (b))	Shipments of FlexJET feedstock from or to other OECD member states to the plant to be planned regulated accordingly
2010/75/EU on Industrial emission (IED)	-It lays down rules designed to prevent or, where that is not practicable, to reduce emissions into the generation of waste - Introduce the concept of ‘substantial change’ - Member States may include requirements for certain categories of installations, combustion plants, waste incineration plants or waste co-incineration plants (“general binding rules”)	- FlexJET project may fall under “disposal or recovery of waste in waste incineration plants or in for non-hazardous waste with a capacity exceeding 3 tonnes per hour” (Annex I). Therefore, all provisions enlisted in Chapter II art10-27 do apply: obligations of the operators, application for permit, BAT reference documents and exchange of information, permit conditions, emission limit values, equivalent parameters, etc. If not country level provisions may apply.	Size of the installation to be considered attentively



EU piece of regulation	Provisions	Critical points and interpretation	Fulfilment and consequences
2010/75/EU on Industrial Emissions (IED)	- establishes an information recording system dealing with the performance of installations and techniques in terms of emissions, expressed as short- and long-term averages, where appropriate, and the associated reference conditions, consumption and nature of raw materials, water consumption, use of energy and generation of waste,	See 2.2.4 Country level provisions may apply.	Set up a monitoring plan and system if required
2010/75/EU on Industrial Emissions (IED)	Special provisions of Chapter IV address waste incineration plants and waste co-incineration plants: application for permits, control of emissions, breakdown, monitoring of emissions, compliance to ELV, reporting and public information on waste co-incineration plants etc.	These provisions do not apply “to gasification or pyrolysis plants, if the gases resulting from this thermal treatment of waste are purified to such an extent that they are no longer a waste prior to their incineration and they can cause emissions no higher than those resulting from the burning of natural gas”	Exploit this advantage to retrofit or convert existing incinerating and co-incinerating plants through FlexJET-technology. This principle can be adopted at country level by competent authorities when issuing permits.
2010/75/EU on Industrial Emissions	[key provision] 6 baseline report	Apply only if FlexJET is an IPPC (Enlisted in Annex I) installation.	a baseline report to be prepared for future installations
2010/75/EU on Industrial Emissions (IED)	[key provision] 7 binding rules	Apply only if FlexJET is an IPPC installation. Many target parameters apply here [! Critical Point] 4.	ELVs , BAT and BAT-AELs as well OTNOC conditions to be reviewed
2010/75/EU on Industrial Emissions (IED)	[key provision] 10 definitive cessation of the activities	Apply only if FlexJET is an IPPC (Enlisted in Annex I) installation.	definitive cessation of activities should be planned and potential additional costs considered
E-PTPR Regulation (EC) No 166/2006	[key provision] 12 Information on releases of pollutants, practical transfers of waste, and pollutants in wastewater, page 58	Enlisted among the installations there are those in the scope of the incineration of non-hazardous waste including also thermal treatment processes such as pyrolysis, gasification or plasma processes, with a capacity of 3 tonnes per hour.	To be considered together with IED implications.
The Seveso III Directive 2012/18/EU	2.2.7Accident prevention [key provision] 13	Sustainable Aviation Fuels in scope of the Seveso if present quantify is above 2500 tonnes	screening of the destination plant and produced quantities
REACH Reg. CE 1907/2006	Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) 2.3.1	Different provisions depending on produced quantities, SAF classify as UVCB, any significant change of source or process would be likely to lead to a different substance. See also [! Critical Point] 9. Is SAF SVHC free?	screening for potential exemptions, a REACH plan to be performed,



EU piece of regulation	Provisions	Critical points and interpretation	Fulfilment and consequences
REACH Reg. CE 1907/2006	downstream users obligations	this obligation would impact customers, importers	prepare a plan depending on the qualification
REACH Reg. CE 1907/2006	information in the supply chain		Safety data sheet to be prepared
CLP Reg. CE 1281/2008	2.3.2 Classification, Labelling and Packaging (CLP)	Shipping of SAF fall under CLP	CLP provisions to be applied accordingly
Regulation (EU) No 649/2012	2.3.3 Export and Import of Dangerous Chemicals	PIC (prior informed consent) might be required for SAF shipping. Mixtures of substances might trigger PIC.	Accurate scanning of the product
RED 2009/28/CE	Sustainability criteria for biofuels to qualify for subsidies, support levels, tax credit.	Biofuels and bio-liquids produced from waste and residues, other than agricultural, aquaculture, fisheries and forestry residues, fulfil the sustainability criteria set out in paragraph 2 of article 17. Depending on the destination plant different GHGs savings targets might apply	A GHGs saving of 60% should be secured to benefit from
EIA 85/337/EEC Environmental Impact Assessment	Obligation to conduct an EIA for installations likely to have significant impact on the environment	Waste disposal installations for the incineration, chemical treatment are subject to National EIA (FlexJET installations being assimilated to a recovery installation and not a disposal one). EIA might apply at national or regional level.	Screening of conditions triggering an EIA should be performed prior of a project.

Validation

Elements defined in the “query” (1.4) have been answered.

The catalogue should be extended to the key countries where the technology can take-off. At this regard the Catalogue set up a methodology to implement a more detailed database.

The catalogue is considered a tool to be implemented and extended to for the need of the consortium in the course of the implementation of the project.

Acknowledgment

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grand agreement No 792216



APPENDIX I: DATA SOURCES

The table below lists all data sources used in this deliverable, with a description of the nature and detail of data provided, reporting frequency and a web link to the relevant dataset online.

Data Source	Country	Description of data	Weblink
Planning and Building Germany	DE	Germany Trade & Invest (GTAI) is the economic development agency of the Federal Republic of Germany. This section of the website explain the legal framework related to building and permit.	https://www.gtai.de/GTAI/Navigation/EN/Invest/Investment-guide/The-legal-framework/planning-and-building,t=building-permits,did=6834.html
Environmental permitting France	FR	AIDA Nomenclature of Activities designated as 'ICPEs' (facilities classified for environmental protection purposes).	https://aida.ineris.fr/sites/default/files/gesdoc/30296/BrochureNom_v44public.pdf
Legislation concerning environmental permitting. France	FR	Web site of the Ministry of Ecology, Energy, Sustainable Development and Regional Planning (Risk Prevention Department). Texts on legislation for classified installations, consolidated versions.	http://www.ineris.fr/aida/
Legislation and principles.	DE	Web site of the German Environment Agency (Umweltbundesamt – UBA). References on waste management: from waste prevention, re-use and recycling to recovery and disposal including collection, transport, sorting and treatment of waste.	www.umweltbundesamt.de/en/topics/waste-resources/
Legislation and principles.	DE	Web site of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU).	www.bmu.de/en
Legislation and principles.	EU	Web site of the Directorate-General for Environment is the European Commission department responsible for EU policy on the environment.	http://ec.europa.eu/environment/legal/liability/
Waste transport, waste dealers and brokers	IT	Website of Italian Register of Environmental Operators, organization, registration procedures, Lists of registered businesses, fees, EWC codes, sanctions, etc.	https://www.albonazionalegestoriambientali.it/Home.aspx?lng=en
Environmental permits guidance	UK	UK government services and information websites: application forms, checks on applications, waste permit guidance.	https://www.gov.uk/topic/environmental-management/environmental-permits
SDS standard 16-section format	UN	The Globally Harmonized System of Classification and Labelling of Chemicals contains a standard specification for safety data sheets.	https://www.osha.gov/Publications/OSHA3514.html



Data Source	Country	Description of data	Weblink
directory on Guidance documents for the REACH	EU	The list contains all the Guidance Documents which are available, or will be available. The objective of these documents is to facilitate the implementation of REACH by describing good practice on how to fulfil the obligations.	https://echa.europa.eu/guidance-documents/guidance-on-reach
IUPAC name	UN	Official website IUPAC	https://iupac.org/what-we-do/nomenclature/
CAS number	UN	Official website CAS registry service	http://www.cas.org
E-PTPR	EU	This is The European Pollutant Release and Transfer Register (E-PRTR) is the Europe-wide register that provides easily accessible key environmental data from industrial facilities in European Union Member States and in Iceland, Liechtenstein, Norway, Serbia and Switzerland.	http://prtr.ec.europa.eu/#/ home
Circular economy	EU	ECN (European Compost Network), 2017.	http://www.compostnetwork.info/
Support Schemes and Grid Issues	EU	ES LEGAL Europe is a professionally edited and free of charge online database on support schemes, grid issues and policies regarding renewable energy sources in the EU 28 Member States, the EFTA Countries and some EU Accession Countries. The database covers all three energy sectors: electricity, heating & cooling and transport.	http://www.res-legal.eu



APPENDIX II: EMS RECOMMENDATIONS

The following are the most important recommendations drawn from the Draft BREF on Waste Incineration [15] and which can be applied to FlexJET installations.

The environmental management system (EMS) will incorporate all of the following features:

- I. commitment of the management, including senior management,
- II. definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation,
- III. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment,
- IV. implementation of procedures paying particular attention to:
 - structure and responsibility,
 - recruitment, training, awareness and competence,
 - communication,
 - employee involvement,
 - documentation,
 - effective process control,
 - planned regular maintenance programmes,
 - emergency preparedness and response,
 - safeguarding compliance with environmental legislation,
 - I. checking performance and taking corrective action, paying particular attention to:
 - a. monitoring and measurement (see also the JRC Reference Report on Monitoring of emissions to air and water from IED-installations – ROM),
 - b. corrective and preventive action,
 - c. maintenance of records,
 - d. independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained,
 - II. review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness,
 - III. following the development of cleaner technologies,
 - IV. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life including:
 - avoiding unnecessary underground structures,
 - incorporating features that facilitate dismantling,
 - choosing surface finishes that are easily decontaminated,
 - using an equipment configuration that minimises trapped chemicals and facilitates drainage or cleaning,
 - designing flexible, self-contained equipment that enables phased closure,
 - using biodegradable and recyclable materials where possible,
 - V. application of sectoral benchmarking on a regular basis.

Specifically for incineration plants and, where relevant, bottom ash treatment plants, BAT is to also incorporate the following features in the EMS:

 - VI. waste stream management plan (see BAT 10 and BAT 11),
 - VII. residues management plan including measures aiming to:
 - minimise the generation of residues,
 - optimise the reuse, regeneration, recycling and/or energy recovery of the residues,
 - ensure the proper disposal of residues,
 - VIII. OTNOC management plan (see General BAT for Waste Incineration, BAT 18),



- IX. accident management plan (see APPENDIX III Accident Management Plan,),
- X. odour management plan where odour nuisance at sensitive receptors is expected and/or has been substantiated, including:
- a protocol for conducting odour monitoring in accordance with EN standards (e.g. EN 13725), it
 - may be complemented by measurement/estimation of odour exposure (e.g. according to EN 16841-1 or EN 16841-2) or estimation of odour impact,
 - a protocol for response to identified odour incidents, e.g. complaints,
 - an odour prevention and reduction programme designed to identify the source(s), to measure/estimate odour exposure, to characterise the contributions of the sources, and to implement prevention and/or reduction measures,
- XI. noise management plan (see also BAT 36) where noise nuisance at sensitive receptors is expected and/or has been substantiated, including,
- a protocol for conducting noise monitoring,
 - a protocol for response to identified noise and vibration incidents,
 - a noise and vibration reduction programme designed to identify the source(s), to
 - measure/estimate noise and vibration exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures.

APPENDIX III: Accident Management Plan

An accident management plan is part of the EMS (see BAT 1) and identifies hazards posed by the installation and the associated risks and defines measures to address these risks. It considers the inventory of pollutants present or likely to be present which could have environmental consequences if they escape.

The following are the most important recommendations drawn from the Draft BREF on Waste Incineration [15] and which can be applied to FlexJET installations.

The accident management plan should include the setting up and implementation of a fire prevention, detection and control plan, which is risk-based and includes the use of automatic fire detection and warning systems, and of manual and/or automatic fire intervention and control systems. The fire prevention, detection and control plan is relevant in particular for:

- waste storage and pre-treatment areas,
- furnace loading areas,
- electrical control systems,
- bag filters,
- fixed adsorption beds.

The accident management plan also includes, in particular in the case of installations where hazardous wastes are received, personnel training programmes regarding:

- explosion and fire prevention,
- fire extinguishing,
- knowledge of chemical risks (labelling, carcinogenic substances, toxicity, corrosion, fire) and transportation.



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