Waste to Energy

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The Waste Incineration Directive and its Implementation in the Netherlands: Assessment of Essent's Waste Wood Gasification Process

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Abstract

Essent operates a coal-fired power plant, called AC-9, in Geertruidenberg. A gasifier connected to AC-9 thermally treats waste wood through gasification. The waste wood Essent used is demolition and construction wood, the so-called B-wood. The gas produced through gasification is fed into the connected AC-9 where it is used as fuel. However, after the BVA's (Besluit Verbranden Afvalstoffen) entry into force, Essent had to stop the gasification of waste wood and the subsequent use of the resulting gas as fuel. The BVA is the Dutch implementing measure of the Waste Incineration Directive (Directive 2000/76/EC, WID). According to the BVA, any power plant co-incinerating products of thermal treatment of waste is regarded as a co-incineration plant irrespective of the quality of the product. In the case of a power plant connected to a gasifier, the BVA treats the whole plant as a co-incineration plant. This raises the question of whether the plant of Essent, which is treated as a co-incineration plant by the BVA, is regarded as a co-incineration plant by the WID as well. To answer the question, first, the report dealt with the highly complicated issue of what constitutes waste. Second, it studied how the WID defines incineration and co-incineration plant. Third, it analysed the consistency of the BVA with the WID and the EC Treaty. Fourth, to find out whether the purified producer gas from the gasifier can be characterized as a 'clean' secondary fuel on which the BEES (Besluiten emissie-eisen stookinstallaties A en B) should be applicable, the properties of the gas were examined and compared with the properties of clean biomass. The report also investigated how the emissions per generated MJ looked like if the power plant is fired on only coal and on a combination of coal and producer gas. Finally, the criteria distilled from the case law of the European Court of Justice were applied to the producer gas of Essent.

Conclusions and recommendations

The report showed that the AC-9 of Essent is not a co-incineration plant under the WID and that the BVA is inconsistent with the WID and incompatible with the EC treaty. It also showed that the definition and related concepts of waste are unclear an ambiguous.

1 AC-9 is not a co-incineration plant under the WID

According to the WID, the decisive condition whether a plant involved in the generation of energy (power plant) or production of material products (factory) can be classified as a co-incineration plant is that the substance used as fuel or thermally treated for the purpose of disposal must be waste. Thus, if a gasifier (1) thermally treats waste for the purpose of recovery and (2) the resulting gas has lost the waste status prior to being co-incinerated as fuel in the connected plant, the whole plant –i.e. the gasifier and the power plant - falls outside the definition of co-incineration plant.

1. Gasification process can be classified as a recovery operation under the WID

The gasification process employed by Essent should be regarded as a recovery operation, because the process complied with the three conditions distilled from the case law of the European Court of Justice (ECJ):

1. The waste must substitute a non-waste material, which would have been used if the waste was absent and this substitution must lead to conservation of natural resources. In case of the AC-9 the producer gas derived from demolition wood replaces the fuels used in AC-9.
2. The principal objective of the operation must be serving a useful purpose through replacing other materials, and thereby protecting natural resources. This condition is highly likely to be satisfied if the person processing the waste pays the holder of the waste. The primary purpose of Essent is replacing the fuels used in AC-9 is. This is indicated by the fact that Essent pays the holders for the demolition wood.
3. The conditions in which the operation takes place must give reason to believe that the operation does indeed what it is claimed to do. There is sufficient ground to believe that the gasification process of Essent does what it is claimed to do. Essent uses a single type of waste, namely demolition wood. The waste is subject to quality criteria and Essent monitors the compliance with the quality criteria on a weekly basis. The producer gas of Essent is capable of being used instead of other fuels. Furthermore, Essent pays for the demolition wood that it gasifies to produce product gas. In such a case, it may be expected that the benefits of using producer gas as fuel exceeds the costs of producing it. Otherwise, Essent would have no incentive to produce producer gas.

2. Producer gas ceases to be waste before incineration

From the case law of ECJ, it can be inferred that waste ceases to be waste the moment it is transformed into a material analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions unless it is discarded. The producer gas of Essent is analogous to clean biomass, which it intends to replace and it is capable of being used under the same environmental conditions as clean biomass. Accordingly, the producer gas of Essent may not be regarded as waste.

1.2 Recommendation

The quality monitoring of Essent, which entails weekly analysis of samples taken from the shipment of demolition wood, is not sufficient to guarantee the quality and comparability of the producer gas to clean biomass. There may be large differences between different shipments meaning that the producer gas may not always be comparable to clean biomass. However, it is imperative that the comparability of the gas be constantly maintained. Thus, Essent should increase the sampling frequency of the delivered demolition wood to guarantee the comparability of the gas prior to its co-incineration in the power plant.

2 The BVA is not consistent with the WID nor compatible with the EC Treaty

Scrutiny of the BVA in light of the WID exhibits that the definition of co-incineration plant in the BVA is inconsistent with the definition provided in the WID. The BVA treats any power plant co-incinerating the products of thermal treatment of waste as a co-incineration plant.

The BVA is a more stringent measure contrary to Article 28 EC, as it is a measure having equivalent effect. Treating all the substances derived through thermal treatment of waste as waste is capable of inhibiting cross-border trade. The BVA may not be justified on the basis of Article 30 EC, as it does not distinguish between materials that may pose a genuine threat to human life and those, which do not. It may not be justified via the rule of reason route either as it goes further than necessary.

3 Unclear and ambiguous definitions

Vagueness and ambiguity surrounding the definition of waste and the related concepts is unacceptable. Businesses must be aware of the legal boundaries within which they have to operate and be able to calculate the costs of their operations. The concept of waste and the related concepts are far from satisfactory in providing the legal certainty, which is indispensable for businesses.

It is questionable whether the broad interpretation of the concept of waste always serves the aim of high level of protection as worded in Article 174(2) EC. Complying with the obligations imposed by waste laws may be harsh. When the concept is interpreted too broadly, substances that do not actually possess the characteristic of waste may fall within the ambit of waste laws. A possible effect of this may be that instead of complying with waste laws, holders of waste may seek methods such as illegal dumping. Another effect of an expanding concept of waste the boundaries of which is not clear is that businesses may have to comply with waste rules even in cases where there may be no need, which may result in unnecessary increases in operation costs.

A high level of legal uncertainty may have a serious deterrent effect on investment in new technologies and hence, chill innovation. Investment in new technologies and innovation only occurs if the investor can recoup its costs and make some returns in the future through exploiting the technology in which he has invested. If the boundaries within which the future technology needs to operate are extremely vague and the investor cannot know with a degree of certainty that he will be able to exploit the technology, the innovative efforts and the fruits that may result from those efforts will be unlikely to be realized.

The efforts of the Court in *Mayer Parry, Palin Granit, and Niselli* to draw some clear lines as regards the concept of waste are highly welcome. However, they are not sufficient as they also contain uncertain points. When the definitions are unclear and ambiguous, the Member States give their own interpretation to Community concepts that should be uniform throughout the Community. Bringing uniformity and thereby creating a level playing field is one of the purposes of harmonization but unclear and ambiguous definitions undermine the achievement of these objectives It is not acceptable that concepts, which are central to the application of directives, have different meanings and consequences in different Member States. It is visible from the implementation of the WID in some other Member States and the Netherlands that there are differences between the Member States as regards the definition of incineration and co-incineration plant. This provides proof that the definitions of incineration and co-incineration plants laid down in the WID are indeed vague and ambiguous.

3.1 Recommendation

The efforts of the Court to enhance the legal certainty and remove the lack of clarity and ambiguity surrounding the definition of waste and the related concepts must also be followed by the legislator. Detailed explanatory memorandums explaining the background and the prospective application of the measure should be published. Where the uncertainty remains, the Commission should issue a guidance explaining the application of the measure.

4 Final remark

The Dutch Ministry of Environment (hereafter VROM) intends to amend the BVA. In its current form, the BVA treats any plant co-incinerating products of thermal treatment of waste as a co-incineration plant irrespective of the quality of the product. Where the gasifier and the plant co-incinerating the products of gasification are connected, the whole plant is regarded as one co-incineration plant. Even though the exact nature of the prospective changes is not known, it is expressed that VROM is looking for a formula which enables the placement of the plants co-incinerating products of thermal treatment of waste outside the scope of the BVA provided that the product complies with some strict quality criteria.

In the meantime, as a temporary solution before the amendment of the BVA, VROM issued a memo to the local authorities responsible for permits and permit conditions. According to this memo, gas produced through thermal treatment (gasification) of B-wood (demolition wood not treated with wood preservatives) which is made comparable to gas from A-wood (clean wood) through cleaning will be treated as a substance belonging to the so-called "white list" if they fulfill some strict quality criteria.[1] The white list includes not only clean biomass streams but also biomass waste streams that are excluded from the scope of the BVA but included within the scope of BEES. The consequence of this placement on the white list is that a plant co-incinerating the gas meeting the quality criteria will not be regarded as a co-incineration plant meaning that it will not be regulated under the BVA but BEES A[2] or BEES B.

[1] VROM, Circulaire Gelijke behandeling van Gereinigd gas uit B-hout met ongereinigd gas uit A-hout, 3 Oktober 2006, Sc 2006, 192, 32.
Also available at http://www.infomil.nl/contents/pages/23564/circulairegereinigdgasuitb-hout.doc.pdf [05.10.2006].

[2] Besluit van 23 februari 2005, houdende wijziging van het Besluit emissie-eisen stookinstallaties milieubeheer A, Stb 2005, 114.

Executive Summary

1 Objectives

The main objective of this project was to investigate the Waste Incineration Directive (Directive 2000/76/EC, hereafter the WID) and to determine how the definitions of incineration plant and co-incineration plant provided in the WID should be interpreted. More specifically, the project aimed at assessing the consistency of the BVA (Besluit Verbranden Afvalstoffen), the Dutch implementing measure, with the WID. Moreover, it attempted to make a legal and technical analysis to determine whether the power plant of Essent in Geertruidenberg should be regarded as a co-incineration plant within the meaning of the WID.

2 Reasons

Essent operates a coal-fired power plant (AC-9) in Geertruidenberg. A gasifier connected to AC-9 thermally treats waste wood (demolition and construction wood, the so-called B-wood) through gasification and the gas produced through gasification is fed into the connected AC-9 where it is used as fuel.

However, after the BVA's entry into force, Essent had to stop the gasification of waste wood and the subsequent use of the resulting gas as fuel. According to the BVA, any power plant co-incinerating products of thermal treatment of waste is regarded as a co-incineration plant irrespective of the quality of the product. In the case of a power plant connected to a gasifier, the BVA treats the whole plant as a co-incineration plant. Since the gasifier of Essent is connected to AC-9 in which the gas produced through gasification of wood waste is co-incinerated, the whole plant is considered to be a co-incineration plant regardless of the quality of the gas. Since the treatment of AC-9 as a co-incineration plant and thereby, its becoming subject to the conditions stipulated in the BVA are unacceptable, Essent decided to close down the operations of the gasifier.

It is not clear from the WID how the definitions of incineration and co-incineration plant should be construed and whether the definitions adopted in the BVA are in line with the WID. This research intended to shed light on the definitions of incineration and co-incineration plant provided within the WID and the BVA.

3 Main Findings

When does waste cease to be waste?

Waste may undergo either a recovery or disposal operation. One of the most important differences between the two concepts is that the classification of waste following a treatment process depends on whether it undergoes a recovery or a disposal operation. Whereas waste undergoing a recovery operation may, at some point, cease to be waste and become a product, waste which is made subject to a disposal operation remains waste.

The following factors indicate whether the operation concerns a recovery or disposal operation. Firstly, the waste must substitute a non-waste material, which would have been used if the waste was absent and this substitution must lead to conservation of natural resources. Secondly, serving a useful purpose through replacing other materials, and thereby protecting natural resources, must be the principal objective of the operation in question. The second condition is highly likely to be satisfied if the person processing the waste pays the holder of the waste. Thirdly, the conditions in which the operation takes place must give reason to believe that the operation does indeed what it is claimed to do. The suitability of the waste for the operation in question, the costs of the processing in relation to the benefits that may be derived from the processing, and the suitability of the material derived from the processing for the use it is intended to be put to may indicate whether the third condition is fulfilled. If these three conditions are fulfilled, the operation in question may be regarded as a recovery operation.

In the case of a plant/operation that is dedicated to the disposal of waste, the principal objective cannot be replacing other materials even if such an operation may have the consequence of conserving natural resources. Such a consequence is only a secondary effect of an operation that has the principal objective of disposal of waste.

Waste undergoing a recovery operation may cease to be waste. It may be inferred from the case law of the ECJ that waste ceases to be waste the moment it is transformed into a material analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions unless it is discarded. When determining whether the waste has ceased to be waste, the obtained material must be compared with the raw material that it intends to replace.

If waste is made analogous to a fuel with the same characteristics as that fuel and capable of being used in the same environmental conditions, the recovery operation becomes complete. The holder of the fuel who uses the fuel in accordance with the purpose for which it is made (incineration) cannot be considered to be discarding the fuel just because incineration happens to be listed as a recovery operation in Annex IIB.

Incineration Plant within the Meaning of the WID

The WID makes a distinction between incineration plants and co-incineration plants. Incineration plants are those dedicated to thermal treatment of waste and they are involved in disposal of waste. Co-incineration plants are those that are involved in the generation of energy (power plant) or production of material products (factory) and they either use waste as fuel or thermally treat waste for the purpose of disposal.

The WID distinguishes between two types of incineration plants depending on the type of thermal treatment employed. The first type is a plant, which is dedicated to thermal treatment of waste by oxidation. This is incineration in its classic form. A plant, which directly incinerates waste through oxidation with the purpose of destroying the waste, is regarded as a waste incineration plant even if the heat generated is recovered. The second type refers to thermal treatment processes in the broad sense. Plants dedicated to thermal treatment of waste using other thermal treatment processes such as gasification, pyrolysis, or plasma processes (hereafter only gasification will be used for the purpose of simplicity) are regarded as incineration plants only if the substances that result from the thermal treatment (mostly gaseous) are subsequently incinerated.

A gasifier that is dedicated to thermal treatment of waste performs a disposal operation because the primary purpose of the gasification is destroying the waste. Accordingly, gas produced by such a gasifier remains waste. Any plant incinerating the gas produced by such a gasifier will be incinerating waste and hence, it will be treated as an incineration plant. Where the gasifier and the plant incinerating the gas are connected, the whole plant must be regarded as an incineration plant because when the products of a gasifier whose purpose is the thermal treatment of waste are subsequently incinerated in a plant connected to the gasifier, the same process, namely the thermal treatment of waste, is carried out.

Co-incineration Plant within the Meaning of the WID

Co-incineration plant should be distinguished from an incineration plant. According to the definition provided in Article 3(5) WID, co-incineration plant means any plant whose main purpose is the generation of energy (hereafter power plant) or the production of material products (hereafter factory) and it either uses wastes as a regular or additional fuel or it thermally treats waste for the purpose of disposal. Thus, the decisive condition is that the substance used as fuel or thermally treated for the purpose of disposal must be waste.

In its simplest form, a power plant or a factory directly co-incinerating (co-combustion) waste as fuel or for the purpose of disposal falls within the definition of co-incineration plant.

The mere fact that gasification is one of the ways to dispose of waste and that it is included within the definition of incineration plant in the WID does not justify the conclusion that every gasifier thermally treating waste is performing a disposal operation and that every plant using the substances resulting from the gasification as fuel is a co-incineration plant.

Gasification may be an effective method to generate fuel or raw material from waste. If the gasifier is not dedicated to thermal treatment of waste and its purpose is to produce fuel or raw material from waste, it may be regarded as a plant performing a recovery operation provided that the conditions summarized above as regards recovery are fulfilled.

If the gasifier may be regarded as performing a recovery operation, the gas resulting from gasification of waste may cease to be waste if it is transformed into a fuel analogous to a non-waste fuel with the same characteristics as that fuel and capable of being used in the same environmental conditions. In accordance with the WID, if the gas produced through gasification of waste does not possesses the waste title any longer because of the fact that it has been completely recovered prior to its use as fuel in a power plant or factory, the power plant or the factory using the gas as fuel will not be co-incinerating waste but fuel meaning that it may not be regarded as a co-incineration plant.

Similarly, in the case of a power plant connected to a gasifier thermally treating waste, whether the whole plant must be regarded as co-incineration plant depends on the classification of the gasification process as recovery or disposal.

If the gasifier thermally treats waste for the purpose of disposal and the gas resulting from the gasification is co-incinerated in a connected power plant, the whole plant must be regarded as a co-incineration plant. Thermal treatment for the purpose of disposal as stated in the second indent of Article 3(5) WID refers to thermal treatment in the broad sense, meaning that it covers gasification of waste and the subsequent incineration of the resulting substances as well. However, as clearly stated in the second indent of article 3(5) WID, such thermal treatment in the broad sense is covered by the definition of co-incineration plant only if the gasification occurs for the purpose of disposal. The underlying reason is that if a gasifier connected to a power plant thermally treats waste for the purpose of disposal; the substances resulting from the gasification never lose their waste status. Accordingly, the connected power plant will be co-incinerating waste. In such a case, the whole plant is carrying out the same process, namely the disposal of waste.

If the gasifier thermally treats waste for the purpose of recovery and the resulting gas has lost the waste status prior to being co-incinerated as fuel in the connected plant, the whole plant, the gasifier and the power plant, falls outside the definition of co-incineration plant. Pursuant to the first indent of Article 3(2) WID, it is the use of waste as fuel that determines whether a power plant is a co-incineration plant. Use of waste as fuel refers to incineration in its classic form, which is oxidation. Thus, the decisive factor that determines whether the power plant is a co-incineration plant is the classification of the gas as waste or non-waste at the moment of co-incineration in the power plant. If the recovery through gasification is complete and the gas is not waste at the moment of co-incineration, neither the power plant nor the gasifier may be regarded as a co-incineration plant. The power plant may not because it will not be co-incinerating waste. The gasifier may not be regarded as (part of) a co-incineration plant either for two reasons. Firstly, the gasifier thermally treats waste to produce gas but it does not use the waste as fuel. That is, it does not co-incinerate the waste. Secondly, since no waste incineration takes place in the power plant, the gasifier connected to the power plant may not be regarded as a waste reception, storage, on site pretreatment facility being part of a co-incineration plant within the meaning of the third paragraph of Article 3(5) WID.

Where the recovery of waste through gasification is incomplete, and hence, the gas remains waste at the moment of co-incineration in the connected power plant, the whole plant, thus the gasifier and the power plant, must be treated as a co-incineration plant. The power plant is regarded as a co-incineration plant because it uses waste as fuel. The gasifier itself does not use waste as fuel. Nevertheless, it must be regarded as part of the co-incineration plant within the meaning of the third paragraph of Article 3(5) WID. Since the power plant co-incinerates waste, the gasifier which is connected to the power plant and which supplies the waste to it must be regarded as a waste reception, storage, and on site pretreatment facility and hence, part of the co-incineration plant.

Is the BVA consistent with the WID?

Scrutiny of the BVA in light of the WID exhibits that the definition of co-incineration plant in the BVA is inconsistent with the definition provided in the WID.

Firstly, unlike the WID, the BVA treats any power plant co-incinerating the products of thermal treatment of waste as a co-incineration plant. That is, according to the BVA, waste that undergoes thermal treatment remains waste irrespective of the quality of the substance resulting from the thermal treatment.

The WID defines co-incineration plant as a power plant or factory, which uses waste as fuel or thermally treats waste for the purpose of disposal without mentioning products of thermal treatment of waste. However, the definition of co-incineration plant provided in the BVA specifically includes products of thermal treatment of waste. This interpretation entails a generalization of the definition of incineration plant to co-incineration plant without any legal justification that may be found in the definition of co-incineration plant provided in the WID. Whereas a gasifier dedicated to thermal treatment of waste as explicitly included within the definition of incineration plant is always involved in disposal of waste, a gasifier not dedicated to thermal treatment of waste may be performing either a disposal or recovery operation. The fundamental difference between the two gasifiers is that the substances resulting from a thermal treatment of waste by a dedicated gasifier always remain waste but substances produced through thermal treatment of waste by a not dedicated gasifier may have lost their waste status and have become products. Consequently, plants co-incinerating products of gasification are not always regarded as co-incinerating waste by the WID.

Secondly, according to the BVA, in the case of a gasifier connected to a power plant in which the products of gasifier are co-incinerated, the whole plant is always regarded as a co-incineration plant. This is inconsistent with the WID. The definition of co-incineration plant provided in the WID encompasses connected plants in two situations. First of those is the situation in which the thermal treatment of waste through gasification and the subsequent co-incineration of the substances in the power plant occurs for the purpose of disposal of the waste. The second one is the situation in which the substance has the status of waste at the moment of its co-incineration in the power plant. However, the BVA treats all the connected gasifiers and power plants as a co-incineration plant even when the substance may have lost its waste status at the moment of its co-incineration in the power plant. This is contrary to the text of the WID according to which the decisive criterion is whether the substance is waste or not at the moment of incineration.

Is the BVA Compatible with the EC Treaty?

The inconsistency of the BVA with the WID does not necessarily mean that the BVA is a legally incorrect implementation of the WID. On the basis of Article 176 EC, the Netherlands is empowered to maintain or introduce more stringent measure than the WID. The BVA may be regarded as such a measure.

The Member States are under an obligation to notify the more stringent measure to the Commission. The Netherlands failed to do so as regards the more stringent definition of co-incineration plant. However, such a failure does not render the BVA inapplicable *vis-à-vis* individuals because Article 176 EC entails a mere obligation on the Netherlands to notify but it neither lays down a procedure for Community monitoring nor requires Commission's approval or inaction.

The BVA is a more stringent measure contrary to Article 28 EC, as it is a measure having equivalent effect. Treating all the substances derived through thermal treatment of waste as waste is capable of inhibiting cross-border trade. The BVA may not be justified on the basis of Article 30 EC, as it does not distinguish between materials, which may pose a genuine threat to human life, and those, which do not. It may not be justified via the rule of reason route due to the fact that it goes further than necessary. The Netherlands may, instead of treating all the substances derived through thermal treatment of waste as waste, may ask the producer to guarantee the quality of the material and its comparability of the substance with non-waste materials. Accordingly, the BVA may be regarded as a more stringent measure incompatible with the EC Treaty.

Is the AC-9 a co-incineration plant under the WID?

The gasification process employed by Essent should be regarded as a recovery operation. Essent uses the waste, demolition wood (B-wood), to produce product gas. Firstly, the producer gas derived from demolition wood replaces part of the fuels used in AC-9. Thus, the replacement leads to a decrease in the use of these non-waste fuels. Secondly, replacing the fuels used in AC-9 is the primary purpose of Essent. This is indicated by the fact that Essent pays the holders for the demolition wood. Thirdly, there is sufficient ground to believe that the gasification process of Essent does what it is claimed to do. Essent uses a single type of waste, namely demolition wood. The waste is subject to quality criteria and Essent monitors the compliance with the quality criteria on a weekly basis. The producer gas of Essent is capable of being used instead of other fuels. Furthermore, Essent pays for the demolition wood that it gasifies to produce product gas. In such a case, it may be expected that the benefits of using producer gas as fuel exceeds the costs of producing it. Otherwise, Essent would have no incentive to produce product gas.

A comparison of the purified producer gas with clean biomass revealed that their compositions are comparable. Furthermore, the emissions that arise from the combustion of the producer gas and clean biomass are comparable as well. From a technical point of view, it can be concluded that the purified producer gas of Essent can be characterized as a ‘clean’ secondary fuel, which is comparable to clean biomass. A comparison between the emissions of the fully coal operated AC-9 and the emissions of AC-9 which operates on coal and producer gas showed that the co-firing of the producer gas results in an minor improvement of the emissions of the AC-9.

The producer gas produced through gasification of demolition wood is the result of a complete recovery operation. The moment that demolition wood is transformed into producer gas analogous to clean biomass, with the same characteristics as clean biomass and capable of being used in the same environmental conditions, recovery becomes complete and the producer gas loses its waste status unless it is discarded. The product rules imposed upon clean biomass may be used to determine whether the producer gas has become analogous to clean biomass. The producer gas of Essent is analogous to clean biomass, which it intends to replace and it is capable of being used under the same environmental conditions as clean biomass. Accordingly, the producer gas of Essent may not be regarded as waste.

The producer gas of Essent which has been made analogous to clean biomass so that it can be used as fuel cannot be considered to be discarded because of the mere fact it is made subject to incineration which happens to be one of the explicitly listed recovery operations in Annex IIB WFD.

The classification of the producer gas as waste or not at the moment of its co-incineration through oxidation in AC-9 determines whether the whole plant must be regarded as a co-incineration plant. Since the recovery is complete and the producer gas is not waste but a fuel at the moment of its co-incineration, neither AC-9 nor the gasifier may be regarded as a co-incineration plant. AC-9 may not because it will not be co-incinerating waste. The gasifier may not be regarded as (part of) a co-incineration plant either for two reasons. Firstly, the gasifier thermally treats demolition wood to produce gas but it does not use the demolition wood as fuel. That is, it does not incinerate the demolition wood. Secondly, since no waste incineration takes place in AC-9, the gasifier connected to AC-9 may not be regarded as a waste reception, storage, on site pretreatment facility being part of a co-incineration plant within the meaning of the third paragraph of Article 3(5) WID. In short, the whole plant of Essent, which is regarded as a co-incineration plant by the BVA, is not considered to be a co-incineration plant by the WID.

Had there been no connection between the gasifier and AC-9, the conclusion as regards the classification of AC-9 would have remained the same. Since the producer gas of Essent may not be regarded as waste at the moment of its co-incineration, AC-9 does not co-incinerate waste but fuel. Accordingly, it may not be considered to be a co-incineration plant.

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List of abbreviations and symbols

AC-9:	Amercentrale unit 9
BVA:	Besluit Verbranden Afvalstoffen
BEES:	Besluit Emissie Eisen Stookinstallaties
CHP:	Combined Heat and Power Plant
ECN:	The Energy research Centre of the Netherlands
ECJ:	European Court of Justice
ELV:	Emission Limit Values
LCPD:	Large Combustion Plants Directive (Directive 2001/80/EC)
PWD:	Packaging Waste Directive (Directive 94/62/EC)
REF:	Recycled Fuel
WFD:	The Waste Framework Directive Directive (Directive 75/442/EC as amended by Directive 91/156)
WID:	The Waste Incineration Directive (2000/76/EC)
WSR:	Waste Shipment Regulation (Regulation 259/93, now repealed by Regulation 1013/2006)
SNG:	Synthetic natural gas
CFB:	Circulating Fluidized Bed gasifier

As:	Arsenicum
Cd:	Cadmium
CH_4:	Methane
Cl:	Chlorine
Co:	Cobalt
CO_2:	Carbon dioxide
Cr:	Chromium
Cu:	Copper
H_2O:	Water
HCl:	Hydrogen Chloride
HF:	Hydrogen Fluoride
Hg:	Mercury
Mn:	Manganese
Ni:	Nickel
NO_x:	Nitrogen oxide
N_2:	Nitrogen
N_2O:	Nitrous Oxide
O_2:	Oxygen
O_3:	Ozone
Pb:	Lead
Sb:	Antimony
SO_2:	Sulphur dioxide
TI:	Thallium
V:	Vanadium

Chapter 1 Introduction

1.1 Introduction

Waste has been a matter of interest both for regulators and economic actors not only because of its environmental impacts but also because of potential economic benefits that might be derived from its reuse, recovery, or disposal. This interest has manifested itself by virtue of many legislative acts which in turn have become the subject matter of many court rulings both at European and national level. One legislative act that is likely to become subject matter of court rulings in the future is the Waste Incineration Directive 2000/76/EC[3] (hereafter the WID). The WID introduces strict emission limits and operating conditions for plants incinerating or co-incinerating waste. This has severe consequences for large combustion plants that co-incinerate waste to generate energy. Once it is established that they incinerate or co-incinerate waste, they fall outside the ambit of Large Combustion Plants Directive 2001/80/EC[4] (Hereafter LCPD) and become subject to the WID. The consequence is that they have to comply with much stricter emission limits and operating conditions.

Besluit Verbranden Afval[5] (hereafter the BVA) is the national measure that transposes the WID into national legislation in the Netherlands. According to the BVA,[6] a power station which co-incinerates products of a thermal treatment of waste, for instance producer gas produced by a gasifier through gasification of waste, will be treated as a co-incineration plant irrespective of the quality of the resulting product co-incinerated even in the absence of a connection between the waste processing plant and the power station. In other words, the BVA is based on the assumption that products produced through thermal treatment of waste remain waste and hence, power plants co-incinerating them are regarded as co-incineration plants. Furthermore, if the power plant is connected to a gasifier which derives producer gas from waste through thermal treatment and the producer gas is subsequently co-incinerated in the power plant, the whole plant is considered to be a co-incineration plant regardless of whether the gas co-incinerated may have ceased to be waste and may have become a fuel after the thermal treatment. That is, the BVA treats the whole power plant as a co-incineration plant when the two installations are connected meaning that the power plant must comply with stricter emission limits and operating conditions, and more demanding measurement requirements.

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[3] Directive 2000/76 of the European Parliament of the Council of 4 December 2000 on the Incineration of Waste [2000] OJ L332/91.
[4] Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants [2001] OJ L309/1.
[5] Stb. 2004, 97.(Also available on www.overheid.nl).
[6] See article 1 a and b BVA.

Essent, a power company, installed a gasifier next to its coal fired power plant (Amercentrale) in Geertruidenberg with the intention to produce energy from waste biomass. The gasifier is connected to the power plant.

Two processes are carried out:

1. The gasifier produces producer gas from demolition wood through thermal treatment and the producer gas is subsequently purified.
2. The coal fired power plant uses the purified producer gas as an additional fuel for the generation of electricity and CO_2 reduction.

In accordance with the BVA, the whole plant of Essent is regarded as a co-incineration plant. According to Essent, whereas the first process, the gasification of scrap wood, should fall under BVA, the second process should fall under BEES as the purified producer gas is not waste but useful secondary fuel. The consequences of this were so severe for Essent that the gasifier had to be shut down. The principal research question of this report, therefore, is: *Are the provisions of the BVA with regard to the definition of incineration and co-incineration plant in line with the definitions provided in the WID*? To answer the principal research question it is divided into legal and technical sub-questions in the next section. These questions show that the expertise of both a law student and a chemistry student were needed to carry out the research.

1.1.1 Legal Research Questions

1. How should be the WID interpreted with respect to the definition of incineration and co-incineration plant? The question above may be divided into three sub-questions.
   a. Is it consistent with the WID that the BVA treats a power plant which co-incinerates producer gas produced through gasification of wood waste as a co-incineration plant regardless of the quality of the producer gas even in the absence of a connection between the gasifier and the power station?
   b. Is it consistent with the WID that the BVA treats the whole plant as a co-incineration plant where the gasifier which thermally treats waste and the power plant which co-incinerates the producer gas resulting from the gasification are connected irrespective of whether the producer gas is clean?
   c. How is the WID implemented in other Member States where similar technology is used?
2. Is the BVA compatible with the EC Treaty?
3. Is the plant of Essent, which is treated as a co-incineration plant by the BVA, regarded as a co-incineration plant by the WID as well? There are two sub-questions:
   a. Is the power station of Essent regarded as a co-incineration plant when it co-incinerates producer gas derived from wood waste?

   b. Is the whole plant of Essent, thus the gasifier and the power station, regarded as a co-incineration plant when the producer gas produced by the gasifier from wood waste is co-incinerated in the connected power plant?
4. Does a substance produced through thermal treatment of waste remain to be waste regardless of the quality it may acquire?
   a. May a waste cease to be waste and become a product? If it may, what are the criteria to be applied to determine whether the waste may have ceased to be waste?
   b. Is the producer gas of Essent waste or fuel?

1.1.2 Technical Research Questions

5. Can the purified producer gas from the gasifier being characterized as a 'clean' secondary fuel on which the BEES should be applicable?
6. How do the emissions per generated MJ look like if the power plant is fired on:
   a. Only coals?
   b. Coals and producer gas?

1.3 Method

Legal research
A comparison between the BVA and the WID was made to provide an answer to the first question. This comparison was not confined to a textual analysis of the BVA and the WID. Official documents of the EU which could provide information on the WID were analyzed as well. As regards the implementation of the WID in other Member States, the national legislative measures and if available, guidelines or explanatory memorandums providing background information were studied. Furthermore, great deal of information was obtained through e-mail correspondence with the authorities in other Member States. The case law concerning free movement of goods provided the necessary information to be able to determine the compatibility of the BVA with the EC Treaty. The answer to the third research question was provided through applying the test derived from the answer to the first question to Essent's case. The fourth question dealt with the highly complicated subject of what constitutes waste. The issue of when waste ceases to be waste was central to almost all the questions involved in the research. A thorough analysis of the case-law of the ECJ on waste was made to be able to answer the third question, and as a matter of fact, all the other questions. Apart from the case law of the ECJ, the Dutch Council of State's (the highest administrative court) rulings were analyzed briefly. Finally, the criteria distilled from the case law of the ECJ were applied to the producer gas of Essent.

Technical research

In order to find an answer to the question five and six, a comparison was made between the fully coal operated AC-9 on the one hand, and the AC-9 which operates on coal and producer gas on the other hand. It was investigated how the co-firing of producer gas influences the emissions of the AC-9. Furthermore, the properties of the purified producer gas from the gasifier were examined and compared with the properties of clean biomass. Secondly, a comparison was made between the emissions that arise from the combustion of producer gas and clean biomass. This gave an answer to the question whether the purified producer gas from the gasifier can be characterized as a ‘clean’ secondary fuel on which BEES should be applicable.

1.4 Outline

The second chapter concerns the issue of what is waste. More specifically, it investigates when waste ceases to be waste. The third chapter is related to the second chapter and it explains the distinction between recovery and disposal of waste. This chapter is essential as the distinction between these two operations is one of the decisive factors determining whether waste may have ceased to be waste. The fourth chapter is devoted to the WID and the BVA. It first discusses how the WID should be interpreted and in light of the conclusions derived from the discussion of the WID, it evaluates the BVA. The fifth chapter provides a technical overview of the gasification process employed by Essent, and it analyses the composition of the producer gas and the emissions resulting from its co-firing. The sixth chapter assesses whether the plant of Essent must be regarded as a co-incineration plant or not. Finally, the appendices provide a description of biomass, the applied gasification technology and an extensive process description of the gasification unit of the AC-9.

Chapter 2 The Definition of Waste

2.1 Introduction

Any person who is asked to provide an answer to the question what is waste would probably be able to give an answer without difficulty and would probably say that it is something thrown away. (Un)fortunately, the legal answer to the question is not as straightforward as the answer given above. The issue of waste has prompted many scholars to do a lot of thinking and to produce tremendous amount of writing in search for a definition of waste and the limits to its scope.[7] Courts and litigators, both at national and European level, have also been involved in this search.[8] As a matter of fact, no other issue within the field of European environmental law has caused more litigation than the issue of waste,[9] which has convinced a former judge at the European Court of Justice that this was a waste of time.[10] However, despite all these efforts,[11] the definition of waste and the issues revolving around this definition are far from settled and it is likely that these matters will continue to occupy courtrooms in the future.

One of the issues that has been a subject matter of discussion and several court rulings is the question of when waste ceases to be waste and becomes a product (see sections 2.2 and 2.3). Products that reach the end of their life or residues that result from production processes are treated as waste and they are destined for either disposal or recovery.[12] [13] Waste that undergoes a recovery operation may at some point cease to be waste and become a product. The moment of transition from waste to product is of vital importance as from then on the special waste regime ceases to apply the consequences of which are not insignificant. However, as with all waste related concepts, the moment of transition from waste to product is a matter of controversy.

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[7] See References for an impression.
[8] See Case list for an impression.
[9] H.H.B. Vedder, Tien Jaar Europees Milieurecht en Nederland, *Nederlands Tijdschrift voor Europees Recht*, (11/12) 2005, p. 277.
[10] J.R.C. Tieman, Brussel heeft over definitie afvalstoffen-begrip niets te zeggen, *Milieu en Recht,* (4) 2005, p. 213. The judge that Tieman quotes is Paul Kapteyn.
[11] In several recent cases, the ECJ has made serious attempts to draw some clear lines with regard to the issue of waste and to clarify the meaning of waste and the related concepts. Some of those are: C-9/00, *Palin Granit Oy,* 2002, ECR I-3533; C-114/01, *Avesta Polarit Oy*, 2003, ECR I-08725; C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163; C-228/00, *Commission v Germany*, 2003, ECR I-01439; C-458/00, *Commission v Luxembourg*, 2003, ECR I-01553; C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853.
[12] In C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 62, the ECJ explicitly stated that any treatment of waste is either recovery or disposal of waste.
[13] Residues should be distinguished from by-products. The latter is not treated as waste when some conditions are fulfilled. See C-9/00, *Palin Granit Oy,* 2002, ECR I-3533; C-114/01, *Avesta Polarit Oy*, 2003, ECR I-08725; C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853. The issue of when something becomes waste is a very controversial subject and it is outside the scope of this chapter. However, those issues will be dealt with when they are imperative for a good understanding of the issue at hand.

There are two main views with regard to the transition from waste to product (see section 2.4). On the one hand, some authors argue that waste which undergoes a recovery operation ceases to be waste the moment that it is transformed into a secondary raw material analogous to a primary raw material.[14] On the other hand, some authors argue that a recovery operation does not end until the actual (re)-use as the (re)-use of the waste is the very reason that the waste is made subject to a recovery operation.[15] Thus, according to this view, waste, and substances recovered from waste through recycling/reclamation do not cease to be waste until they are used and processed into products. Accordingly, the essential questions are when does waste cease to be waste and what are the criteria applied to determine whether waste may have ceased to be waste?

2.2 The Waste Framework Directive and Subjectivity

The roots of all the current waste management systems in the European Union may be traced back to the Waste Framework Directive (hereafter the WFD).[16] The WFD is the basic instrument that regulates waste management within the EU unless a specific directive provides otherwise.[17]

The WFD entails obligations for the Member States. In article 3, the hierarchy of waste management is laid down. It obliges the Member States to encourage the prevention and reduction of waste. Waste that cannot be prevented, must be recycled, reused, reclaimed, or processed in any other way to extract secondary raw materials or used as a source of energy where reuse or material recovery is not possible. Finally, waste that may neither be prevented nor recovered must be disposed of safely.[18] Article 4 is another crucial provision, according to which Member States must ensure that waste is recovered or disposed of without endangering human health and without harming the environment. In Article 5, the self-sufficiency and proximity principles are laid down. Self-sufficiency requires Member States to establish a network of disposal installations on the basis of the best available technique not involving excessive costs with a view to becoming self-sufficient in waste disposal individually as Member States and as Community. Proximity requires waste to be disposed of in the nearest

[14] A. van Rossem, Hof Geeft Uitleg aan het (Gevaarlijke-)Afvalstoffenbegrip, *Nederlands Tijdschrift voor Euopees Recht*, (9) 2000, p. 205-206; Ch.W. Backes, Case comment, *Administratiefrechtelijke Beslissingen*, (311) 2000, p.1512-1513.

[15] J. Tieman, The Broad Concept of Waste and the Case of ARCO-Chemie and Hees-EPON, *European Environmental Law Review*, (December) 2000, p. 331-332. J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 239-249, 266-277, 335-344.

[16] Directive 75/442 [1975] OJ L194/39 amended by Directive 91/156 [1991] OJ L78/32.

[17] Art. 2(2) WFD provides that waste specific directives may be laid down. Examples of such directives are Council Directive 94/62 on Packaging and Packaging Waste [1994] OJ L365/10; Directive 91/157 [1991] OJ L/78/38 on Batteries and Accumulators Containing Dangerous Substances.

[18] Art. 4 WFD.

installation through the most appropriate technologies and methods to ensure a high level of protection for the environment and public health.[19] Article 7 obliges the Member States to draw up national waste management plans.

The WFD entails obligations for the Member States as they have to implement the WFD. National implementing measures in turn entail obligations for the persons involved in waste management. Persons carrying out disposal or recovery operations are obliged to obtain a permit from the national authorities.[20] All establishments which carry out recovery and disposal operations are subject to periodic inspections.[21] Furthermore, they must keep a record of the quantity, origin, nature, destination, and method of treatment of wastes that they recover or dispose of and make the record available to the competent national authorities.[22]

Furthermore, Annex IIA and Annex IIB provide a non-exhaustive list of disposal operations and recovery operations respectively.[23] The Annexes repeat the obligation to dispose of or recover waste without endangering human health and without harming the environment. However, neither the WFD nor the Annexes provide a definition of disposal or recovery, which leads to problems in practice especially when cross-border movement of waste is involved.

Apart from the fact that the basic requirements of waste management are laid down in it, there is another reason that makes the WFD essential: it defines waste. If the entire waste management system in the European Union may be compared to a building, the WFD forms the foundation of it as the functioning of the entire system is dependent upon the definition of waste provided within the WFD. Anything that falls within the definition of waste becomes subject to the rules laid down in the WFD or to the rules laid down in the specific daughter directives. Where the environmental concerns, and economic interests of businesses and governments are high as in the case of waste management, one may assume a fundamental concept to be defined clearly. However, this is not the case.

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[19] In the case C-203/96 *Chemische Afvalstoffen Dusseldorp BV*, 1998, ECR I-4075, the ECJ decided that the proximity principle was only applicable to waste for disposal. See for an overview of the more recent judgments on the issue H.H.B. Vedder, Ontwikkelingen in het Europees Afvalstoffenrecht, *Sociaal Economisch Wetgeving*, (7/8) 2003, p.234-250.

[20] According to article 11 WFD, establishments or undertakings carrying out their own disposal operations at the place of production or those that carry out their own recovery operations are exempted from the permit requirement provided that the Member State have general rules and the disposal and recovery operations are performed in accordance with article 4 WFD.

[21] Article 13 WFD

[22] Article 14 WFD

[23] In C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 61, the ECJ made it clear that the Annexes IIA and IIB were non-exhaustive.

2.2.1 Discarding is the keyword in the WFD

Article 1(a) of the WFD provides that "waste shall mean any substance or object in the categories set out in Annex I which the holder discards or intends or is required to discard". Accordingly, there must be an object or substance belonging to the categories in Annex I and the holder of that object or substance must discard it or have the intention or the obligation to discard it. Moreover, the Commission is obliged to produce a list of wastes belonging to the categories listed in Annex I.

A look into Annex I reveals that Annex I is not essential for the determination of whether something is waste. The Annex provides a list of 16 categories of waste. Q16, the final category, provides that any product, substance, or material not mentioned in the other categories fall within the ambit of Q16. Thus, any material, substance, or product may fall under Q16.[24] Furthermore, the list of wastes drawn up by the Commission explicitly provides that the fact that a substance or a material is cited in the waste list does not mean that it is to be regarded as waste unless the holder discards it, intends to discard it, or must discard it.[25]

Thus, whether something must be regarded as waste hinges upon whether it is discarded.[26] However, a search for a definition of "discard" within the WFD would be in vain as no such definition is provided. The requirement of "discarding" makes the definition of waste dependent on the personal actions or intentions of the holder of the substance irrespective of the degree of harmfulness that the substance may have.[27] The consequences of such an open definition of waste are twofold: on the one hand, a flexible and open definition of waste is indispensable for a well-functioning waste law which is capable of coping with changes.[28] On the other hand, it may result in uncertainty.[29]

The case law of the ECJ on waste and its insistence on a broad definition of waste may sometimes be difficult to appreciate. It is, therefore, necessary to have an understanding of the underlying logic.

2.2.2 Waste Regulation depends on a Subjective Factor

In *ARCO,* by referring to article 174 (2) EC, the Court made clear that the Community environmental policy was aimed at high level of protection and was to be based on precautionary principle and the principle of preventive action as a result of which the concept

[24] There are some exceptions though. Those exceptions are provided in Art. 2 WFD.
[25] Commission Decision 2000/532 replacing Decision 94/3 Establishing a List of Wastes [2000] OJ 226/3
[26] C-129/96, *Inter-Environnement Wallonie*, 1997, ECR I-7411.
[27] Or an obligation which may be a legal one. See Art 1 (1)(a) WFD.
[28] H.H.B. Vedder, Plantresten en het Afvalstoffen Begrip, *Agrarisch Recht,* (2) 2005, p.80. See also I, Cheyne, the Definition of Waste in EC Law, *Journal of Environmental Law*, (14) 2002, p. 62.
[29] I, Cheyne, The Definition of Waste in EC Law, *Journal of Environmental Law*, (14) 2002, p. 62.

of waste had to be interpreted broadly.[30] The aim of high level of protection, and the precautionary principle and the principle of preventive action suggest that when there is a risk that a certain activity may result in environmental harm, action may be taken at an early stage to prevent the materialization of the harm.[31] The term discard must be interpreted in light of these aims and principles, which is a recurring theme observed in the case law of the ECJ on waste.[32]

Waste regulation goes further than pollution regulation.[33] Pollution regulation depends on objective factors such as the toxicity, flammability etc of the substance and the degree of regulation is determined by the hazardous features of the substance. Where these hazardous features are less visible or absent, the rules on pollution prevention do not apply. However, substances lacking hazardous features, and hence falling outside the ambit of pollution laws, may also cause pollution and environmental harm. This is where waste regulation enters into the picture. Unlike pollution regulation, waste regulation does not depend on objective factors. The application of waste laws depends on a subjective factor, namely the fact that the substance/product becomes unwanted by its holder.[34]

The fact that something becomes unwanted by its holder provides the main justification for an extensive waste regulation. There are several reasons. Firstly, disposal of the unwanted substance may occur on purely economic grounds without due regard to environmental concerns and inappropriate methods may be used.[35] Whereas a holder who values a product will probably use it as efficiently as possible and in accordance with its intended use, a holder who does not value the product any longer is likely to get rid of it as cheaply as possible or use it inefficiently as a result of which the likelihood of environmental harm increases.[36] In the absence of controls, the cheapest method is likely to be the release into the environment. Secondly, the probability that an unwanted product will cause environmental harm is also present when the product is not gotten rid of but kept by the holder in that an unwanted product will not be kept as safely as a valued product. Finally, EC waste management is not confined to waste disposal. Compliance with the obligation to treat waste according to the hierarchy laid down in article 3 WFD and the obligation to recover or dispose of waste without endangering human health and without harming environment in accordance with article 4 WFD, and Annex IIA and Annex IIB may only be ensured if the movement and treatment of waste is monitored from the moment of its existence until the moment of

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[30] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475, par. 37-40.
[31] J.H.Jans, *European Environmental Law*, Second Edition, Europa Law Publishing, Groningen, 2000, p.33-35.
[32] H.H.B. Vedder, Plantresten en het Afvalstoffen Begrip, *Agrarisch Recht,* (2) 2005, p.80-81.
[33] I, Cheyne, The Definition of Waste in EC Law, *Journal of Environmental Law*, (14) 2002, p. 62-63.; S. Tromans, EC Waste Law: A Complete Mess?, *Journal of Environmental Law*, 13 2001, p. 135-136.
[34] *Ibid.*
[35] *Ibid.*
[36] *Ibid.*

disposal or recovery.[37] Where these controls are not present, the temptation to find some other ways of disposal or recovery which may be cheaper but not in accordance with the objectives of the WFD is great.

It must be admitted that the ECJ has not always been consistent and clear in its decisions concerning waste. However, if the ECJ's case law is analyzed with the above in mind, it may become easier to understand why the concept of waste is interpreted broadly. As stated above, the aim of high level of environmental protection on the basis of precautionary principle and the principle of preventive action necessitates that action be taken when there is a risk that environmental harm may occur. The moment that something is discarded by its holder, thus the moment that something becomes unwanted, the risk that it may be released into the environment without due regard to environmental concerns increases, which triggers the application of waste laws to prevent the risk from materializing.

However, the determination of the moment from when on such a risk exists is highly arduous for two reasons. Firstly, the triggering event is a subjective one that depends on the personal conduct or intention of the holder. Some actions of the holder may be taken as indications that he has discarded the product but they may not conclusively prove that this is indeed the case. Secondly, the fact that a product is not wanted by the holder anymore does not rule out the possibility that the product may have an economic value or may be sold, reused, or used for another purpose. Putting the label waste on such substances is sometimes difficult to explain.

The task of the ECJ is not easy one. On the one hand, a narrow definition of waste is unlikely to achieve the aimed high level of protection since genuine risks may fall outside the scope of waste laws. On the other hand, putting the label waste on products/substances that belong to normal industrial processes may result in an unnecessary burden on businesses and persons. In its endeavors to strike a balance, the ECJ has sometimes made things even more blurred. Waste law has turned into a highly slippery field of environmental law within which the economic actors and governments have had to operate with the least legal certainty. However, in a later series of cases, the ECJ has been able to clarify some controversial points and remove some of the legal uncertainty.[38] Yet, controversy remains on several important points.

2.3 Definition of Waste

As mentioned earlier, looking for a definition of waste in the WFD or other legislative measures may be disappointing as the definition provided is not satisfactory because of the

[37] *Ibid.*
[38] See fn 5. It must be added that even though these rulings clarified some blurred points, they also introduced some new points that became matter of discussion.

reasons explained above. Guidance, therefore, must be sought in the case law of the ECJ. Apart from pointing to some circumstances which may imply that the substance is waste, the Court has always avoided giving a positive definition of waste. Instead, it has chosen to provide some negative guidelines through rejecting the criteria whereby the Member States excluded substances from the scope of waste.

2.3.1 Acquiring the Status of Waste[39]

The moment that something becomes waste corresponds to the moment that it is discarded. However, what constitutes discarding has not always been obvious. Some guidelines may be found in the case law.

2.3.1.1 Substances with Economic Value

In earlier cases, the Court had to deal with the question whether substances that have economic value could be regarded as waste. In a series of cases concerning the same issue, the Court made it clear that substances may be waste even if they have an economic value.

In *Vessoso en Zanetti,*[40] two transport companies were charged with transporting hazardous waste without the necessary permit. According to the Italian Decree, waste was defined as substance or object thrown away or intended to be thrown away. The companies argued that the substances they collected were not waste as they were suitable for economic re-use. The Courts response was not surprising. According to the Court, national legislation which defined waste as excluding substances and objects which were capable of economic reutilization was not compatible with Directives 75/442. It also added that the holder discarding a substance or object did not need to have the purpose of making the economic reuse by others impossible. Thus, objects or substances discarded by their holders were to be regarded as waste even if they were capable of being recycled, or reused.

Tombesi also concerned an Italian Decree which excluded certain substances from the scope of waste.[41] According to this decree, residues which were suitable for reuse were subject to a simplified control regime. Furthermore, residues that were quoted on some commercial lists were totally excluded from the concept of waste. The Courts response was not very different from its response in *Vevosso and Zanetti.* According to the Court, the concept of waste did not exclude substances and objects which were capable of economic reutilization, even if the materials in question may have been the subject of a transaction or quoted on public or private commercial lists. This suggests that a substance may be waste even if it is the subject of a

[39] The reader must be reminded that the contents of this section are not directly related to the subject of this thesis. Because of this reason, important cases are summarized but no detailed analysis is made.
[40] Joined Cases C-206/88 and C-207/88, *Vessoso and Zanetti*, 1990, ECR I-1461.
[41] Joined Cases C-304/94 et al, *Tombesi*, 1997, ECR I-3561.

legal transaction which entails a transfer of property to another person in return for economic benefits. In other words, if the substance has been discarded, the fact that the holder may sell it to another person does not alter the fact that the substance is waste.

The Court gave a clear response to the much voiced argument that substances that have an economic value should not be treated as waste. This approach is impossible to align with the WFD. Firstly, as pointed out by Krämer, almost every object or substance has an economic value somewhere.[42] Accordingly, if economic value was the decisive criterion, there would be almost no waste at all. For instance, if applied to incineration of waste, this would mean that anything that has enough calorific value to generate energy would not be waste but a product as it would have an economic value.[43]

Secondly, the fact that the holder may derive economic benefit from the waste does not mean that it may not be discarded. A production residue that results from a production process may be a raw material for another industrial process and may therefore become subject of a legal transaction. However, this does not alter the fact that the residue is a burden on the producer and he would be better off without it. If there happens to be a market, he may simply get rid of it by selling it to another person. If there is no demand for it, then there is the risk that the producer in question may seek the cheapest ways of disposal or recovery which, in the absence of controls, may occur without respect to environmental concerns. It may be argued that the same reasoning applies to products as well since demand for a product may fall and the product itself may also become a burden. However, a product is unlikely to be produced if there is no demand. Hence, whereas the production of the product will be avoided in the absence of a demand, the production of residues cannot be avoided as long as there is demand for the product. That is, the residue is unavoidable as long as the production proceeds, thereby creating risk of environmental harm the actual occurrence of which must be prevented.

Thirdly, discarding encompasses both disposal and recovery. Thus, discarded substances that are bought for the purpose of recovery remain waste until they are fully recovered. Furthermore, the obligations laid down in articles 3 and 4 WFD require that discarded substances be subject to control so as to ensure that the hierarchy in article 3 is achieved without causing harm to human health or environment. In the absence of controls, the achievement of these objectives may not be ensured as there is the risk that holder of the waste does not treat the waste in accordance with the objectives of the WFD as he would prefer to recover the waste as cheaply and profitably as possible . For instance, a paper recycler who buys waste paper to recycle may prefer to sell it to other persons who may

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[42] L. Krämer, *EC Environmental Law,* Fifth Edition, Sweet & Maxwell, London, 2003, p. 326.
[43] *Ibid.*

incinerate it to generate energy. This is a contravention of article 3 and it may not be prevented unless waste paper remains waste until it is recycled.

It probably has not escaped the reader's attention that the Court does not say anything about the issue when something must be regarded as discarded. The Court is only saying that the fact that something has an economic value does not mean that it may not be discarded. Thus, the contribution of these cases to the much needed legal certainty was not significant and the concept of discarding remained fuzzy. An attempt to clarify the concept of waste was also made by AG Jacobs.

2.3.1.2 Tombesi By-pass

The complexity of determining the moment when a substance becomes waste on the basis of personal conduct of the holder of the substance and the legal uncertainty that this complexity leads to prompted AG Jacobs to formulate an alternative approach which has become to be known as the Tombesi by-pass.[44] AG Jacobs proposed his solution in his opinion in *Tombesi* and elaborated it *Inter-Environnement Wallonie*.[45]

According to the AG, the term discard in the WFD had a special meaning. He stated that the WFD and the Annexes IIA and IIB extended both to objects and substances which were disposed of or recovered. Hence, the scope of waste was dependent on what was meant by disposal operation or discovery operation. He then looked at the Annexes IIA and IIB and stated that the Annexes did not list the disposal and recovery operations exhaustively. He defined recovery as a process by which goods were restored to their previous state or transformed into a usable state or by which certain usable components were extracted or produced. A substance which was destined to be put directly to continued use in its existing form would not be undergoing a recovery operation and thus, it would not be waste. He further stated that in the case of residues, by-products, secondary raw materials, or other materials resulting from industrial processes, the condition of continued use in existing form would be satisfied where the material or the process that material would undergo met normal health and environmental requirements applicable to non-waste products or processes. Hence, according to AG Jacobs' proposal, any material which was subject to a treatment operation before being used would be treated as waste. Conversely, all the materials that were put to a continued use in their existing form and all the secondary raw materials, residues etc. which were put to direct use and satisfied the normal health and environmental requirements applied to non-waste products would be treated as non-waste.

[44] G. van Calster, The EC Definition of Waste: The Euro Tombesi Bypass and Basel relief Routes, *European Business Law Review*, 1997, p.137-143.
[45] AG Jacobs, Joined Cases C-304/94 et al, *Tombesi*, 1997, ECR I-3561; AG Jacobs, C-129/96, *Inter-Environnement Wallonie*, 1997, ECR I-7411.

AG Jacob's proposal has been criticized in the literature. One of the often voiced criticisms which the AG himself also admitted is that there is an element of circularity in AG Jacobs' approach.[46] Whether something is recovered depends on whether it is waste which in turn depends on whether it is recovered. Furthermore, while trying to bring some clarity to the concept of waste through bypassing "discarding", the AG was shifting the problem to the interpretation of recovery.[47] If recovery meant that a substance had to be regarded as discarded because of the mere fact that it had undergone a recovery operation, the scope of definition of waste would be unjustifiably extended as non-waste products could also undergo processes listed in Annex IIB, such as use principally as fuel.[48] Conversely, exclusion of processes that do not involve treatment before use from the scope of recovery would not be a good solution either as not all the recovery operations involve some sort of pre-treatment.[49] For instance, substances may be used as a fuel without any pre-treatment. The AG's interpretation of recovery would result in an awkward situation where old tyres which were incinerated directly would be treated as non-waste, whereas old construction wood which had been ground before it was used as fuel would be waste.[50]

Apart from the problems stated above, the suggested approach of the AG suffers from another problem. The moment that a substance becomes waste is of vital importance as from then on the control mechanism provided in the WFD and other measures becomes applicable. When the decisive criterion is the discarding of the substance, the moment that the substance becomes waste corresponds to the moment that holder discards it. However, when something is to be regarded as discarded depends on whether it is subject to a recovery or disposal operation, the moment that the substance becomes waste corresponds to the moment that that it undergoes a recovery or disposal operation. Accordingly, until the recovery or disposal operation takes place, the substance will not be subject to a control mechanism. Hence, activities that precede a recovery or disposal operation will be outside the scope of waste laws. This is highly undesirable as these activities may also constitute a risk of environmental harm that justifies the application of waste laws.

It is not surprising that the solutions proposed by the AG were rejected by the Court. Two of the several questions that the Court had to answer in *ARCO* concerned the solutions proposed

[46] AG Jacobs, Joined Cases C-304/94 et al, *Tombesi*, 1997, ECR I-3561, p. 55. See also G. Van Calster, The Legal Framework for the Regulation of Waste in the European Community, for the Regulation of Waste in the European Community, in H. Somsen (ed.), *Yearbook of European Environmental Law,* Oxford University Press, Oxford and New York, 2000, p.166.
[47]M. Purdue and A. van Rossem, Comment by van Rossem, The Distinction between Using Secondary Raw Materials and Recovery of Waste: the Directive Definition of Waste, *Journal of Environmental Law,* (10) 1998, p.142.
[48] *Ibid*
[49] *Ibid.*
[50] *Ibid*

by AG Jacobs. The first question was whether the mere fact that a substance was subject to a recovery operation meant that it had been discarded, and hence it was waste. The second question concerned the issue of whether the fact that the substances could be recovered in an environmentally responsible way without substantial processing could be relevant for the determination whether they were waste or not.

The reply of the Court to the first question was an explicit rejection of AG Jacob's proposition. According to the Court, it may not be inferred from the mere fact that a substance is subject to a recovery operation listed in Annex IIB that the substance has been discarded whereby it has became waste.[51] Some recovery operations such as (R1) use as a fuel in Annex IIB could apply to non-waste materials as well, meaning that treating anything that undergoes a recovery operation as discarded would turn even non-waste products such as fuel oil into waste.[52] This is obviously not the intention of the drafters of the WFD. However, the fact that the use of a substance as fuel is a common method of waste recovery and the fact that the substance is commonly regarded as waste may be taken as evidence that the holder has discarded it.[53] Nevertheless, whether the substance is indeed waste must be determined in light of all the circumstances keeping the aim of the directive and the need to ensure its effectiveness in mind.[54]

In its reply to the second question, the Court made it clear that substances which may be recovered in an environmentally responsible manner without substantial treatment may not be excluded from the scope of waste.[55] According to the Court, what subsequently happens to a substance does not affect its nature as waste.[56] The fact that the substance does not cause environmental harm when processed has no effect on its classification as waste.[57] A substance such as coal may be incinerated without due regard to environmental standards and it does not become waste. However, a substance that is discarded will be treated as waste even if the recovery of the substance as a fuel is environmentally responsible and it happens without substantial treatment.[58] Thus, a discarded substance which produces much less environmental harm than coal when it is directly made subject to a recovery operation through incineration is treated as waste, whereas coal which is not discarded is not treated as waste even if it causes much more environmental harm than coal.

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[51] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475, par. 51.
[52] *Ibid* par.50.
[53] *Ibid* par 73.
[54] *Ibid.*
[55] *Ibid* par. 65, par 72
[56] *Ibid* par. 64.
[57] *Ibid* par 66.
[58] *Ibid* par. 66.

Discarding is the criterion

The Court's reasoning may seem odd as one may wonder whether the Court's interpretation is environmentally friendly. However, the underlying logic of waste regulation explained above must be kept in mind when trying to understand the Court's reasoning. The Court stresses the importance of not losing sight of the essential objectives of waste regulation. Waste regulation is not the same as pollution regulation. Waste regulation is not concerned with the objective factors such as the composition and hazardousness of substances. These are matters to be regulated by pollution control measures.[59] The fact that a substance may be recovered in an environmentally responsible manner, and the objective factors such as its composition and hazardousness have therefore no bearing on the status of the substance as waste.

Waste regulation aims at coping with the risk of environmental harm that may occur when a substance is not wanted by its holder any longer as from then on the risk that the substance may be released into the environment or that it may be treated in an environmentally harmful manner increases. Therefore, it is the subjective factor, namely the fact that the substance is not wanted by its holder anymore that determines whether something is waste. Once this subjective condition is satisfied, the substance becomes subject to waste rules until it is fully recovered or disposed of even though the substance itself may not be environmentally harmful. The fact that the process by which the waste is treated does not cause any environmental harm does not alter the fact that the substance is waste.

Neither does the transfer of the discarded substance to another person alter the status of the substance as waste. It may be argued that the subsequent holder does not discard the substance as he values the substance, and thus, the subjective factor is absent. For instance, scrap metal, a production residue from automobile industry may be sold to another person who produces steel from scrap metal. A huge company office which produces an enormous amount of waste paper may sell the waste paper to a paper factory which recycles it to produce paper. In both of these cases, the subsequent holders value the substance. However, had these wastes ceased to be waste the moment that they were transferred to the subsequent holders, it would have been possible to circumvent waste laws by a simple transfer of the substance. Since from then on waste laws would not apply, the actual processes to which these substances are put into cannot be known. Therefore, it is necessary to subject discarded substances to waste laws until they are fully recovered or disposed of even when the treatment that they may undergo is environmentally benign and even when these substances are transferred to other holders who value them.

[59] However, it must be kept in mind that product rules that impose obligations on producers with regard to substances and materials that they may use in the production of products are directly linked with waste management (prevention, use etc) as the use of hazardous, environmentally unfriendly, or unsustainable substances or materials affects the amount of waste generated and the amount of waste that may be recycled.

If it is beyond doubt that the discarding has taken place, the application of waste laws from the moment of discarding until recovery or disposal is justified. However, the difficulty lies in the determination of whether discarding has taken place. The problem is particularly obvious when production residues are involved.

2.3.1.3 Production Residues, By-products, and Consumption Residues

One of the recurring questions that the Court has had to answer is whether residues that result from a production process should be treated as waste. The answer to this question has serious consequences for industries as those residues are usually capable of being used as raw material. If they are waste, waste laws apply to them not only when they are processed within the same place of production but also when they are transferred and used in another industrial process.

After a period of hesitation and avoidance,[60] the Court clarified some blurred points in *Palin Granit.*[61] The case concerned the question of whether leftover stones that resulted from granite quarrying and stored on a site next to the place of quarrying waiting subsequent use were waste.

The Court first defined the production residue. According to the Court a production residue was a product "not in itself sought for a subsequent use".[62] The production of leftover stone was not Palin Granit's primary objective and the undertaking was trying to limit the amount of leftover stones produced and hence, it would in principle fall under Q11 of Annex I.[63]

It then made a distinction between production residues and by-products. Unlike production residues, by-products that resulted from manufacturing or extraction processes the primary aim of which was not the production of those items would not be wished to be discarded.[64] They were intended to be exploited and marketed on advantageous terms in a subsequent process without any further processing prior to reuse.[65] There was no reason to apply the provisions of WFD to "materials or raw materials which have an economic value as products regardless of any form of processing and which, as such, are subject to the legislation applicable to those products".[66]

[60] See C-129/96, *Inter-Environnement Wallonie*, 1997, ECR I-7411; Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475.
[61] C-9/00, *Palin Granit Oy,* 2002, ECR I-3533; The other cases that deal with the same issue are C-114/01, *Avesta Polarit Oy*, 2003, ECR I-08725; C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853; C-235/02, *Saetti*, 2004, not yet published.
[62] C-9/00, *Palin Granit Oy,* 2002, ECR I-3533, par.32.
[63] *Ibid*, par. 32-33.
[64] *Ibid* Par. 34.
[65] *Ibid.*
[66] *Ibid* par.35

However, the Court makes the by-product exception subject to a proviso. According to the Court, the reuse of the goods, materials etc must not be "a mere possibility but a certainty, without any further processing prior to reuse and as an integral part of the production process".[67] The Court further states that in addition to the criterion of whether a substance constitutes a production residue, degree of likelihood that that substance would be reused, without any further processing prior to its reuse constitutes a second relevant criterion for the determination of whether something is waste.[68] Furthermore, the degree of likelihood of reuse is high when there is a financial advantage for the holder. In such a case, the substance in question must be regarded as a genuine product and not as a burden that holder seeks to discard.[69]

In short, production residues which are not sought to be produced are, in principle, waste. However, if the reuse of the production residue without any further processing is certain and the holder derives a financial advantage from this reuse, the production residue will not be treated as waste but as a product.

In *Niselli,* the Court makes clear that the by-product exception formulated in *Palin Granit* may not be applied to consumption residues.[70] Thus, consumption residues will be treated as waste even if they are capable of being reused without further processing. Second hand goods, defined as goods that are reused definitely and in a comparable manner without prior processing are not treated as waste.[71]

Developing criteria for determining when something becomes waste has been painful not only for the Court but also for the actors involved in waste management. Another issue that has caused as much pain as the acquisition of waste status is the losing of waste status.

2.4 Losing the Waste Status

A substance which has been discarded by its holder may have two destinations: it may be either disposed of or recovered.[72] Neither of these important terms is defined in the WFD.[73]

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[67] *Ibid* par. 36. See for a criticism H.H.B. Vedder, Ontwikkelingen in het Europees Afvalstoffenrecht, *Sociaal Economisch Wetgeving*, (7/8) 2003, p.236.
[68] *Ibid par. 37.*
[69] *Ibid.* par. 37.
[70] C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853, par. 49.
[71] *Ibid* par. 49.
[72] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 62.
[73] The consequences of whether a waste is intended to be subject to a disposal or recovery operation is very important for the application of Council Regulation 259/93 on the Supervision and Control of Shipments of Waste within, into, and out of the Community [1993] OJ 1993 L30/1 amended by Regulation 2557/2001 [2001] OJ L349/1 Hereafter Waste Shipment Regulation (WSR). Now repealed by Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste [2006] OJ L190/1.

However, Annex IIA and Annex IIB provide a list of disposal and recovery operations respectively. These lists are not exhaustive meaning that waste may be disposed of or recovered in ways other than listed in the Annexes.[74]

One of the essential differences between disposal and recovery is the consequences that they have for the waste treated. The holder of a waste which is subject to a disposal operation is indifferent to what may happen to the substance afterwards and the purpose of subjecting a waste to a disposal operation is to exclude any further use of it.[75] Accordingly, waste going through a disposal operation remains waste and it may never lose its waste status.[76] [77] Unlike waste going through a disposal operation, waste going through a recovery operation may lose its waste status and become a product.[78] The moment of transition to a product coincides with the moment that the recovery process is complete.[79]

Even though the possibility that waste may turn into a product after a complete recovery operation is a settled issue, the moment that this transition occurs, that is the moment that recovery is complete, is a matter of debate. There are two views on the issue. According to the first view, a recovery operation is complete as soon as waste has been turned into a material or substance that has the same characteristics as a primary raw material.[80] Once the recovered substance is made analogous to a primary raw material, there is no need to subject the substance to waste laws. The second view is based on the assumption that a recovery operation does not end until the actual (re)use as (re)use of the waste is the very reason that the waste is made subject to a recovery operation.[81] Thus, according to this view, waste, and substances recovered from waste through recycling/reclamation do not cease to be waste until they are used and processed into products. For instance, demolition wood, which has been made analogous to clean wood through a recovery process so that it can be incinerated to generate energy, remains waste until the actual incineration takes place as this is the very reason that the waste has been made subject to a recovery operation. The extension of

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[74] *Ibid.*
[75] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 264.
[76] *Ibid* p.335
[77] However, it must be remembered that the residues of a disposal operation may themselves become subject to a recovery operation as a result of which they may lose their waste status.
[78] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 336.
[79] *Ibid.*
[80] A. van Rossem, Hof Geeft Uitleg aan het (Gevaarlijke-)Afvalstoffenbegrip, *Nederlands Tijdschrift voor Euopees Recht*, (9) 2000, p. 205-206; Ch.W. Backes, Case comment, *Administratiefrechtelijke Beslissingen*, (311) 2000, p.1512-1513.
[81] J. Tieman, The Broad Concept of Waste and the Case of ARCO-Chemie and Hees-EPON, *European Environmental Law Review*, (December) 2000, p. 331-332. J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 239-249, 266-277, 335-344.

recovery process to the actual (re)use is based on the *ARCO* and R11 listed in Annex IIB of the WFD.[82] An analysis of the case law is required to determine which view should prevail.

2.4.1 Analysis of the ECJ's Case Law

There have been three cases in which the Court was confronted with the question of when waste ceases to be waste namely *ARCO, Mayer Parry,* and *Niselli.*

2.4.1.1 ARCO

As mentioned earlier, the Court's responses to the questions of national courts may sometimes make the matters more complicated. *ARCO* is one of the most cited landmark cases which, instead of clarifying several urgent issues concerning waste, took the complexity to one upper level. Because of the vague and ambiguous answers of the Court, many important issues became prone to speculation.

One of the questions that the Court needed to answer concerned the issue of transition from waste to product. *Epon*, an electricity generating company, incinerated wood powder to generate electricity. The process took several steps. Waste wood containing toxic substances was turned into woodchips which was ground into powder and then burnt to generate electricity. The question was when the wood waste could be said to have been through a full recovery process and hence, ceased to be waste.

The Court first held that where the holder of the substance discards it, it may be regarded as waste even if it has been the result of a complete recovery operation whereby it has acquired the same properties and characteristics as a raw material.[83] The Court further held that the fact that the substance is the result of a complete recovery operation is not conclusive in determining whether it is waste but it is only one of the factors to be taken into consideration when making such a determination.[84]

In the following paragraph, the Court made several findings.[85] According to the Court, a complete recovery operation does not *necessarily* deprive an object of its classification as waste. The same applies *a fortiori* to an operation during which the objects are only sorted or pre-treated. This was the case in the issue at hand. Waste wood which is impregnated with toxic substances is reduced into chips which are then ground to wood powder. However, since this operation does not remove the toxic substances from the waste, the waste is not transformed into a substance analogous to a raw material with the same characteristics as that

[82] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475; R11 of Annex IIB of the WFD reads as "use of wastes obtained from any of the operations numbered R1 to R10".
[83] *Ibid* par. 94.
[84] *Ibid* par. 95.
[85] *Ibid* par. 96.

raw material and capable of being used without there being a need to take extra measures to protect the environment.

Discussion of ARCO[86]

As mentioned before, the contribution of *ARCO* to the clarification of important issues with regard to waste is very limited. One such issue is the transition from waste to product. The Court's answer to the question whether waste may cease to be waste revolves around the issue of whether a "complete recovery operation" resulting in a substance that has acquired the characteristics of a raw material may end the classification of waste. The cautious tone of the Court and the ambiguity of the language that it uses, which is visible throughout the decision, may give the impression that the Court is unwilling to consider a complete recovery as a definitive criterion for the determination of whether something has ceased to be waste. However, scrutiny of the Court's words reveals that a complete recovery operation ends the classification of waste provided that the holder does not discard it.

In paragraph 94, the Court says that waste which has acquired characteristics as a raw material after a complete recovery *may nonetheless* be regarded as waste if its holder discards it. These words suggest that substances that are made analogous to raw materials after a recovery operation may cease to be waste.[87] However, whether they may do so depends whether its holder discards them or not. There are two thinkable situations and the Court probably had both situations in mind. On the one hand, the substance may cease to be waste the moment that it has acquired characteristics as a raw material but it may become waste again if the holder discards it at a later time.[88] Accordingly, the waste status ends after the complete recovery but it begins anew if the holder discards it again. On the other hand, the substance may not cease to be waste even after a complete recovery whereby it has acquired characteristics as a raw material if the holder has discarded it either prior to or during the complete recovery process. That is, the waste status does not end since the substance that has acquired the characteristics of raw material as a result of complete recovery process has already been discarded prior to the end of the complete recovery process.

Paragraph 95, which says that the fact that the substance is the result of a complete recovery process is not the only factor that determines whether the substance constitutes waste and that there are other factors that needs to be considered, should be read in light of paragraph 94.

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[86] The discussion is confined to paragraphs 94-96 of the *ARCO* case.

[87] See also G. Van Thuyne, De Draagwijdte van het Begrip 'Afvalstof' na het ARCO/EPON-arrest voor de Vlaamse en Nederlandse Rechtspraktijk, *Sociaal Economisch Wetgeving*, (9) 2002, p.300; A. van Rossem, Hof Geeft Uitleg aan het (Gevaarlijke-)Afvalstoffenbegrip, *Nederlands Tijdschrift voor Euopees Recht*, (9) 2000, p. 205-206.

[88] I, Cheyne, The Definition of Waste in EC Law, *Journal of Environmental Law*, (14) 2002; J. Pike, Waste not Want not: An (Even) Wider Definition of Waste, (14) 2002, *Journal of Environmental Law*, p.206-207.

That is, according to the Court, the status of a substance (waste or not) is not only determined on the basis of (1) whether the substance is the result of complete recovery process but also (2) whether the holder discards it and (3) if so, when the holder discards it (either prior to/during or after the complete recovery).[89]

There are several inferences that can be made out of paragraph 96. The statement in paragraph 96 that "a complete recovery operation does not *necessarily deprive* an object of its classification as waste" is in line with the Court's previous statements (paragraphs 94-95) for two reasons.[90] Firstly, the word *necessarily* suggests that a complete recovery may indeed deprive an object of its classification as waste. This is the case when the holder does not discard the completely recovered substance prior to or during the complete recovery process. In such a case, the substance loses its waste status the moment the substance acquires characteristics as a raw material but it may become waste anew if the holder discards it again. Secondly, a complete recovery may not *deprive* an object of its classification as waste. This is the case when the holder has discarded the completely recovered substance either prior to or during the recovery process. In such a case, the status of the substance remains to be waste even if the substance may have acquired characteristics as a raw material.

In paragraph 96, the Court further draws attention to the fact that a "complete recovery process" is a pre-condition for the waste status to be ended. According to the Court, recovery operations that do not transform the waste into a substance analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions are not considered as "complete" recovery operations but as mere sorting or pre-treatment. *A contrario,* it may be inferred from paragraph 96 that complete recovery is necessary (but not sufficient) for the waste status to be ended and that recovery is complete if the substance is made "analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions".[91] After all, if the recovery is incomplete, the substance cannot become analogous to the raw material.

Conclusion

In sum, the following conclusions can be drawn from the *ARCO* case. Firstly, a recovery operation which does not transform the waste into a substance analogous to a raw material, with the same characteristics as that raw material and capable of being used in the same environmental conditions does not bring the waste status of the substance to an end. For instance, wood waste which is turned into woodchips but which still contains toxic substances that are not present in woodchips produced from non-waste wood, which the former

[89] See the paragraph above.
[90] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475, p.96. Emphasis added.
[91] *Ibid.* par.96.

woodchips intend to substitute, remains to be waste. Secondly, waste which has acquired characteristics of a raw material after a complete recovery operation ceases to be waste the moment it acquires characteristics of a raw material unless it is discarded. Wood waste which has been transformed into woodchips and thereby has acquired the characteristics of non-waste woodchips ceases to be waste the moment it becomes analogous to non-waste woodchips. Thirdly, waste which has been made analogous to a raw material ceases to be waste the moment it acquires the characteristics of a raw material but it becomes waste again if it is discarded at a later time. Wood waste which has been transformed into woodchips and thereby has acquired the characteristics of non-waste woodchips ceases to be waste the moment it becomes analogous to non-waste woodchips but it will become waste again if the holder discards it later on. Fourthly, if waste which is made analogous to a raw material has been discarded either prior to or during the recovery operation, the status of the substance remains to be waste even if the substance may have acquired characteristics as a raw material. If wood waste which has been transformed into woodchips that are analogous to woodchips from non-waste wood have been discarded either prior to or during the recovery operation, the completely recovered woodchips remain to be waste.

As may be expected, the Court's ambiguous language use in *ARCO* has been incapable of removing the questions concerning the ending of waste status. The Court had to address similar questions in other cases as well.

2.4.1.2 Mayer Parry[92]

Mayer Parry is a company that specializes in the treatment of scrap metal to be used by steelmakers that aim to produce steel. Mayer Parry generally pays for the scrap metal, including packaging waste. It applies several processes such as cleaning, sorting, testing for radiation, cutting, separating and shredding. As a result of these processes, scrap metal is transformed into material that complies with the specifications of Grade 3B material. This material is sold to steelmakers who melt it down to produce ingots, sheets or coils of steel.

Mayer Parry asked the Environment Agency to recognize it as a reprocessor and hence, grant it Packaging Recovery Notes (hereafter PRNs) with regard to the material that it produced. PRNs constitute evidence of packaging producers' compliance with the UK legislation implementing the Packaging Waste Directive (hereafter PWD)[93] that imposes obligations upon producers of such waste to recycle and recover certain amount of packaging waste. Reprocessors usually sell the PRNs to packaging waste producers who use them to be able to comply with their recycling obligations stipulated in UK legislation implementing the PWD.[94]

[92] C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163.
[93] Council Directive 94/62 on Packaging and Packaging Waste OJ 1994 L365/10.
[94] M. Lee, Resources, Recycling, and Waste, *Environmental Law Review,* (6) 2004, p.39.

Therefore, they have considerable economic value. The PRNs are issued by the Environment Agency to those that recycle waste and according to the British authorities the end of recycling coincides with the moment that a new product has been created which cannot be distinguished from a product produced from non-waste materials.

The issue between Mayer Parry and the Environment Agency concerned whether Mayer Parry was recycling waste. Mayer Parry claimed that its activities concerned waste recycling and that Grade 3B material was the result of a recycling process. However, the Agency refused to issue PRNs to Mayer Parry on the ground that the recovery operations performed by it did not constitute recycling. Thus, the issue was when waste could be said to have been recycled: Is it (1) the moment that the packaging material is transformed into Grade 3B material, or (2) the moment that the Grade 3B material is transformed into secondary raw materials like ingots, coils or sheet of steel or (3) the moment that these secondary raw materials (ingots, coils, sheets) are transformed into products like cans etc.[95]

The Court first takes issue with the relationship between the PWD and the WFD. According to the Court, the PWD is a *lex specialis* vis-a-vis the WFD and its provisions prevail over the provisions in the WFD within the field of packaging waste but the WFD remains applicable when something is not regulated by the PWD.[96]

The Court secondly starts with interpreting the term recycling within the meaning of PWD. Before getting into the details of the definition of recycling, the Court notes that recycling is a form of recovery and that it should pursue the same principal objective namely serving a useful purpose in replacing other materials which would have had to be used for that purpose and thereby enabling natural resources to be conserved.[97]

Then, the Court looks at the elements of the definition of recycling provided in Article 3(7) of the PWD. Those elements are reprocessing of waste materials, in a production process, for the original purpose of other purposes except energy recovery.[98]

According to the Court, since recycling requires the packaging waste to be reprocessed in a production process to produce new material or to make a new product, it can be distinguished from other recovery such as reclamation of raw materials (R3, R4, R5 WFD) or waste-

[95] H.H.B. Vedder, Ontwikkelingen in het Europees Afvalstoffenrecht, *Sociaal Economisch Wetgeving*, (7/8) 2003, p.240.
[96] C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163, par. 53-57.
[97] *Ibid* par. 63.
[98] *Ibid* par. 64.

processing operations such as preprocessing, mixing, or other operations which result only in a change in the nature or composition of the waste (Article 1(b) WFD).[99]

Further, the Court states that for the waste to be regarded as recycled it is necessary that it has been reprocessed to obtain new material or new product for the original purpose. Accordingly, the waste must be transformed into its original state to be useable, if possible, for the same purpose as the original purpose of the material from which it was derived. In the case of metal packaging waste, in order to be regarded as recycled, metal packaging waste must go through reprocessing in the form of a production process designed to produce new material or new product having features comparable to those of which the waste was composed so that it can be used again for the production of metal packaging.[100] However, in the following paragraph, the Court adds that the new material or the new product obtained through recycling can be used for purposes other than the original one.[101]

According to the court, high level of environmental protection and reduction in the consumption of energy and primary raw materials, both of which are the objectives of the PWD, can only be achieved if packaging waste ceases to be waste when it is transformed into new material or new product that has the characteristics comparable to those of the material from which the waste was derived[102]. It is only after this point that the control mechanisms provided in Community waste laws lose their rationale and become inapplicable.[103]

The Court then assesses whether Grade 3B material may be considered as recycled. According to the Court, in producing Grade 3B material, even though Mayer Parry aims to reprocess the metal packaging waste in order to produce a secondary raw material comparable to a primary raw material such as iron ore, the production of Grade 3B material (cleaning, cutting, shredding and testing for radiation etc.) does not in fact constitute reprocessing in a production process that aims at and is capable of conferring on the Grade 3B material the characteristics that are comparable to those materials of which the metal packaging was composed: it contains impurities such paint, oil and non-metallic materials that needed to be removed when it is used to produce steel.[104] Therefore, the Grade 3B cannot be used directly for the manufacture of new metal packaging and it cannot be regarded as recycled metal packaging waste.[105] By contrast, the ingots, sheets or coils of steel that are produced from Grade 3B have the same characteristics as the original packaging and thus, they can be used

[99] *Ibid* par. 66.
[100] *Ibid* par. 67.
[101] *Ibid* par. 68.
[102] *Ibid* par. 71-75.
[103] *Ibid* par. 75.
[104] *Ibid* par. 81-84.
[105] *Ibid* par. 84.

for original purposes (metal packaging) or other purposes (steel-made products).[106] Finally, the court added that the interpretation of recycling would not differ if the concepts of recycling and waste in the WFD were taken into account.[107]

Discussion of Mayer Parry

Mayer Parry is definitely one of the most important cases concerning waste. Several important points, such as the concept of recycling, are touched upon by the Court and the Court's findings and its statements shed light on the vague issue of when recycling ends and hence, when waste that undergoes recycling ceases to be waste: is it the moment when secondary raw materials are obtained or the moment that these materials are used? That is, is it the moment that waste glass is turned into glass powder or when the glass powder obtained from waste glass turned into glass or glass made objects?

One point that should be made at the outset is that the *Mayer Parry* case concerns the PWD and the definition of recycling in that directive but there is no reason to assume that the concept of recycling is any different in the WFD. As the Court itself accepted, the outcome of the case would not have been different if the matter had been decided on the basis of the WFD.[108] Accordingly, the interpretation given by the Court with regard to concept of recycling and the moment of transition from waste to product as a result of a recycling operation holds irrespective of the waste type treated.

Even though recycling is one form of recovery and it has to serve the same objective, it is distinguished from recovery. The aim of recycling is to transform waste material into a new material or product that is comparable to the material of which the waste was originally composed so that it can be used for the identical purpose, or another purpose. For example, metal packaging waste is recycled when it is transformed into steel which can be used to make metal packaging or steel-made-products. In the case of *Mayer Parry*, the reprocessing of metal packaging waste performed by Mayer Parry was aimed at producing a material, namely Grade 3B material, which could replace iron ore but not steel. However, since the metal packaging waste in question was originally composed of steel and not iron ore, the material produced by Mayer Parry was not comparable to the material of which the metal packaging was composed. The material produced by Mayer Parry could be used as a raw material to make steel but it could not be used directly as a raw material to produce metal packaging or another metal product. Therefore, Mayer Parry's product was not recycled packaging waste. However, steel ingots, coils, and sheets produced from Grade 3B material were the materials that metal packaging was originally composed of and they could be used

[106] *Ibid* par. 86-87.
[107] *Ibid* par. 93.
[108] *Ibid.*

directly to make metal packaging and other metal products. Hence, steel produced from Grade 3B material constituted recycled material.

The *Mayer Parry* case is an explicit rejection of the argument that waste remains to be waste until it is used. According to the Court, the moment that the material acquires characteristics comparable to those of the material from which the waste was made of, Community waste laws lose their rationale. Accordingly, it is not necessary that that raw material be used: steel, which was obtained from packaging waste and which was comparable to the material of which the metal packaging waste was originally composed, did not need to be transformed into metal packaging or other metal objects. Thus, waste glass which is transformed into glass powder so that it can be used as a raw material for the production of glass is recycled and ceases to be waste the moment that the glass powder obtained from the waste glass becomes comparable to the glass powder of which the waste glass was originally composed of. The objectives of high level of environmental protection and reduction in the consumption of energy and primary raw materials are achieved at this stage[109] and there is no need to extend the application of waste laws until such raw materials are put to use.

In both *ASA* and *Mayer Parry*, the Court states that recycling is a form of recovery and therefore it should pursue the same principal objective namely serving a useful purpose in replacing other materials which would have had to be used for that purpose and thereby enabling natural resources to be conserved.[110] The point that distinguishes recycling from recovery is that whereas recycling requires the waste material to be processed to transform it into its original state, recovery requires that the material be transformed into a material that has the characteristics of the primary raw material that it replaces. That is, they both aim to serve the purpose of replacing other materials which would have had to be used but the difference is in the materials that they need to replace.

An example may clarify the difference between recovery and recycling. In *Mayer Parry*, the process was like the one given below (figure 2.1).

1. iron ore 2. steel (ingots, sheets etc) 3. metal packaging 4. metal packaging waste 5. Grade 3B material (*iron ore*) 2. steel (ingots, sheets etc).

[109] *Ibid* par.71-75.
[110] In C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, PAR. 69; C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163, par. 63.

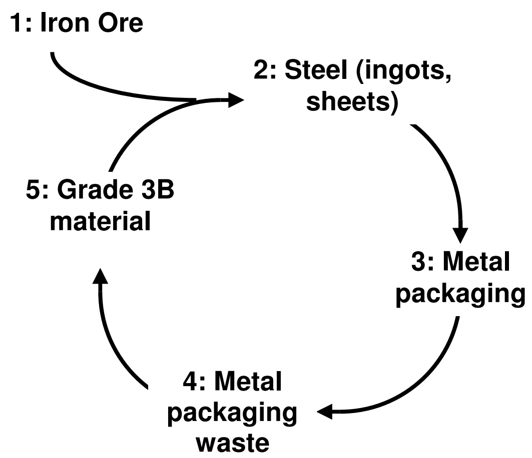

Figure 2.1 Recycling and recovery of metal packaging waste

As mentioned several times, recycling is complete when (4) metal packaging waste is transformed into (2) steel because (2) steel is the material that (4) the metal packaging waste, and thus also (3) metal packaging, was originally composed of and it is the material that can directly be used for the production of (3) metal packaging. The moment that (4) metal packaging waste ceases to be waste cannot be later than the moment that (2) steel is produced. However, this does not necessarily mean that (4) metal packaging waste may not cease to be waste at an earlier moment than the production of (2) steel. As explained above, in *ARCO,* the Court decided that waste which is transformed into a material analogous to a primary raw material ceases to be waste unless it is discarded. In the situation above, (5) Grade 3B material which is produced from (4) packaging waste aims to replace iron ore which would have been used if Grade 3B had not been used. In *Mayer Parry*, (5) Grade 3B material contained impurities and it had to be cleaned before it could be used to make steel. That is, since it was not analogous to the primary raw material, namely iron ore, and it could not be used directly to produce steel, it did not cease to be waste. However, if it had been analogous to iron ore and could have been used directly to produce steel, it would have ceased to be waste the moment it became analogous to iron ore. In sum, a waste material ceases to be waste when it is transformed into a material that is analogous to a raw material but this does not necessarily mean that it is also recycled. A waste material is recycled when it is transformed into its original state and the moment that the waste ceases to be waste cannot be a moment further than the moment that waste is transformed into its original state.

What to compare?

Another issue which is essential for the determination of when waste ceases to be waste is the material with which the materials obtained from waste should be compared. Tieman argues that the material with which a comparison should be made is left obscure by the Court as it is not clear whether the obtained materials should be compared with the primary raw materials that they replace (*ARCO*) or the material that waste material was originally composed of

(*Mayer Parry*).[111] However, if both of the cases are read in light of what is said above with regard to recovery and recycling, it becomes clear that the comparisons suggested by the Court are not obscure at all. When determining whether the waste has ceased to be waste, the obtained material must be compared with the raw material that it replaces. The waste ceases to be waste the moment it is made analogous to a raw material and it is capable of being used as that raw material in the same environmental conditions. This moment may either be earlier than the moment of recycling or coincide with the moment of recycling but it cannot be later than the moment of recycling. Another comparison is required to determine whether the waste has been recycled. The material obtained from waste must be compared with the material of which the waste material was originally composed. When the material is made comparable to the material of which the waste was originally composed, the waste is recycled. Since this is also the raw material that the obtained material seeks to replace, the moment that the waste ceases to be waste cannot be a moment further than the moment that waste is transformed into its original state.

That the Court could not have meant that the test for determining whether waste has ceased to be waste is that the material must be transformed into its original state is obvious. Such a test would have the awkward consequence that only a recycling operation may result in a raw material that may cease to be waste. Recycling is a form of recovery and there are some other forms of recovery as well which may transform waste materials into, albeit not to their original state, genuine raw materials which may replace primary raw materials. Why should waste glass cease to be waste when transformed into glass powder, the original state of the glass, but coal derived from wood waste remain to be waste until burnt simply because the operation does not entail transforming into the original state, namely wood? Why should woodchips derived from waste chipboard cease to be waste simply because the chipboard was originally composed of woodchips but woodchips derived from construction/demolition wood waste remain to be waste just because the material is not turned into its original state, namely clean wood, even though both type of woodchips may be used in the production of the same chipboard?[112] These examples show that "original state" test is only suitable for the determination of recycling but not the determination of whether something may have ceased to be waste. Therefore, the test for determining whether waste has ceased to be waste is the "analogous raw material" test.

[111] J. Tieman, Case comment on Mayer Parry, *Jurisprudentie Milieurecht*, (99) 2003.
[112] The example assumes that wood waste from which the woodchips were produced was already clean.

2.4.1.3 Niselli[113]

Mr. Niselli was involved in the collection and management of ferrous materials originating from dismantling of machines and vehicles, and discarded materials. These materials were partially contaminated with organic materials such as paint and fibers etc. Since Mr. Niselli did not have the necessary permits, he was charged with a criminal offence. One of the issues that arose was when the waste in question could cease to be waste.

The Court first notes that the substances or objects in question have been discarded by their holders. Then, the Court states that the materials are sorted and sometimes treated and they can be used as secondary raw material in steelmaking. In such a context, they remain waste until they have been recycled into steel products, that is, until the constitution of the finished products derived from the reprocessing. In the earlier phases, the reprocessing has not come to an end, and thus the materials have not been recycled. Further, by referring to *Mayer Parry*, the Court says that the moment that the materials in question ceases to be waste cannot be any further than the moment they are transformed into steel products as from then on they can hardly be distinguished from other steel products made from primary raw materials.

Discussion of Niselli

The case is a confirmation of *Mayer Parry* and there is not much that it adds to the discussion of when waste ceases to be waste.[114] The activities performed by Mr. Niselli were confined to sorting and sometimes treating. They were thus pre-treatment activities and as the Court had already decided in *ARCO* and *Mayer Parry* such activities could only change the nature and composition of waste but were not capable of removing the waste tag on the substance.[115] Just like Grade 3B material in *Mayer Parry*, the materials that Mr. Niselli obtained from waste materials were secondary raw materials to be used in steelmaking but, *in such a context,*[116] where the reprocessing was not concluded as the activities of Mr. Niselli were confined to pre-treatment, they had to remain waste until they were recycled into steel products. Accordingly, had the operations performed by Mr. Niselli been able to conclude the reprocessing, that is if the waste material could have been transformed into a material analogous to iron ore which could have been used directly in the production of steel (or steel products), the waste material would have ceased to be waste at that moment.[117]

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[113] C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853. The part of the judgment discussed here is paragraph 52.

[114] See for a view against what the current author argues, J.R.C. Tieman, Niselli: laatste stukje in puzzel berip afvalstof?, *Nederlands Tijdschrift voor Europees Recht*, (2) 2005, p. 25-31.

[115] See Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475, p.96; C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163, par. 66 where the Court refers to Art. 1(b) of the WFD.

[116] C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853, par. 52.

[117] See for a contrary view, J.R.C. Tieman, Niselli: laatste stukje in puzzel berip afvalstof?, *Nederlands Tijdschrift voor Europees Recht*, (2) 2005, p. 30.

In any event, steel products obtained from the waste material may not be classified as waste any longer when they become almost indistinguishable from products made from primary raw materials.[118] Even though this sentence may seem confusing, the Court's reference to *Mayer Parry* in this sentence makes it clear that the word "product" encompasses also the products which may themselves be raw materials used in the production of other products. That is, sheets of steel which are produced from waste metal and which are used for the production of other products may not be classified as waste anymore because they are hardly distinguishable from sheets of steel produced from iron ore.

Conclusion

In short, the Court's case law on the issue of transition from waste to product has been quite controversial and confusing due to the ambiguous language use and reluctance of the Court to give generally applicable guidelines to determine when something may cease to be waste. Even though some question marks on important points still persist,[119] the Court managed to reduce the degree of legal uncertainty significantly in *Mayer Parry* and *Niselli.* However, it is not unlikely that the Court will be confronted with similar types of questions in the future as well because of the extremely casuistic nature of the issue. It is to be hoped that future cases bring more legal certainty.

The case law of the ECJ provides guidelines for national courts on how to interpret and apply Community Laws. When deciding issues that involve Community Laws, national courts are obliged to follow the interpretation provided by the ECJ. However, since the judgments of the ECJ are sometimes rather cryptic as in the case of transition from waste to product, they themselves need interpretation. Therefore, the interpretation of the ECJ's judgments by national courts is of immense value for a sound understanding of the application of Community Law.

2.4.2 Analysis of the Dutch Case Law

One of the issues that the Council of State (Raad van State), the highest administrative court in the Netherlands, often encounters is the question of when waste ceases to be waste. There have been several judgments on the issue and the following gives an overview of the cases post-*ARCO.*[120]

[118] C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853, par. 52.
[119] Such as how to determine whether the material is "analogous" or "comparable".
[120] Those who are interested may find an extended overview of the cases that the RvS had to deal with as regards waste are referred to G.H. Addink, Afvalstoffenrechtspraak in Vogelvlucht, *Milieu en Recht*, (8) 2004, p. 470-482.

2.4.2.1 Icopower I

The first case that the Council of State had to deal with concerning the transition from waste to product was *Icopower I.*[121] The issue concerned energy pellets which were produced from waste. The process was as follows: the producer of the pellets collects industrial waste which includes several types of waste such as paper, cardboard, glass, cans, untreated wood, textile etc. These are first pre-sorted, shredded, and then ferrous elements are removed followed by a separation of the low from highly calorific fraction. This is followed by a separation of non-ferrous metals and other types of components. Materials obtained are then homogenized and adjusted for the suitable humidity level, and then pressed to energy pellets which are sold to combustion plants that use the pellets as fuel. The government claims that the energy pellets are incapable of being used without extra environmental protection measures as they contained impurities, and hence they have not ceased to be waste.

The Council of State, citing *ARCO¸* states that the fact that waste has become analogous to a raw material, it has acquired the characteristics of a raw material and it is capable of being used in the same environmental conditions as that raw material must be considered as an indication that the substance is not waste any longer. Even though the energy pellets are produced from waste, considering the strict controls, nature of the treatment, and the calorific value of the energy pellets, they cannot be considered as waste in another shape. Furthermore, there is nothing to suggest that special environmental measures are required for the use of the pellets.

2.4.2.2 Icopower II

Icopower II[122] is an almost identical case to *Icopower I* and it concerns energy pellets as well. The process is the same as described above. It is added that the producer, upon request of the buyer, is able to add components, such as calcium, to the pellets, and he is also capable of changing the ash percentage and/or the calorific value of the pellets.

The RvS states that the production process is designed to produce energy pellets from various waste materials with the only purpose of using them as fuel in combustion plants. Even though the pellets contain impurities such as heavy metals, they are capable of being used without extra environmental protection measures just like primary raw materials. On the basis of these facts, the RvS concludes that the energy pellets are analogous to primary raw materials, and hence they are not waste. This conclusion is not affected by the fact that use as fuel is a common method of waste recovery. The fact that use as fuel is a common method of

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[121] ABRvS 3 April 2002, 200103485/1.
[122] ABvRS 14 May 2003, 200205047/1, *AB* 2003, 235.

recovery does not mean that substances analogous to primary fuels should be treated as waste just because they are intended to be used as fuel.

2.4.2.3 Woodchips I

Woodchips I[123] concerns, as the name speaks for itself, woodchips produced from waste wood (pallet wood) to be used as raw material in the production of chipboard. The process was as follows. First, unwanted materials are removed from the pallet wood and the wood is then broken into small pieces, which is followed by removal of undesired materials again. Then the material undergoes automatic metal removal followed by non-ferrous substance detection and separation. Then the material is reduced to a size of 50mm followed by automatic metal removal again. Finally, the material is purified through many techniques such as vibration, cyclone, sieving etc. This final material contains impurities. However, the final material, after it is transferred to the subsequent holder, is made subject to a further cleaning operation at the chipboard factory prior to its use in the production of chipboard. Clean wood which is used in the production of woodchips must also undergo the same cleaning operation.

The Council of State says that the production process is designed to transform waste wood into a material which is suitable for use in the chipboard industry. The materials obtained contain impurities but these impurities are not of such a nature which requires special environmental protection measures be taken. The woodchips must go through a further cleaning operation at the chipboard factory but clean wood intended to be used in chipboard production must go through the same cleaning operation as well. Therefore, no distinction is made between clean wood and the woodchips obtained from waste wood. Hence, the composition of the woodchips is suitable for the use made of it. Since the materials are produced in the way described above and sold for the production of chipboard, they may not be regarded as discarded. Accordingly the materials are not waste.

2.4.2.4 Discussion of the Dutch Case Law

Even though the conformity of the Council of State's case law with that of the ECJ with regard to some points is questionable, but it is reasonable to say that Council of State interpretation of the ECJ's case law is, in general, correct. Several elements that are encountered in the ECJ's case law are present in the Council of State's case law as well. According to the Council of State's case law, waste ceases to be waste when it is transformed into a material that is analogous to a raw material and if the material is capable of being used without special environmental measures.

[123] ABRvS 29 oktober 2003, 200301868/1, *JM* 2003, 131.

The first element that the Council of State checks when determining whether the material may have ceased to be waste is the process that it undergoes. It may be inferred from the cases summarized above that the process must be designed to produce a material for a specific use and it must involve steps that lead to a transformation of the waste into a raw material. Thus, processes which only change the form of the waste such as sorting, shredding etc. are not sufficient. This is in line with *ARCO, Mayer Parry* and *Niselli* where the Court said that these operations were only pre-treatment operations and they were not capable of transforming waste into non-waste.[124]

The second element that the Council of State finds essential is whether the material has become analogous to a raw material. In addition to checking whether the material is produced for a specific purpose, the Council of State checks whether the material is suitable for the use made of it. Further, the material must be capable of being used without extra environmental protection measures. The fact that the materials obtained may contain impurities has no relevance for the determination of whether the material is analogous to a raw material as long as there is no need for extra environmental measures. That is, materials that contain impurities remain to be considered as analogous, thus non-waste, unless some extra measures are required by the use of the materials.

It is doubtful whether the criteria used by the Council of State to determine whether the waste has become analogous to a raw material are compatible with the ECJ's case law. Firstly, one may wonder whether materials that contain impurities may be considered as analogous to raw materials as long as there is no need to take extra measures to protect the environment.[125] In both *ARCO* and *Mayer Parry,* the materials that were obtained contained impurities and in both cases it was clear that the Court considered these materials to be waste. Even though the reason that the Court considered them as waste was the fact that the materials were incapable of being used directly because of the impurities, and thus not the mere fact that they contained impurities, it is likely that the Court would not embrace the interpretation of the Council of State. Where the obtained materials contain impurities, the non-restrictive interpretation of the concept of waste and the aim of high level of environmental protection on the basis of precautionary principle and the principle of prevention would justify the continuance of the waste status to ensure that the materials do not pose a risk of environmental harm. This would be the case even if the material obtained which contains impurities may be used without extra measures to protect the environment.

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[124] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475, p.96; C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163, par. 66 where the Court refers to Art. 1(b) of the WFD; C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853, par. 52.

[125] J. Tieman, Case comment on *Icopower II*, *Administratiefrechtelijke Beslissingen*, (235) 2003.

Secondly, and more seriously, there is no doubt that the approach applied by the Council of State in *Woodchips I* is incompatible with the ECJ's case law. In this case, the Council of State decided that woodchips which contained impurities had ceased to be waste even though they had to go through a further cleaning operation at the factory where they were intended to be used in the production of chipboard. The reason was that clean wood used for the production of non-waste wood chips had to go through the same cleaning operation. Such an approach is not consistent with the ECJ's judgments. As mentioned above, in *Mayer Parry*, Grade 3B material produced from metal packaging waste was considered to be waste as it could not be used directly and it had to be cleaned up before it could be used in steel production due the impurities it contained. The situation in *Woodchips I* is identical to the situation in *Mayer Parry*. Thus, the woodchips in question had to remain waste at least until the moment they were capable of substituting the raw material in question without there being a need for further processing.

The fact that clean wood used for the production of non-waste woodchips had to go through the same cleaning process does not alter the fact that the woodchips in question had to remain waste. The Council of State makes a mistake here and it compares the woodchips obtained from wood waste with clean wood used in the production of non-waste wood chips. As stated several times, determining whether waste has ceased to be waste requires a comparison between the material obtained from waste and the raw material that the obtained material intends to replace. In this case, the woodchips obtained from wood waste substitute woodchips obtained from clean wood. That is, in this case, the Council of State must have compared the woodchips obtained from wood waste with woodchips obtained from clean wood as those were the raw materials intended to be substituted by the woodchips produced from waste.[126] If the Council of State had made the correct comparison, it would have inevitably reached the conclusion that the woodchips in question had to remain waste until they became analogous to the woodchips produced clean wood.

A final point that must be added is that the Council of State totally rejects the argument that recovery continues until the materials obtained are put to use.[127] The same holds even when the recovery operation is one of the operations explicitly listed in Annex IIB of the WFD. Accordingly, the Council of State is of opinion that waste that has been made analogous to a

[126] In his comment on *Woodchips I,* Tieman argues that, in light of Mayer Parry, the comparison should have been made with the material that the wood waste was originally composed of, which was pellet wood. As explained earlier, this is the test for determining whether the material is recycled and not necessarily the test for determining whether the waste has ceased to be waste. The test for such a determination requires a comparison between the material obtained from waste and the raw material that the obtained material intends to replace See J. Tieman, Case Comment on *Woodchips I*, *Jurisprudentie Milieurecht*, (131) 2003.

[127] See for a brief overview of this view which is fervently defended by Tieman, J. Tieman, Case comment on *Icopower II*, *Administratiefrechtelijke Beslissingen*, (235) 2003. The current author presented his views on this issue in section 3.2.1.1.1

primary fuel so that it can be incinerated may cease to be waste before being incinerated even though incineration is an explicit recovery operation listed in Annex IIB and it is a common method of waste recovery. This is in line with what is presented in section 6.1 below.

In short, apart from some points that are questionable, the case law of the Council of State's is in line with the ECJ's judgments with regard to the issue of transition from waste to product. The Council of State's comparison made in *Woodchips I* is not a correct comparison and it is to be hoped that the Council of State does not pursue with the same line of decisions.

2.4.3 Use or Analogous Material?

It has been argued that the *ARCO* case must be read as such that a recovery operation is not complete until the substances resulting from the operation are (re)used.[128] Accordingly, waste that is subject to a recovery operation remains waste until the actual re(use) as the actual (re)use is the reason that the substance has been put to a recovery operation.[129] Thus, even if the wood powder in the *ARCO* case had been made analogous to a primary raw material (e.g. Non-waste wood), it would have been regarded as waste until it was incinerated because the incineration of the wood powder to generate energy was the very reason that the wood powder had been made.[130] Some others on the other hand argue that waste ceases to be waste when it has been made analogous to a raw material.

2.4.3.1 Use as a Condition for the Completion of Recovery

Several arguments are brought forward in support of the view that waste going through recovery remains waste until (re)used even if it has become analogous to a primary raw material. Firstly, it is argued that the reason that waste is put to a recovery process is not to make the waste comparable to a raw material but the eventual use of the substance.[131] For instance, in the case of wood waste which is turned into wood powder to be used as fuel and which is analogous to non-waste wood, the eventual purpose is to recover the wood waste through use as fuel and not just turning the wood waste into a material comparable to non-waste wood.[132] Secondly, it is suggested that the Court's reasoning in *ARCO* supports the view that the actual use constitutes the end of recovery. The Court held that a complete recovery operation, which is argued to be a recycling/reclamation operation,[133] resulting in a substance analogous to a raw material and capable of being used in the same environmental conditions

[128] J. Tieman, The Broad Concept of Waste and the Case of ARCO-Chemie and Hees-EPON, *European Environmental Law Review*, (December) 2000, p. 331-332; J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 239-249, 266-277, 335-344.
[129] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 244.
[130] *Ibid* p. 245.
[131] *Ibid.*
[132] *Ibid.*
[133] *Ibid.*

of environmental protection, does not *necessarily* deprive an object of its waste status.[134] The fact that even a complete recovery operation resulting in a substance analogous to a raw material does not *necessarily* alter the status of the substance as waste is taken as evidence that the Court considers recovery to be complete, at least in the case of recovery operations explicitly listed in Annex IIB of the WFD, when the substance is put to use.[135] Thirdly, it is argued that R11 in Annex IIB, use of wastes obtained from any of the operations R1 to R10 in Annex IIB of the WFD, may cover substances obtained through recycling/reclamation processes.[136] The wording in R11 which includes the word "obtain" may suggest that not only residues of recovery processes but also intentionally obtained substances through recovery processes from R1 to R10 may fall under R11. Therefore, they must be treated as waste until used.

The arguments summarized above are not convincing. As regards the first argument, there is nothing in the WFD or the Annexes thereto to suggest that recycling/reclamation processes reach completion when the substances resulting from these processes are put to use. The recycling/reclamation process is itself a recovery process and the fact that the substances obtained through recycling/reclamation are intended to be used in a following process does not make the recycling/reclamation of waste incomplete provided that the substances obtained fulfill the conditions stipulated for primary raw materials.

More importantly, the fact that waste is made subject to a recovery operation so that it can be put to use in a subsequent process is precisely the reason why the completion of recovery should not necessarily extend to use. In the case of direct recovery by means of direct use (e.g. incineration of waste to generate energy), the waste that is made subject to the operation has not been produced for that purpose. The use of a substance not in conformity with its intended use creates a risk of environmental harm the materialization of which must be prevented. The application of waste laws and the supervision mechanism provided in the WFD until recovery, in this case recovery by means of use, or disposal ensure that the risk of environmental harm does not materialize. However, where waste is made subject to a recycling/reclamation operation prior to its use, the risk of environmental harm does not necessarily exist. Waste going through recycling/reclamation can be transformed into a substance which can be used in the same way as a non-waste substance in accordance with its intended use. In other words, an operation the input of which is waste may result in an output that is indistinguishable from the output of ordinary industrial processes that do not use waste input. The output of such recovery processes may be made subject to product rules that apply to ordinary production/extraction processes instead of waste laws. Where they fulfill the

[134] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475.
[135] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 244-245.
[136] *Ibid* 274.

conditions stipulated for ordinary products/substances which they intend to replace, they may cease to be classified as waste. However, where they do not fulfill these conditions, they may continue to be classified as waste without interruption, and thus, remain subject to the supervision provided in the WFD until they are fully recovered or disposed of.

The same holds even when the subsequent process (use) is listed as a recovery process in Annex IIB of the WFD. The Court decided in *ARCO* that the mere fact that a substance or material is subject to a recovery operation listed in Annex IIB does not justify the classification of the substance as waste.[137] The reason is that if this had been the case, non-waste fuels, for instance fuel oil, produced to be incinerated would have needed to be classified as waste since use as fuel to generate energy (R1) is one of the recovery operations listed in Annex IIB. Obviously, the holder of fuel oil does not discard it when he incinerates it to produce energy. There is no compelling reason why the same reasoning should not apply to substances that have been obtained through a recovery process. Just like ordinary production/extraction processes, recycling and reclamation processes are geared towards obtaining substances that can be used in a subsequent process. When the substances obtained through recycling/reclamation processes fulfill the conditions that non-waste substances need to fulfill, the use of the substances resulting from such operations cannot be distinguished from the use of non-waste substances. Accordingly, if, for instance, use of non-waste fuel oil to produce energy cannot be considered as discarding, the use of a substance derived from waste but which is made analogous to fuel oil cannot be regarded as discarding either.[138] The substances are produced for use as fuel in both cases and they both comply with the stipulated product rules.

Even though it must be admitted that the Court's reasoning is difficult to grasp, it is difficult to see how the Court's words in *ARCO* may be taken as evidence that waste recovery extends to the actual use of the substances resulting from recovery processes. The Court held that a "...complete recovery operation does not *necessarily* deprive an object of its classification as waste".[139] The word *necessarily* in this sentence suggests that in some cases, a complete recovery operation, which is argued to be a recycling/reclamation operation resulting in a substance analogous to a non-waste material and capable of being used in the same environmental conditions of environmental protection as the non-waste material,[140] can actually deprive an object of its classification as waste. Accordingly, the *ARCO* case leaves no

[137] Joined Cases C-418/97 and C-419/97, ARCO Chemie, 2000, ECR I-4475, par.49-51.

[138] This would, of course, not be the case if the purpose of the recycling/reclamation process preceding the incineration was not the creation of a substance to be used as fuel. When a substance obtained through recycling/reclamation which is not intended for incineration is made subject to incineration, it is an indication that the substance may be waste. See par. 73 *ARCO*.

[139] *Ibid* par.96. Emphasis added.

[140] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 244-245.

scope for speculation that a recovery operation may be complete without the substances resulting from the operation being put to use.

The *ARCO* case provides no support for the argument that the recovery is incomplete, at least in cases of recovery operations explicitly listed in Annex IIB, until the substances analogous to raw materials which are obtained through a complete recovery operation[141] are used in an explicitly listed recovery operation in Annex IIB of the WFD. It is argued that the Court's words, which say that even a complete recovery does not necessarily remove the label of waste, must be taken as evidence that, at least in cases where the waste is completely recovered (made analogous to non-waste materials through recycling/reclamation) so that it can be used as fuel (incinerated to generate energy), it remains waste until it is used as fuel as such a use would be the actual recovery and not the phases preceding such a use.[142] This could not have been the interpretation that the Court had in mind. The reason is that such an interpretation would have resulted in awkward situations where the same substances obtained through the same recovery operations would have been classified as waste or non-waste depending on the subsequent operation.[143] Thus, in the case of woodchips from wood waste produced by the same producer using the same method and made analogous to primary raw materials, whereas woodchips which are used as raw material in a chipboard factory would cease to be waste the moment they acquire characteristics that make them analogous to raw materials, the same woodchips which are used as fuel in a power station would remain waste until they are incinerated even though they also possess the characteristics that make them analogous to raw materials. Obviously, such a differentiation the repercussions of which are immense cannot be justified by the mere fact that use as fuel is an explicit recovery operation and use as raw material in the production of a product not. After all, the list of recovery operations is not exhaustive.[144]

The argument that R11 in Annex IIB of the WFD may provide a legal ground for the classification of the substances obtained through recovery as waste until they are used must be rejected as well. Firstly, if R11 had encompassed the use of substances intentionally obtained through recovery operations from R1 to R10, electricity produced through incineration of waste, an R1 operation, would have been waste as well and it would have remained so until used in households or industry. Thus, households and industries using such electricity would have needed to be treated as waste processors. It is, therefore, rather far-fetched to argue that R11 also covers intentionally obtained substances through recovery. Secondly, if the word

[141] A complete recovery operation in the sense that the materials obtained are analogous to primary raw materials.
[142] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 247.
[143] *Ibid.* Tieman uses the same argument but he does so in support of his view that waste is not recovered until it is used. In the paragraph above, it is used to show the contrary.
[144] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 62

"obtain" in R11 had implied an intention, residual waste resulting from recovery operations R1 to R10 should not have fallen within the scope of R11 as those residues would not have been intentionally produced. However, as clearly underlined in *SITA,*[145] residual wastes that result from recovery operations fall within the ambit of R11. Thus, the word "obtain" in R11 does not imply that R11 covers the use of intentionally recovered substances.

2.4.3.2 Justifications for the "Analogous Material" Test

Why should the waste status end when waste is transformed into raw material and not continue until the material is put to use? Would not it be better for the environment to subject the materials obtained from waste to waste laws until they are put to use even when the obtained materials are comparable to analogous? The answer should be no.

Absence of the Subjective Factor

The main ground that justifies the application of waste laws disappears when waste is transformed into a material that is analogous to a raw material. As explained previously,[146] the rationale behind the existence of waste laws is that as soon as a material becomes unwanted by its holder, that is the moment the material is discarded, there is a risk that the material may find its way to the environment and cause environmental harm because its holder may either want to get rid of it as cheaply as possible or use it in a manner inconsistent with its intended use. The control mechanism provided in the WFD aims at preventing the materialization of that risk through requiring compliance with waste laws until the material is recovered or disposed of.

Once the waste is transformed into a material analogous to a raw material through a recovery operation, the risk of environmental harm that it poses is not greater than the risk that a non-waste material poses. The question that should be asked is why a person would transform waste into a raw material through a process that may be quite expensive and then would want to get rid of it. Just like a non-waste material, the material obtained from waste and is made analogous to a raw material, is produced for a certain use and the risk that it will not be used as such is not any greater than the risk the non-waste material will not be used in accordance with its intended use. Therefore, it is not necessary to subject the control mechanism provided in waste laws.

The materials obtained may be subject to product rules and the control mechanisms provided in those rules rather than waste laws and waste control mechanisms. This would mean that the waste laws would apply without interruption until the materials obtained satisfy product rules.

[145] C-116/01, *SITA Eco Service*, 2003, ECR I-02969, par. 44.
[146] See section 2.2 and 3.1.2.

In this way, the objectives of waste laws would be satisfied and businesses would not be burdened more than it is necessary.

Undermining Effective Waste Management

There are several waste laws which pursue several objectives and provide several mechanisms that ensure that those objectives are achieved. The application of these laws depends on the concept of waste. Obviously, all the waste laws are there to serve a useful purpose of preventing environmental harm. When applied appropriately, they are indeed useful. However, when applied aggressively, they may undermine their own objectives. The continuance of the waste status even after a recovery operation which has transformed the waste material into a material analogous to a raw material may undermine the objectives of the WFD.

The continuance of the waste status even after the material has become analogous to a raw material may have the consequence of removing the competitive advantage of recycled and recovered materials and thereby undermine the waste hierarchy laid down in article 3 of the WFD. The price of a material is the most important factor determining the demand for it. The prices of recycled and recovered materials are likely to be lower than the prices of non-waste materials and this is the most important factor that determines the demand for recycled and recovered materials. A material which has the waste tag attached on it brings both administrative and operational costs to its holder. Thus, if recycled and recovered materials were treated as waste, their price would increase. In the absence or a lessening of such a competitive advantage *vis-à-vis* non-waste materials, recycled and recovered materials are likely to experience a fall in demand because people are inclined to buy non-waste materials instead of recycled or recovered materials. In such a case, the supply of recycled and recovered materials, thus recycling and recovery, would decrease because of the diminishing demand. Hence, there would be less recycling and recovery which may undermine the objectives of the WFD.

Furthermore, the materials would not be able to take advantage of the internal market to the full extent. Article 28 and 29 of the EC Treaty ensure that goods can move freely between Member States. However, the movement of waste between Member States is regulated by Waste Shipment Regulation (hereafter WSR) and, depending on the type of waste, it may be subject to an extensive notification and authorization mechanism.[147] If recycled and recovered materials which were made analogous to primary raw materials were regarded as waste until

[147] Council Regulation 259/93 on the Supervision and Control of Shipments of Waste within, into, and out of the Community [1993] OJ L30/1) amended by Regulation 2557/2001 [2001] OJ L349/1. Now repealed by Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste [2006] OJ L190/1.

they were put to use, they would be subject to the mechanism provided in the WSR. This would have several consequences. Firstly, even though it would not totally prevent the cross-border movement of recycled and recovered materials, it would most certainly discourage some persons and inhibit the cross-border shipment of such materials as the compliance with the cumbersome mechanism provided in the WSR may be quite demanding. As a result, instead of having a market as large as the EC, the materials may be confined to the national market. Secondly, whereas the movement of recycled and recovered materials which are comparable to non-waste materials would be restricted, non-waste materials would be able to move freely. Thirdly, complying with the conditions stipulated in the WSR would cost money, which would lead to an increase in the price of recycled and recovered materials. All these consequences may have the consequence of less recycling and recovery.

Finally, continuance of the waste status even when the materials are analogous to primary raw materials may have a chilling effect on recycling and recovery technologies. Those who might want to invest in such technologies might refrain from doing so if the materials they produce from waste remain waste irrespective of the quality of the materials.

In sum, continuance of the waste status until the use of the materials even when they are analogous to raw materials, not only disregards the essential motive of waste regulation but it may also undermine the WFD.

2.5 Conclusion

The question of what is waste has become a notoriously difficult issue which has vexed not only persons involved in waste management but also the courts both at national and European level. The indispensable presence of a subjective element in the definition of waste coupled with the ECJ's failure to draw some clear lines has turned waste law into a highly confusing area of environmental law.

One of the issues that has been a matter of controversy is the moment of transition from waste to product following a recovery operation. That is, the essential questions as posed in the introduction to this chapter were: (1) when does waste cease to be waste? (2) What are the criteria applied to determine whether the waste may have ceased to be waste? Of the two views on the issue of transition from waste to product, the view that waste ceases to be waste the moment that it is transformed into a secondary raw material analogous to a primary raw material is the one that finds more support in the case law of the ECJ.

The following conclusions may be drawn from the ECJ's case law. Waste ceases to be waste the moment it is transformed into a material analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions unless it is discarded *(ARCO)*. When determining whether the waste has ceased to be waste, the obtained material must be compared with the raw material that it intends to replace. If the material obtained from waste contains impurities and, therefore, needs further processing before it can be used in the production of a product, the material remains waste at least until the end of such processing (*Mayer Parry*). In any event, products, which may themselves be raw materials in other production processes, obtained from waste materials may not be classified as waste when they become almost indistinguishable from products made from primary raw materials (*Niselli*). Recycling, albeit a form of recovery, must be distinguished from recovery. The purpose of recycling is to transform a waste material into its original state (*Mayer Parry)*. When determining whether a waste material is recycled, the material obtained must be compared with the material of which the waste material was originally composed. The same line of reasoning is also evident in the RvS' case law.

Chapter 3 The Distinction between Recovery and Disposal of Waste

3.1 Introduction

The previous chapter has demonstrated how controversial the concept of waste has been and that it is likely to remain controversial due to lack of clarity. A related issue is the distinction between recovery and disposal of waste. A substance which has been discarded can be subject to either a recovery or disposal operation.[148] Under such circumstances, distinguishing between the two types of operations may appear to be simple. However, appearance may be deceiving. Distinguishing between these two types of waste treatment operations has proven to be rather intricate.

The high number of legal disputes that have arisen both at national and European level with regard to recovery and disposal may be attributed not only to the consequences of the distinction but also to the equivocal legal texts that lack definitions of the concepts. In such a context, the ECJ is the ultimate authority that can bring clarity through interpreting the existing legal texts. The Court has spoken on the issue several times. Therefore, guidance on how to distinguish between these two operations must be sought in the case law of the ECJ.

This chapter aims to provide an overview of the cases as regards recovery and disposal and to illustrate the factors that may be relevant in making the distinction between recovery and disposal.[149] First, the significance of the distinction between recovery and disposal is briefly explained. This is followed by a section setting out the reasons that make the distinction between the two concepts difficult. Finally, the case law of the ECJ is summarized.

3.2 The Importance and Complexity of the Distinction

The significance of the distinction between the two types of operations cannot be underestimated. All the actors involved in waste management are affected by the distinction between recovery and disposal.

[148] In C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par.62-63.
[149] Therefore, it is not the intention of this chapter to discuss whether the Court's interpretation is correct or what the distinguishing factors should be. Those who are interested are hereby referred to J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 282-317.

3.2.1 The importance of the Distinction

One of the most important differences between the two concepts is that the classification of waste following a treatment process depends on whether it undergoes a recovery or a disposal operation. The holder of waste which is subject to a disposal operation is indifferent to what may happen to the substance afterwards and the purpose of subjecting waste to a disposal operation is to exclude any further use of it.[150] In other words, disposal operations intend to end the use of a substance definitively either through destruction or through permanent storage.[151] Accordingly, waste going through a disposal operation remains waste and it never loses its waste status.[152] [153] Unlike in the case of disposal, the holder of waste which is made subject to recovery intends to make a particular use of the substance. Thus, waste going through a recovery operation may lose its waste status and become a product.[154] The moment of transition to a product coincides with the moment that the recovery process is complete.[155] In short, whereas a substance which is disposed of never ceases to be waste, a substance that is recovered may cease to be waste and hence, lose its waste status.

Furthermore, the determination of whether waste is intended to be recovered or disposed of is decisive for the cross-border movement of waste. The Waste Shipment Regulation (WSR) which regulates the cross-border movement of wastes within the EC makes a distinction between waste for disposal and waste for recovery.[156] Waste which is shipped to be disposed of in another Member State is subject to more stringent rules than waste shipped to be recovered. The holder of waste that is intended to be disposed of in another Member State must notify the shipment to all the authorities involved and must provide detailed information with regard to the composition of the waste, its transport, and the method of disposal etc.[157] The waste may not be shipped without the explicit authorization of the state of destination which may be made subject to conditions.[158] The authorization must be refused if the state of destination or state of dispatch raises objections.[159] The objections may be raised if the shipment is contrary to the WFD especially articles 5 and 7: to implement the principle of self-sufficiency, and to ensure that the shipments are in conformity with waste management plans, and in cases where the installation has to dispose of waste from a nearer source and the

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[150] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 264.
[151] *Ibid.*
[152] *Ibid* p.335.
[153] However, it must be remembered that the residues of a disposal operation may themselves become subject to a recovery operation as a result of which they may lose their waste status.
[154] J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p. 336.
[155] *Ibid.*
[156] Council Regulation 259/93 on the Supervision and Control of Shipments of Waste within, into, and out of the Community [1993]OJ L30/1) amended by Regulation 2557/2001 [2001] OJ L349/1. The Regulation also regulates shipments of waste into the EC from third countries and out of the EC to third countries.
[157] Art. 3 WSR
[158] Art. 4 (2) and 5 WSR
[159] Art 4(2) WSR

authority has given priority to this waste.[160] Authorities of the Member States including the state of transit may further raise objections if the shipment violates national law or international obligations, or the person was guilty of illegal trafficking.[161] Moreover, Member States may take national measures in which they, in accordance with the Treaty, prohibit shipments of waste generally or partially to implement the principles of proximity, priority for recovery, and self sufficiency.[162]

The rules that apply to waste crossing the border to be recovered in another Member State are not as strict as the rules that apply to waste for disposal. The WSR makes distinction between three types of waste to be recovered. Annex II is the green list and wastes listed on this list and intended to be recovered in other Member States are excluded from the scope of the WSR[163] and hence, they may be shipped to other Member States without notification. However, they remain subject to the WFD and they must be accompanied by information signed by the holder.[164] Wastes listed in Annex III (amber list) and IV (Red list) and shipped to be recovered must be notified to the competent authority of state of destination and copies of the notification must be sent to state of dispatch and transit.[165] The notification must provide detailed information about the waste and the process it will be made subject to.[166] Both the shipments of waste in amber and red lists are subject to prior consent of the competent authorities. However, whereas the consent to shipments of waste in the amber list may be tacit, the consent to shipments of waste in the red list must be written.[167] The states of destination, dispatch, or transit may raise objections only on the basis of article 7(4) WSR: when the shipment is a violation of national law or international obligations, or if the notifier or the consignee has been guilty of illegal trafficking, or if the shipment is contrary to the WFD, especially waste management plans, or there is reason to believe that the waste is not recoverable under economic and environmental considerations. Importantly, unlike in the case of shipment for disposal, there is no provision allowing the Member States to ban shipments of waste on the basis of proximity and self-sufficiency principles.[168]

Moreover, the requirements that a holder of waste must comply with in accordance with the WFD hinge upon whether the holder pursues recovery or disposal. The requirements that an

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[160] Art. 4(3)(b) WSR
[161] Art. 4(3) (c) WSR
[162] Art 4(3) (a) WSR
[163] See for exceptions Art 1(3), Art 11(b)-(e) and Art 25-26 WSR.
[164] Art 11 WSR
[165] Art 6 (1)-(4) WSR
[166] Art 6 (5) WSR
[167] Art 7 (2) and 10 WSR
[168] See C-203/96 *Dusseldorp,* 1996, ECR I-4075, par. 33-34, where the Court confirmed that these principles applied only to waste for disposal.

establishment carrying out a disposal operation must comply with are more stringent than those that must be complied with by establishments carrying out recovery operations.[169]

Therefore, the consequences of the distinction between recovery and disposal are immense for all those involved in waste management. The question that arises is then why is it so difficult to distinguish between the two.

3.2.2 Complexity of the Distinction

The difficulty stems from a notorious deficit of the EC waste laws, namely the lack of definitions that enable the actors involved in waste management to determine whether the operation concerns recovery or disposal of waste. The central legal instrument, the WFD, defines neither of the concepts; thus, the actors involved in waste management including those who apply and interpret the laws are left in the dark with regard to recovery and disposal. The only assistance they receive from the WFD is the list of disposal and recovery operations provided in Annex IIA and Annex IIB respectively.

However, a glimpse into the Annexes reveals that their assistance is restricted because some operations that are common in practice are listed in both of the Annexes. One such operation which has been the subject matter of several legal disputes is incineration. Whereas incineration on land (D10) and at sea (D11) are listed as disposal operations in Annex IIA, use of waste principally as a fuel or other means to generate energy (R1) is listed in Annex IIB as a recovery operation. As it may be expected, ascertaining whether the incineration of waste in a particular case occurs for the purpose of destroying it or using it as a fuel and recovering its energy potential is extremely complicated. On the one hand, it cannot be excluded that plants which are involved in production processes and incinerate waste to use the energy potential of waste may incinerate waste for the purpose of disposal as well.[170] On the other hand, waste incineration plants, plants that are destined for incinerating waste for the purpose of disposal, are also obliged to recover the heat generated as far as practicable.[171]

Problems with the listed operations are not confined to incineration. Another operation which causes problems in practice is the use of waste as fertilizers.[172] Such an operation may be classified as a disposal, deposit into or onto land (D1), or a recovery operation, land treatment resulting in benefit to agriculture or ecological improvement (R10). Similar problems are also

[169] See Art 9 and 10 WFD.
[170] Art 3 (5) Directive 2000/76 of the European Parliament of the Council of 4 December 2000 on the Incineration of Waste [2000] OJ L332/91, (hereafter the WID).
[171] Art. 4 (2)(b) WID.
[172] See for a discussion, H.H.B. Vedder, Plantresten en het Afvalstoffen Begrip, *Agrarisch Recht,* (2) 2005, p. 79-86.

encountered when waste is used to fill hollow spaces in mines. Is using waste to secure mines a disposal operation, permanent storage (D12), or a recovery operation, recycling/reclamation of other inorganic materials (R5)?

The ambiguous lists of recovery and disposal operations in the Annexes, as shown above, do not provide sufficient guidance that may enable the actors involved in waste management to determine whether they perform disposal or recovery. In such circumstances, the Court's decisions must show the way.

3.3 The Case law of the ECJ

There have been numerous cases on recovery and disposal. However, the most important judgments, namely *ASA, Luxembourg Waste,* and *German Waste,* have been delivered in the last few years and they belong to the series of ECJ judgments which attempt to remove the legal uncertainty that exists within the field of waste law.

3.3.1 *ASA*[173]

The case concerned slag and ash which resulted from incineration of waste and which were intended to be shipped from Austria to Germany where they would be used to secure hollow spaces in an old salt mine. ASA, the holder of the waste, classified the filling of hollow spaces with the waste in question as recovery, namely recycling/reclamation of other inorganic materials (R5). However, the Austrian Ministry of Environment, as the state of dispatch, raised objections and argued that the waste was intended to be disposed of in Germany as filling mines with waste was a disposal operation, namely permanent storage (D12).

The Court makes several important remarks in its judgment. After stating that the Annex IIA and Annex IIB are not exhaustive and that any treatment of waste may be either recovery or disposal but it cannot be both, the Court says that where it is not possible to bring the treatment under one of the operations in Annex IIA or IIB solely on the basis of the wording of the operations in the Annexes, it must be classified on a case by case basis.[174] This is the case here because deposit of ash and slag in an old mine may be regarded as either disposal (D12) or recovery (R5).[175] Furthermore, the Court observes that recovery of waste does not necessarily entail only treatment before use and that the hazardous or non-hazardous nature of the waste is, of itself, irrelevant for evaluating whether a particular operation may be regarded as recovery operation.[176] Most importantly, in paragraph 69, the Court does something that it

[173] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961.
[174] *Ibid* par. 60-64.
[175] *Ibid* par.66.
[176] *Ibid* 67-68.

has never done before and it provides a positive definition of recovery.[177] According to the Court "the essential characteristic of a waste recovery operation is that its *principal objective* is that the waste serves a useful purpose in *replacing other materials* which would have had to be used for that purpose, thereby conserving natural resources".[178] This is the criterion to be used when determining whether a treatment operation constitutes recovery.

In two subsequent cases, the Court applies the *ASA* criterion. Both cases concerned incineration of waste.

3.3.2 Commission v Germany (German Waste)[179]

The case concerned mixed waste which was intended to be shipped from Germany to Belgium where it would be incinerated in cement kilns to generate energy. The holder of the waste classified the shipment as recovery (R1). However, German authorities raised objections. According to a Germany, waste intended to be used as fuel had to have a calorific value of at least 11 000 kj/kg. Incineration of waste with a calorific value below 11 000 kj/kg would be regarded as a disposal operation (D1).

The Court starts with rephrasing the *ASA* criterion. It states that essential purpose of R1 (use principally as fuel or other means to generate energy) is to enable waste to fulfill a useful function, namely the generation of energy.[180] Furthermore, the conditions in which the use of waste in cement kilns occurs must give reason to believe that the operation is indeed a means to generate energy. This is the case where more energy is generated by and recovered from the combustion of waste than the energy consumed during the combustion process, and the surplus energy generated must also be used either in the form of heat, or after processing, in the form of electricity.[181] Finally, the term "principally" in R1 implies that greater part of the waste must be consumed during the operation and the greater part of the energy generated must be recovered and used.[182] When these conditions are satisfied, combustion of waste may be regarded as recovery as the *ASA* criterion would be fulfilled.

3.3.3 Commission v Luxembourg (Luxembourg Waste)[183]

The case concerned household waste intended to be shipped from Luxembourg to France where it would be thermally treated in a waste incineration plant and the resulting energy

[177] H.H.B. Vedder, Ontwikkelingen in het Europees Afvalstoffenrecht, *Sociaal Economisch Wetgeving*, (7/8) 2003, p.237.
[178] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 69. Emphasis added.
[179] C-228/00, *Commission v Germany*, 2003, ECR I-01439.
[180] *Ibid* par. 41.
[181] *Ibid* par. 42.
[182] *Ibid.*par. 43.
[183] C-458/00, *Commission v Luxembourg*, 2003, ECR I-01553.

would be reclaimed. The authorities in Luxembourg raised objections because incineration of waste in a plant the primary purpose of which was the thermal treatment of waste with the intention of the mineralization of the waste, even if the resulting heat was reclaimed, was regarded as a disposal operation (D1).

After repeating what it has said in *ASA* and *German Waste*, the Court turns to the issue at hand. It first says that incineration of waste in a plant dedicated to disposal of waste cannot be considered to have recovery of waste as its principal objective even when all or part of the resulting heat from combustion is reclaimed. According to the Court, even though such reclamation is in accordance with the objective of protecting natural resources, the fact remains that the operation in question must be classified as disposal because the reclamation of the heat resulting from combustion of waste is only a secondary effect of the operation whose principal objective is the disposal of waste. Moreover, the Court considers two factors as evidence that the principal objective of the operation is recovery: if the plant continues to operate using a primary source of energy in the absence of waste, there is likely to be recovery of energy. The same holds if the plant operator makes a payment to the holder of the waste in exchange for the delivery of the waste to the plant.

3.4 Conclusion

The importance of these three cases[184] cannot be underestimated as they provide invaluable guidance which is highly necessary for a well functioning waste management system within the Community. The Court attempts to come up with a workable test that may be used when determining whether a particular operation is recovery or disposal and then illustrates how the test must be applied. Even though the two cases in which the Court applies the *ASA* test (or the principal objective test[185]) specifically concern the distinction between incineration for the purpose of recovery and disposal, the Court provides sufficient detail that enables conclusions to be drawn that may be used with regard to other waste treatment operations.

The following conclusions may be drawn from the case law of the ECJ with regard to the distinction between recovery and disposal. The test to be applied in determining whether a particular operation is recovery or disposal is provided in *ASA*: [186] *principal objective* of recovery is that the waste serves a useful purpose in *replacing other materials* which would have had to be used for that purpose, thereby conserving natural resources. Firstly, the waste

[184] C-116/01, *SITA Eco Service*, 2003, ECR I-02969, which deals with the issue of waste treatment processes that comprise several stages of recovery or disposal. According to the Court, each stage must be classified separately for the purpose of the WSR and the first stage determines whether the shipment should be treated as shipment for recovery or disposal.

[185] H.H.B. Vedder, Ontwikkelingen in het Europees Afvalstoffenrecht, *Sociaal Economisch Wetgeving*, (7/8) 2003, p.239.

[186] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 69. Emphasis added.

must substitute a non-waste material which would have been used if the waste was absent and this substitution must lead to conservation of natural resources.[187] The replacement does not necessarily need to occur during the recovery operation in question and the moment of actual replacement may lie in the future. For instance, during the stage of recycling of metals (R4 Annex IIB WFD), metals may be reclaimed from scrap metal but the actual replacement, the use of the metals derived from recycling instead of non-waste metals, may occur in the future.

Secondly, serving a useful purpose through replacing other materials, and thereby protecting natural resources, must be the principal objective of the operation in question.[188] Two factors may indicate that the principal objective of the operation is indeed replacement of other materials. One of those is whether the plant in question continues to operate by using other substances in the absence of waste. If this is the case, it is likely that the principal objective is that the waste replaces other materials. The other factor is whether the person who processes the waste pays or gets paid. Unlike in the case of disposal in which the processor is likely to get paid, the processor is likely to pay the holder of the waste in the case of recovery.

In the case of a plant/operation that is dedicated to the disposal of waste, the principal objective cannot be replacing other materials even if such an operation may have the consequence of conserving natural resources. Such a consequence is only a secondary effect of an operation which has the principal objective of disposal of waste.

Thirdly, the conditions in which the operation takes place must give reason to believe that the operation does indeed what it is claimed to do. In *German Waste*, the Court stated that, in the case of use of waste as a means to generate energy, this condition would be satisfied where more energy was generated by and recovered from the combustion of waste than the energy consumed during the combustion process, and the surplus energy generated was used either in the form of heat, or after processing, in the form of electricity.[189] This condition requires a case by case analysis and the conditions that may need to be satisfied may depend on the specific operation. For instance, in the case of recycling/reclamation of organic substances which are not used as solvents (R3 of the Annex IIB WFD), if the substance reclaimed is so minimal that the cost of reclamation exceeds the benefits that may be derived from the reclamation, it may be concluded that the operation does not constitute recovery. The same is true if the reclaimed substance is not suitable for the use it is intended to be put to.

In short, the Court's attempt to enhance the legal certainty within the field of waste law is most certainly welcome. Difficulties with regard to the distinction between recovery and

[187] See also J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p 292.
[188] *Ibid* p.294.
[189] *Ibid* par. 42.

disposal will still be encountered as determining the principal objective of an operation might not always be as smooth as it may be hoped. Nevertheless, the principal objective test is a workable test that is sufficiently concrete and hence, suitable for determining whether the operation is recovery or disposal.

Chapter 4 The Waste Incineration Directive and its Implementation

4.1 Introduction

Waste incineration is a common method of waste processing in the Community. Large amounts of waste are treated through incineration[190] as it is an effective way of disposing of or recovering waste. However, incineration entails costs in terms of environmental harm. In the absence of effective supervision, the emissions that may result from incineration may form a major threat to both human health and environment. Non-hazardous waste incineration was responsible for 40% of all the dioxin and furan emissions in Europe by the end 1990s.[191] Dioxins and furans are known to have not only carcinogenic but also non-cancer effects such as adverse effects on reproduction and unborn foetus. Waste incineration was also a major contributor to overall heavy metal emissions which have various adverse effects.[192] For instance, exposure to even low levels of mercury results in behavior change and renal damage.[193] Cadmium is associated with lung cancer and several other non-cancer effects.[194] Waste incineration leads to NOx and SO_2 emissions as well. These are known to cause respiratory problems, acidification of ecosystems, and production of low level of ozone.[195]

In line with the provisions of the WFD,[196] disposal or recovery of waste, therefore, incineration as well, must occur without endangering human health and harming the environment. To ensure that incineration of waste occurred without the adverse effects summarized above, the Community adopted Directive 2000/76, the Waste Incineration Directive (hereafter the WID).[197]

The WID is not free from controversy. The ambiguity of the definition of incineration and co-incineration plant has resulted in disparity and confusion among the Member States with regard to the determination of the plants that are subject to the WID. In the case of direct incineration of waste, the classification of the plant incinerating the waste as a waste incineration plant is rather straightforward. The difficulty arises when waste is made subject

[190] 31 Mt/y in 1990s and 56 Mt/y in 2000. See Commission, Proposal for a Council Directive on Incineration of Waste, COM (1998) 558 Final, 98/0289 (SYN), 07.10.1998.
[191] *Ibid.* p.6.
[192] *Ibid* p. 7: 8% of all the cadmium emissions and 16% of all the mercury emissions in Europe were attributed to waste incineration.
[193] *Ibid.*
[194] *Ibid.*
[195] *Ibid.*
[196] See Article 4 WFD.
[197] Directive 2000/76 of the European Parliament of the Council of 4 December 2000 on the Incineration of Waste [2000] OJ L332/91. The previous directives were repealed by the WID.

to a thermal treatment process such as gasification or pyrolysis prior to its use as fuel in a plant whose main purpose is the generation of energy or production of material products.

Besluit Verbranden Afvalstoffen (Hereafter the BVA),[198] the Dutch decree that transposes the WID into national law, is one of those national implementing measures struggling with the definition of co-incineration plant. Firstly, according to the BVA, any plant whose main purpose is the generation of energy (power plant) or production of material products and which uses products of thermal treatment of waste (producer gas) as fuel is treated as a waste co-incineration plant, irrespective of the quality of the substance, even in the absence of a connection between the plant thermally treating the waste (gasifier) and the plant where the products of the thermal treatment are used as fuel (power plant).[199] Secondly, if a plant whose main purpose is the generation of energy (power plant) or production of material products is connected to a waste processing plant which thermally treats waste (gasifier) and the substance derived from the thermal treatment (producer gas) is subsequently co-incinerated in the power plant as fuel, the whole plant, the power plant and the gasifier, is considered to be one co-incineration plant irrespective of the quality of the substance derived from thermal treatment of waste.[200] The questions that need to be addressed in this regard are: (1) how should the WID be interpreted with regard to the definition of incineration and co-incineration plant? (2) Is the BVA consistent with the WID as regards the two points just mentioned above? (3) Is the BVA compatible with the EC Treaty?

First, an overview of the WID is presented. The overview is followed by an extensive discussion of the definition of incineration and co-incineration plant in the WID. Subsequently, the consistency of the BVA with the WID as regards the definition of incineration and co-incineration plant is examined followed by the assessment of the compatibility of the BVA with the EC Treaty. Finally, the implementation of the WID in some other Member States is described.

4.2 Brief Overview of the Waste Incineration Directive (Directive 2000/76)

Prior to the adoption of the WID, there were three directives that dealt with waste incineration. Two of those, directive 89/369 and directive 89/429,[201] dealt with new and

198 Stb. 2004, 97.(Also available on www.overheid.nl).
199 Article 1 (1)(b) BVA.
200 See Chapter 12 (1) (2) of the Explanatory Memorandum of the BVA (Stb. 2004, 97).
201 Council Directive on the prevention of air pollution from new municipal waste incineration plants [1989] OJ L163/32; Council Directive on the reduction of air pollution from existing municipal waste-incineration plants [1989] OJ L205/50.

existing municipal waste incineration plants respectively. The third one was adopted in 1994 and it regulated the incineration of the most hazardous wastes.[202]

However, these directives had several deficiencies which made them incapable of coping with the problems caused by waste incineration.[203] Firstly, their scope was very limited. The scope of the 1989 directives was confined to the incineration of municipal waste and therefore, waste that resulted from industrial processes was not subject to those directives. The 1994 directive which regulated the incineration of hazardous wastes covered only the most hazardous waste types but other hazardous waste types such solvents and clinical waste were outside its scope.

Secondly, only the 1994 directive set emission limits for dioxins and furans meaning that incineration of non-hazardous wastes which was responsible for 40% of all the dioxin and furan emissions in Europe could be carried out without being subject to any emission limits as regards dioxins and furans.[204] Considering that the Community had become party to some international treaties in which it undertook to reduce the dioxin and furan as well as particulate and mercury emissions, more stringent measures were required.

Thirdly, the 1989 directives were confined to the regulation of emissions to air. However, waste incineration results in emissions to water, especially heavy metals, as well. Due to this gap, emissions to water caused by non-hazardous waste incineration could not be controlled.

Finally, co-incineration of waste was not covered by any of the directives. Waste was used as fuel instead of primary fuels in some industrial processes. The exclusion of co-incineration from the scope of the directives had two important consequences. One of them was that even though co-incineration was capable of causing as much harm as incineration, it was not subject to emission limits and hence, there was a legal loophole which created a high risk of environmental degradation. The other consequence was that since the cost of co-incineration was lower than the cost of incineration due to the fact that co-incineration was not subject to the rules stipulated in the directives, co-incineration of waste became more attractive. This in turn resulted in cross-border movements of waste to the Member States where industries that co-incinerated waste were situated and the dedicated incineration plants were confronted with overcapacity problems. In sum, the directives were not capable of addressing the issues that incineration of waste gave rise to.

[202] Council Directive on the incineration of hazardous waste [1994] OJ L365/34.
[203] All the deficiencies summarized here are explained in Commission, Proposal for a Council Directive on Incineration of Waste, COM (1998) 558 Final, 98/0289 (SYN), 07.10.1998.
[204] This does not imply that the Member States did not regulate such emissions at national level.

The shortcomings of the waste incineration directives and the problems stemming from those shortcomings were undesirable from an environmental perspective and they needed to be addressed. It was necessary to adopt new waste incineration directive which could adequately deal with the issues related to waste incineration. For this purpose, the WID was adopted. The WID has a comprehensive scope and it covers both hazardous and non-hazardous wastes. It removes the distinction between hazardous and non-hazardous wastes for the purpose of the directive and sets emission limits for both types of wastes. Moreover, emissions to water are regulated as well. Finally, plants that co-incinerate waste fall within the ambit of the directive and thus, they are subject to emission limits and operating conditions as well. Thus, the WID entailed a genuine progress in comparison with the situation that existed prior to its adoption.

4.2.1 Objectives

The principal objective of the WID is laid down in Article 1 WID. According to this article, the aim is to prevent or to limit as far as possible, adverse effects of incineration and co-incineration of waste on the environment and human health caused by the emissions into air, soil, and water.

Several other key objectives which serve the achievement of the principal objective may be identified. Firstly, the WID aims to reduce the emissions into air, water, and soil substantially by setting stringent emission limits and operating conditions and by subjecting incineration and co-incineration plants to stringent measurement requirements.[205] More specifically, it attempts to contribute to the achievement of the reduction of dioxin and furan emissions by 90% and cadmium and mercury emissions by 70%.[206] Secondly, it attempts to regulate incineration and co-incineration of hazardous and non-hazardous waste by a single text and thereby increase legal clarity and enforceability.[207] Thirdly, by subjecting both incineration and co-incineration plants to strict rules, it aims to prevent the cross-border movement of wastes to plants co-incinerating waste that result from lower costs due to less stringent environmental standards.[208] The co-incineration of waste should not cause higher emissions than the incineration of waste.[209]

4.2.2 Scope

The directive covers plants that incinerate or co-incinerate waste.[210] Waste is defined as any solid or liquid substance which is discarded, intended to be discarded, or required to be

[205] Preambles 7 and 28 of the WID.
[206] Preamble 1 WID.
[207] Preamble 22 WID.
[208] Preamles 9 and 10 WID.
[209] Preamble 27 WID.
[210] Article 2(1) WID.

discarded.[211] Accordingly, gaseous waste is excluded from the scope of the directive. However, if the gaseous waste is derived from solid or liquid waste through thermal treatment, it falls within the scope of the directive.[212]

In conformity with the Community policy of promoting the use of renewable energy resources such as the co-firing of biomass in industrial plants, the directive provides a list of wastes that are excluded from the scope of the directive. Plants incinerating these wastes are not regarded as incineration or co-incineration plants.[213] The excluded wastes are: vegetable waste from agriculture and forestry or the food processing industry,[214] fibrous vegetable waste from virgin pulp production and from production of paper from pulp,[215] wood waste except wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, particularly wood waste from construction and demolition waste,[216] and cork waste.[217]

4.2.3 Emission Limits

The WID sets emission limit values (hereafter ELVs) for both incineration and co-incineration plants and both the emissions into air and water are regulated by the WID. The ELVs for water discharges for both incineration and co-incineration plants are laid down in Annex III. The ELVs for air emissions to which a plant is subject depend on the classification of the plant as an incineration or co-incineration plant. The ELVs of a dedicated incineration plant are laid down in Annex V. Annex II sets the ELVs for co-incineration plants.

Annex II distinguishes between three types of co-incineration plants. First, cement kilns co-incinerating waste are treated as co-incineration plants and they must comply with fixed ELVs. Second, combustion plants with a capacity of 50 MWth and above are subject to the ELVs calculated on the basis of the mixing rule formula laid down in Annex II. Third, plants that co-incinerate waste but are not covered under the first two types of plants must comply with the fixed ELVs set for these smaller scale co-incineration plants.

A co-incineration plant which is subject to the ELVs in Annex II become subject to the ELVs laid down for dedicated incineration plants in Annex V in two situations. Firstly, if more than 40% of the heat release in a co-incineration plant comes from hazardous waste, the ELVs in

[211] Article 3(1) WID.
[212] Article 3(4) WID.
[213] Article 2 (2) WID.
[214] Vegetable waste from the food processing industry is excluded if the heat generated is recovered. See article 2(2)(a)(ii) WID.
[215] Provided that it is co-incinerated at the place of production and the heat is recovered. See article 2(2)(a)(iii) WID.
[216] Article 2(2)(a)(iv) WID.
[217] Article 2(2)(a)(v) WID. Radioactive waste, animal carcasses, and the waste resulting from off-shore gas or oil exploitation/exploration are also excluded. See article 2(2)(a)(vi-viii) WID.

Annex V apply to the co-incineration plant.[218] Secondly, the same holds in the case of co-incineration of untreated mixed municipal waste.[219]

It is remarkable that the WID stipulates different ELVs for incineration and co-incineration plants. As explained above, one of the objectives of the WID is to equalize the costs of operation of incineration and co-incineration plants through making them subject to the same stringent emission limits, and thereby not only prevent the cross-border movement of wastes to cheaper co-incineration plants but also ensure that co-incineration does not cause higher emissions than incineration of waste. However, the application of different ELVs to incineration and co-incineration plants makes it questionable whether this objective is indeed achieved by the directive. Dedicated incineration plants are subject to stricter ELVs with regard to some pollutants. The following differences are worth mentioning:[220]

- Dedicated incineration plants are subject to more stringent ELVs as regards dust compared to combustion plants and cement kilns;
- Dedicated incineration plants are subject to much more stringent ELVs as regards NOx compared to cement kilns;
- Dedicated incineration plants are subject to much more stringent ELVs as regards SO_2 compared to combustion plants.

4.2.4 Permit, (Abnormal) Operating Conditions, and Measurement Requirements

Any plant incinerating or co-incinerating waste must acquire a permit from the competent authorities. The permit must list the types of wastes which may be treated, the total capacity of the plant, and specify the measurement procedures.[221] The permit may not be granted unless the application shows that the measurement techniques comply with the national measures implementing the directive.[222] Furthermore, the application must include a description of the measures envisaged to guarantee that (a) the plant is designed, equipped and will be operated in such a way that the requirements of the WID are taken into account, (b) the heat generated is recovered as far as practicable, (c) the residues will be minimized and recycled where appropriate, and the disposal of the residues will occur in accordance with national and Community legislation.[223] In the case of a plant incinerating or co-incinerating hazardous waste, the permit must also list the quantities of the different categories of hazardous waste,

[218] Article 7(2) WID.
[219] Article 7(4) WID.
[220] European Commission, Directorate General Environment, *Refuse Derived Fuel, Current Practice, and Perspectives,* (B4-3040/2000/306517/MAR/E3), Final Report, 2003, p. 16. Available at http://ec.europa.eu/environment/waste/studies/pdf/rdf.pdf [25.07.2006].
[221] Article 4(4) WID.
[222] Article 4(3) WID.
[223] Article 4(2) WID.

and specify the minimum and maximum mass flows, the lowest and the highest calorific value, and their maximum contents of the pollutants.[224]

Plants incinerating or co-incinerating waste must operate under stringent operating conditions and measurement requirements. Both incineration and co-incineration plants must employ a temperature of at least 850°C for two seconds to ensure that wastes are genuinely destroyed.[225] If the waste treated is hazardous waste containing more than 1% halogenated organic substances, the temperature must be raised to at least 1100°C for two seconds. An incineration or co-incineration plant must be equipped with an automatic system that prevents waste feed when the temperatures are not reached/maintained or when the continuous measurements show that the ELVs are exceeded.[226] Where some conditions are satisfied, different operating conditions may be authorized by the competent authorities.[227]

The measurement requirements stipulated for both air and water emissions are of a highly technical nature.[228] In short, the WID stipulates two kinds of measurement. Some substances such as NOx, dust, SO_2, Co, HCL etc. must be measured continuously. Some others such as heavy metals, dioxins and furans must be measured twice a year. In some cases, subject to the authorization of the competent authority, derogations from the measurement requirements are possible.

Abnormal operating conditions stipulated in the WID are also strict. Firstly, in the case of a breakdown, the operations of the plant must be reduced or closed down as soon as practicable until normal conditions are restored.[229] This condition has severe consequences for co-incineration plants, particularly power plants. Power plants must provide a continuous supply of electricity. They cannot comply with this obligation if their operations must be closed down in the case of a breakdown. Secondly, an incineration or co-incineration plant may under no circumstances carry on with waste incineration for a period of more than four hours uninterrupted where the ELVs are exceeded.[230] The cumulative duration of operation under such circumstances must be less than 60 hours a year.

As mentioned several times, the stringent conditions stipulated in the WID are applicable only when the plant in question can be regarded as an incineration or co-incineration plant. The WID defines both incineration and co-incineration plants.

[224] Article 4(5) WID.
[225] Article 6(1-2) WID.
[226] Article 6(3) WID.
[227] Article 6(4) WID.
[228] See article 11 WID.
[229] Article 13(2) WID.
[230] Article 13(3) WID.

4.3 The Definition of Incineration and Co-incineration Plant

The definitions of incineration and co-incineration plant provided within the WID constitute the heart of the WID because the exact reach of the directive is determined by these definitions. The determination of whether a plant incinerates or co-incinerates waste may seem to be a straightforward exercise but it is not.

4.3.1 The Definition of Incineration Plant

The definition of incineration plant is not as controversial as the definition of co-incineration plant. Nevertheless, difficulties may still arise as the definition of incineration plant provided within the WID allows for more than one interpretation.

The definition of incineration plant is laid down in Article 3(4) of the WID.[231] According to this definition, an incineration plant means a technical unit or equipment dedicated to thermal treatment of wastes with or without recovery of the combustion heat generated. This covers not only incineration by oxidation but also other thermal treatment processes such as gasification, pyrolysis, or plasma processes in so far as the substances resulting from the thermal treatment are subsequently incinerated.

The WID, therefore, distinguishes between two types of incineration plants depending on the type of thermal treatment employed. The first type is a plant which is dedicated to incineration of waste by oxidation. This is incineration in its classic form. A plant which directly incinerates waste through oxidation with the purpose of destroying the waste is regarded as a waste incineration plant even if the heat generated is recovered.

The definition of incineration plant is not confined to incineration through oxidation; it also covers other thermal treatment processes dedicated to thermal treatment of waste such as gasification, pyrolysis, or plasma processes (hereafter only gasification will be used for the purpose of simplicity). However, plants using these thermal treatment processes are regarded as incineration plants only if the substances that result from the thermal treatment (mostly gaseous) are subsequently incinerated.

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[231] '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 substances resulting from the treatment are subsequently incinerated.

This definition covers the site and the entire incineration plant including all incineration lines, waste reception, storage, on site pretreatment facilities, waste-fuel and airsupply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack, devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

The exact meaning of this definition is not clear. In most cases, gasifiers that are dedicated to thermal treatment of waste are connected to a boiler through a pipeline.[232] The gas produced by the gasifier through thermal treatment is transmitted to the boiler where it is incinerated. However, it is also possible to build stand-alone gasifiers which are dedicated to the thermal treatment of waste. In such a case, the gas produced by the gasifier may be transported to another plant where it is incinerated. The first question that arises concerns the gasifier which is connected to a boiler where the gas produced by the gasifier is incinerated. Should the gasifier and the boiler be treated separately or should they be treated as one incineration plant? The second question concerns the gasifier and the boiler which are two separate plants. Should each of these plants be regarded as waste incineration plants?

A look into the preparatory materials of the WID reveals that the drafters of the WID intended to treat a gasifier dedicated to thermal treatment of waste and a boiler which are connected to each other as an incineration plant. In its original proposal of the WID in which the Commission made some explanatory statements, the Commission states that the definition of incineration plant includes gasification plants where the products of gasification are subsequently incinerated in the same process.[233] When the products of a gasifier whose purpose is the thermal treatment of waste are subsequently incinerated in a boiler connected to the gasifier, the same process, namely the thermal treatment of waste, is carried out even if the heat generated through incineration of the product in the boiler is recovered.

This is also consistent with the remarks made as regards disposal operations in the previous chapter. A gasifier which is dedicated to thermal treatment of waste performs a disposal operation. The definition of recovery was provided in *ASA*: [234] *principal objective* of recovery is that the waste serves a useful purpose in *replacing other materials* which would have had to be used for that purpose, thereby conserving natural resources. However, the principal objective of a gasifier dedicated to thermal treatment of waste is the destruction of the waste and not the production of a product which may serve a useful purpose by replacing other materials. The products of a gasifier which is dedicated to the thermal treatment of waste may be used to replace other materials but this would be only a secondary effect of an operation the principal purpose of which is disposal.

Any plant incinerating the product of such a gasifier must be regarded as a plant incinerating waste. As explained in Chapter 3, one of the most important features distinguishing a disposal operation from a recovery operation is the classification of the substance after the operation.

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[232] The pipeline may be a very short one.
[233] Commission, Proposal for a Council Directive on Incineration of Waste, COM (1998) 558 Final, 98/0289 (SYN), 07.10.1998.
[234] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 69. Emphasis added.

Unlike in the case of recovery, the purpose of putting waste through a disposal operation is to exclude further use of the substance and not to make further use of it. Accordingly, the substances that result from a disposal operation remain waste. Therefore, the products of a gasifier which is dedicated to thermal treatment of waste must be regarded as waste. Since the products of a gasifier dedicated to thermal treatment of waste remain waste, plants incinerating these products will be incinerating waste.

The incineration of these products may occur in three types of plants. Firstly, incineration may occur at a boiler which is connected to the gasifier dedicated to thermal treatment of waste. In such a case, since the whole plant is dedicated to thermal treatment of waste, the whole plant will be regarded as an incineration plant even if the heat generated through incineration of the products of the gasifier in the boiler is used for a useful purpose. Secondly, the products may be incinerated at a plant which is not connected to the gasifier and which is itself dedicated to thermal treatment of waste. In such a case, the second plant will be regarded as an incineration plant because it will be incinerating the products of the gasifier with the purpose of destruction. Thirdly, these products may also be incinerated in an unconnected plant whose main purpose is the generation of energy or production of material products. Such a plant will be regarded as a co-incineration plant.[235]

What has been said above does not provide an answer to the question how a stand-alone gasifier, where no incineration of waste takes place, must be treated if its products are incinerated in an unconnected plant. As emphasized earlier, a gasifier dedicated to thermal treatment of waste is treated as an incineration plant in so far its products are subsequently incinerated. However, where the incineration of its products should occur for the gasifier to be treated as an incineration plant is fuzzy.

One the one hand, it may be argued that a gasification plant dedicated to thermal treatment of waste and whose products are incinerated must be regarded as an incineration plant irrespective of where the incineration occurs. That is, it is not imperative that the incineration of the products of the gasifier occur at a connected boiler. If the products are incinerated, even if this incineration occurs at a plant which is far away from the gasifier and not connected to it, the gasifier must be regarded as an incineration plant. Otherwise, it would have been possible to evade the application of the rules of the WID to the gasifier by a simple separation of the gasifier and the plant incinerating the products.

On the other hand, the other interpretation according to which a gasifier is treated as an incineration plant only if it is connected to a boiler incinerating the products of the gasifier is

[235] See section 3.2 below.

more plausible. Firstly, as stated above, this is probably the interpretation that the Commission had in mind when it first proposed the WID. The Commission states that the definition of incineration plant includes gasification plants where the products of gasification are subsequently incinerated in the same process.[236] This statement strongly implies that it was the intention of the drafters to treat gasifiers as incineration plants only when their products are subsequently incinerated in a connected boiler.

Secondly, the condition that a gasifier dedicated to thermal treatment of waste is regarded as an incineration plant only if the substances obtained through the gasification of waste are incinerated suggests that the decisive condition for the application of the WID is the release of combustion gases. Where the gasifier dedicated to thermal treatment of waste is not connected to the boiler incinerating the products of the gasifier, no release of combustion gases takes place from the gasifier. Since it is the boiler incinerating the products which must be regarded as waste, the release of combustion gases resulting from the incineration of waste occurs only from the boiler. Accordingly, in such a case, it must be the boiler and not the gasifier that must be treated as an incineration plant.

Thirdly, subjecting the separate gasifier to the WID even if the incineration of its products occurs at a plant which is remote from the gasifier leads to a dubious situation in which the classification of the gasifier as an incineration plant or not is determined by the subsequent holder. In the case of two identical gasifiers dedicated to thermal treatment of waste which are not connected to other plants, whereas the gasifier whose products are incinerated in another installation would be subject to the WID, an identical gasifier which produces identical products to be used as raw material in a chemical process without being burnt would not be subject to the WID. It may quite legitimately wondered why should identical gasifiers that produce identical products be subject to two different regimes depending on whether the installation using the product incinerates it or not.

In short, any plant incinerating the products of a gasifier dedicated to thermal treatment of waste must be regarded as a waste incineration plant.[237] However, a gasifier whose products are incinerated at a remote plant should not be treated as an incineration plant.

As stated earlier, incineration of waste is not confined to incineration in a plant dedicated to thermal treatment of waste. Incineration may also occur in plants whose main purpose is the generation of energy or production of material products. Such a plant is named as a co-

[236] Commission, Proposal for a Council Directive on Incineration of Waste, COM (1998) 558 Final, 98/0289 (SYN), 07.10.1998.

[237] If the plant incinerating the products of a dedicated gasifier has the main purpose of generation of energy or production of material products, it must be regarded as a co-incineration plant.

incineration plant. Even though incineration and co-incineration are similar activities, there may be substantial differences between them. These differences are also reflected in the definition of co-incineration plant provided within the WID.

4.3.2 The Definition of Co-incineration Plant

Co-incineration plant is defined in Article 3(5) of the WID.[238] According to this definition, co-incineration plant means any plant whose main purpose is the generation of energy (hereafter power plant) or the production of material products (hereafter factory) provided that:

- the plant uses wastes as a regular or additional fuel; or
- the plant thermally treats waste for the purpose of disposal.

In some cases, it is easy to determine whether the plant must be regarded as a co-incineration plant. This is the case when a power plant or a factory directly co-incinerates waste as fuel or thermally treats waste for the purpose of disposal. For instance, a coal-fired power plant may directly co-incinerate waste such as LUWA bottoms as in the case of *ARCO* and thereby generate energy.[239] That is, LUWA bottoms may be directly used as fuel in the power plant. Such a plant is considered to be a co-incineration plant. The same is true for a cement kiln which thermally treats waste for the purpose of disposal. In other words, if a cement kiln directly co-incinerates waste with the purpose of destroying it, it will be regarded as a waste co-incineration plant.

4.3.2.1 Complexity of Defining Co-incineration Plant

Considerable problems are experienced as regards the definition of co-incineration plant when waste is made subject to a thermal treatment process such as gasification or pyrolysis and the substances resulting from such processes are used as fuel in a power plant or factory. The difficulty may be attributed to both the ambiguous definitions emplyed by the WID and the lack of understanding of the case law of the ECJ on the question of when waste ceases to be waste.

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[238] ‘co-incineration plant’ means any stationary or mobile plant whose main purpose is the generation of energy or production of material products and:
— which uses wastes as a regular or additional fuel; or
— in which waste is thermally treated for the purpose of disposal.
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 of point 4. This definition covers the site and the entire plant including all co-incineration lines, waste reception, storage, on site pretreatment facilities, waste-, fuel- and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

[239] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475.

In some Member States, such as the Netherlands and Germany, any power plant or factory using the substances resulting from the gasification of waste as fuel is regarded as a waste co-incineration plant even in the absence of a connection and irrespective of the quality of the substance. If the gasifier and the power plant, or the factory where the substances are co-incinerated are connected, the whole plant is regarded as a co-incineration plant. Thus, according to these Member States, a thermal treatment of waste such as gasification is not capable of removing the waste tag, and hence, substances that result from such a treatment do not cease to be waste until they are co-incinerated. That is, a gasifier thermally treating waste is always regarded as performing a disposal operation.

4.3.2.2 Gasification as a Form of Recovery

A look into the definition of co-incineration plant reveals that a power plant or a factory is regarded as a co-incineration plant if it uses waste as a fuel or it thermally treats waste for the purpose of disposal. Accordingly, the decisive condition is that the substance used as fuel or thermally treated for the purpose of disposal must be waste. Therefore, the essential question is whether the substances obtained through gasification of waste, which are co-incinerated in a power plant or a factory are waste.

It was explained in the previous chapters as well as in the section above that one of the fundamental differences between a disposal and a recovery operation is that waste undergoing a disposal operation remains waste but waste undergoing a recovery operation may cease to be waste and become a product. A gasifier which is dedicated to thermal treatment of waste has the principal purpose of destroying the waste, thus the disposal of waste, meaning that substances produced by the gasifier remain waste. However, not every gasifier thermally treating waste may be regarded as performing a disposal operation. Gasification is an effective method that is employed to destroy waste. It alters the chemical structure of the waste and converts it into gas which may easily be incinerated. Yet, the mere fact that gasification is one of the ways to dispose of waste and that it is included within the definition of incineration plant in the WID does not justify the conclusion that every gasifier thermally treating waste is performing a disposal operation and that every plant using the substances resulting from the gasification as fuel is a co-incineration plant.

A gasifier which thermally treats waste and thereby produces gas which may be used as fuel in a power plant or factory may be performing either a recovery or a disposal operation depending on the circumstances under which the operation takes place. The distinction between the two forms of treatment is a very fine one as it may not be clear whether the waste thermally treated through gasification is disposed of or recovered. Nevertheless, the distinction can be made and it should be made as it is this distinction that determines whether the substance may have lost its waste status.

The test for determining whether an operation is a recovery or disposal operation was provided in *ASA*[240] and the conditions that must be satisfied was explained in the previous chapter. According to *ASA,* recovery has the *principal objective* that the waste serves a useful purpose in *replacing other materials* which would have had to be used for that purpose, thereby conserving natural resources.

Firstly, the waste must substitute a non-waste material which would have been used if the waste was absent and this substitution must lead to conservation of natural resources.[241] That is, if the gas produced by the gasifier replaces other fuels or materials, and thereby result in conservation of natural resources, the first condition is satisfied.

Secondly, serving a useful purpose through replacing other materials, and thereby protecting natural resources, must be the principal objective of the operation in question.[242] That is, production of the gas which replaces other materials must be the main purpose of the gasification process. There are two factors which may be regarded as strong evidence that the main purpose of the operation is replacing other materials. One of them is the fact that the gasifier continues to operate using other substances in the absence of waste. The other one is whether the operator of the gasifier pays or gets paid for treating the waste. If the operator pays, it is highly likely that the gasification is a recovery operation.

Thirdly, the conditions in which the gasification takes place must give reason to believe that the gasification does indeed what it is claimed to do. Several factors may be indicative. One such indication may be the types of waste gasified. If, for instance, several waste types are gasified without checking whether they may be suitable or not, it may be reason to believe that the operation does not occur with the intention to produce gas but to dispose of waste. Another indication may be the suitability of the gas for use as fuel. The same holds if the costs of producing the gas exceed the benefits that may be derived from its use as fuel.

If the gasification of waste in a particular case fulfills all these conditions, it may be classified as a recovery operation. However, this does not mean that gas produced through gasification of waste has ceased to be waste simply because it is a product of a recovery operation.

In Chapter 2, it was shown that a recovery operation could remove the waste tag attached to a substance if some conditions were fulfilled. Being a recovery operation, gasification of waste may also remove the waste status of the gasified waste. Waste ceases to be waste the moment it is transformed into a material analogous to a raw material with the same characteristics as

[240] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 69. Emphasis added.
[241] See also J. Tieman, *Naar een Nuttige Toepassing van het Begrip Afvalstof*, Kluwer, Deventer, 2003, p 292.
[242] *Ibid* p.294.

that raw material and capable of being used in the same environmental conditions unless it is discarded (ARCO)[243]. That is, the gas produced through gasification of waste loses its waste status the moment it becomes analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions unless it is discarded. When determining whether the waste has ceased to be waste, the obtained gas must be compared with the raw material that it intends to replace. If the gas contains impurities and, therefore, needs further processing before it can be used as fuel, it remains waste at least until the end of such processing (*Mayer Parry*)[244].

If all the conditions stated above are satisfied, recovery becomes complete and the gas produced through gasification loses its waste status. This conclusion is not altered by the fact that the gas is intended to be made subject to incineration which is one of the recovery operations listed in Annex IIB of the WFD. The holder of the gas who uses the gas in accordance with the purpose for which it is made (incineration) cannot be considered to be discarding the gas just because incineration happens to be listed in Annex IIB.

In accordance with the WID, if the gas produced through gasification of waste does not possesses the waste title any longer because of the fact that it has been completely recovered prior to its use as fuel in a power plant or factory, the power plant or the factory using the gas as fuel will not be co-incinerating waste but fuel meaning that it may not be regarded as a co-incineration plant.

However, what is said above does not completely resolve the issue of whether the whole plant may be regarded as a co-incineration plant. It is argued that the WID stipulates that if a gasifier thermally treating waste is connected to a power plant co-incinerating the gas produced by the gasifier, the whole plant must be regarded as a co-incineration plant irrespective of the quality of the gas co-incinerated.

4.3.2.3 Connected Gasifier and Power Plant

There are two possible grounds that may be relied on to provide support for the argument that if a gasifier thermally treating waste is connected to a power plant co-incinerating the gas produced by the gasifier, the whole plant must be regarded as a co-incineration plant irrespective of the quality of the gas co-incinerated. The first one is the explicit inclusion of a gasification plant dedicated to thermal treatment of waste, whose products are subsequently incinerated, within the definition of incineration plant. It is basically assumed that if a waste gasification plant whose products are subsequently incinerated is regarded as an incineration plant, in the case of a gasifier which thermally treats waste and whose products are co-

[243] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475, par. 37-40.
[244] C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163.

incinerated in a connected power plant or factory, the whole plant must be regarded as a co-incineration plant since both are the same processes in different settings. Secondly, the argument also relies on the third indent of Article 3(5) WID according to which the definition of co-incineration plant covers the site and the entire plant including all co-incineration lines, waste reception, storage, on site pre-treatment facilities, waste-, fuel-, air-supply systems, boiler, facilities for treatment of exhaust gases etc. According to this view, the whole plant must regarded as a co-incineration plant since the input of the gasifier is waste and this input is eventually co-incinerated in the power plant which is connected to the gasifier.

The first ground which is argued to be supportive of the argument that a waste gasifier and a power plant (or factory) connected to each other must always be treated as a co-incineration plant is undermined not only by the definition of co-incineration plant but also by the legislative history of the WID which sheds light on the exact meaning of the definition. A power plant or a factory is regarded as a co-incineration plant in two situations. First of those situations is when the power plant or factory uses waste as fuel. Use as fuel refers to thermal treatment in the narrow sense, meaning that it only covers incineration in its classic form. Second of those situations is when a power plant or a factory thermally treats waste for the purpose of disposal. “Thermal treatment” refers to thermal treatment in the broad sense meaning that not only incineration in its classic form but also gasification (also pyrolysis, and plasma processes) is included in so far the substances resulting from gasification are co-incinerated.

A look into the definitions of the incineration and co-incineration plants in the WID reveals that it is not possible to assume that the thermal treatment of waste through gasification as included in the definition of incineration plant can be generalized to the thermal treatment of waste as included in the definition of co-incineration plant. While every gasifier dedicated to thermal treatment of waste and whose products are subsequently incinerated is regarded as an incineration plant, not every gasifier which thermally treats waste and whose products are subsequently co-incinerated is regarded as a co-incineration plant. The difference stems from the fact that whereas a gasifier dedicated to thermal treatment of waste whose products are subsequently incinerated always performs a disposal operation, a gasifier thermally treating waste and whose products are subsequently co-incinerated but which is not dedicated to thermal treatment of waste may be performing either a disposal operation or a recovery operation. Pursuant to the definition of co-incineration plant, a gasifier not dedicated to thermal treatment of waste is only regarded as a co-incineration plant if it thermally treats waste for the purpose of disposal.

The fact that the definition of co-incineration plant was not intended to cover all thermal treatment of waste in the broad sense is also visible in the legislative history of the WID. In the Commission's original proposal, co-incineration plant was defined as a plant whose main purpose was to generate energy or to produce material products, which used wastes as a regular or additional fuel.[245] The European Parliament was of opinion that this definition was too narrow and that it implied that only waste co-incineration for use as fuel was within its scope and hence, waste co-incineration for other purposes such as disposal would fall outside the scope of the definition.[246] This was undesirable and the EP adopted an amendment to the definition of co-incineration plant during the first reading of the proposal within the EP. According to this amendment, a co-incineration plant was any plant whose main purpose was the generation of energy or the production of material products and which thermally treated waste except the thermal treatments dedicated to the recovery of the metal content of waste and cleaning of tools.[247] Thus, the EP removed the "use as fuel condition" and made the determination of whether a plant was a co-incineration plant dependent on whether it was thermally treating waste. Despite the EP's insistence on maintaining the amendment as proposed by the EP,[248] the Council, in its Common Position,[249] adopted another definition which became the definition of co-incineration plant in its current form, namely that thermal treatment of waste in the broad sense.

The important point that the legislative history of the WID illustrates is that had the amendment proposed by the EP been enacted, any plant whose purpose was to generate energy or to produce material products and which thermally treated waste would have fallen under the definition of co-incineration plant. That is, any thermal treatment through gasification of waste the products of which were co-incinerated in a power plant or factory would have fallen within the ambit of the definition. It is obvious that the Council thought that this was undesirable and that a thermal treatment of waste in the broad sense by a plant was to be included within the definition of co-incineration plant when this occurred for the purpose of disposal.

Accordingly, a gasifier thermally treating waste and a power plant (or factory) co-incinerating the products of the gasifier which are connected to each other does not always need to be

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245 Commission, Proposal for a Council Directive on Incineration of Waste, COM (1998) 558 Final, 98/0289 (SYN), 07.10.1998.

246 European Parliament, Committee on the Environment, Public Health, and Consumer Protection, Report on the Proposal for a Council Directive on the Incineration of Waste, A4-0183/99, 31.03.1999, p.29.

247 See Amendment 10 in, European Parliament, Incineration of Waste, Proposal for a Council Directive on the incineration of waste (COM(98)0558 – C4-0668/98 –98/0289(SYN)), [1998] OJ C219/249.

248 European Parliament, Committee on the Environment, Public Health, and Consumer Protection, Recommendation for Second Reading on the Council common position for adopting a European Parliament and Council directive on the incineration of waste (11472/1/1999 – C5-0274/1999 – 1998/0289(COD)), A5-0056/2000 Final, 01.03.2000, p.28-29.

249 The Council of the European Union, Common Position (EC) No 7/2000 adopted by the Council on 25 November 1999 with a view to adopting Directive 2000/.../EC of the European Parliament and of the Council of ...on the incineration of waste, 28.1.2000, [2000] OJ C25/17.

treated as a co-incineration plant. According to the definition of the co-incineration plant, a distinction needs to be made between the situation where the gasifier connected to a power plant thermally treats waste for the purpose of disposal and where this occurs for the purpose of recovery. In the former case, the whole plant must be regarded as a co-incineration plant. That is, if waste is thermally treated in a gasifier connected to a power plant in which the products of the gasifier is co-incinerated and the purpose of the thermal treatment is to dispose of waste, the whole plant, thus the gasifier and the power plant, is to be treated as a co-incineration plant. The reason is that if a gasifier connected to a power plant thermally treats waste for the purpose of disposal, the substances resulting from the gasification never ceases to be waste. Thus, when the connected power plant co-incinerates the substances, it will be co-incinerating waste. In such a case, the whole plant is carrying out the same process, namely the disposal of waste, even if the heat generated is recovered.

However, as explained above, gasification of waste may also take place for the purpose of recovery. A gasifier which is connected to a power plant may be thermally treating the waste to convert it into a fuel which may be used in the power plant. In such a case, the gasification of waste concerns a recovery operation and, depending on the circumstances, the waste may or may not cease to be waste prior to its use in the power plant. This is the decisive factor determining whether a waste gasifier and a power plant (or factory) connected to each other, thus the whole plant, must be treated as a co-incineration plant.

As mentioned above, there is a second ground which is relied on to support the argument that a waste gasifier and a power plant (or factory) connected to each other, thus the whole plant, must always be treated as a co-incineration plant. It is argued that since the input of the gasifier is waste and this input is eventually co-incinerated in the power plant which is connected to the gasifier, the whole plant must regarded as a co-incineration plant. In other words, according to this view, the input at the beginning of the process determines whether the whole plant must be regarded as a co-incineration plant.

However, neither the definition of co-incineration plant provided within the WID nor the case law of the ECJ on the question of when waste ceases to be waste provide any support for this view. According to the definition of co-incineration plant, a power plant or a factory is regarded as a co-incineration plant if (1) it uses waste as a regular or additional fuel or (2) it thermally treats waste for the purpose of disposal. The second situation was already explained above.

Use of waste as fuel, the first situation, refers to incineration in its classic form, that is, oxidation of waste. Accordingly, whether a power plant connected to a gasifier which thermally treats waste must be regarded as a co-incineration plant depends on whether the substances used as fuel in the power plant are waste at the moment of their incineration to generate energy. That is, the decisive factor is not the classification of the input as waste at the beginning of the process but the classification of the substance at the moment of its co-incineration. In the case of a gasifier thermally treating waste and a power plant co-incinerating the substances resulting from the gasification which are connected to each other, the gasifier does not use the waste as fuel but only thermally treats it to convert it into gas. That is, even though the gasifier thermally treats the waste, it does not incinerate it. The use of the substance as fuel, thus, incineration takes place in the connected power plant. The classification of the substance as waste or not at this moment determines whether the whole plant must be regarded as a co-incineration plant.

What is said above in the previous paragraph seems to be the approach endorsed by the Commission as well. In its reply to a question posed by the Dutch MEP, Lambert van Nistelrooij, the Commission states that the classification of a power plant as a co-incineration plant is not determined by its link to a waste processing plant. If the substances produced at the waste processing plant which are co-incinerated in the connected power plant no longer have the status of waste when being co-incinerated, the power plant may not be regarded as a co-incineration plant.[250]

In Chapter 2 and section 3.2.1 above, it was explained in detail that waste which undergoes a recovery operation may, at some point, cease to be waste. The same reasoning applies to a waste gasifier and a power plant which are connected to each other. Gasification of waste may constitute a recovery operation. Like in any other recovery operation, the waste which is gasified ceases to be waste the moment that it becomes analogous to the raw material which it intends to replace and capable of being used under the same environmental conditions as that raw material even if the substance obtained through recovery is incinerated in a connected power plant. A material which has been made analogous to a fuel so that it can be used as fuel cannot be considered to be discarded because of the mere fact that it is incinerated. When these conditions are fulfilled, the recovery is complete and the substance ceases to be waste prior to its use as fuel in the power plant.

In the case of a gasifier thermally treating waste and a power plant co-incinerating the substances resulting from the gasification which are connected to each other, there are two thinkable situations concerning the classification of the plant as a co-incineration plant. The first one is the situation in which the recovery of the waste through gasification becomes complete and the waste in question loses its waste status prior to its incineration in the power

[250] Question by L.van Nistelrooij, H-0343/06, 18 May 2006, Available at: http://www.europarl.europa.eu/omk/sipade3?L=EN&OBJID=117273&DETAIL=H-2006-0343&MODE-CRE=NAV [13.07.2006].

plant. In such a case, the whole plant, thus the gasifier and the power plant, falls outside the definition of co-incineration plant. As explained above, the decisive condition is the classification of the substance as waste at the moment of its incineration. If the substance incinerated by the power plant is not waste, the power plant may not be regarded as a co-incineration plant. The gasifier is not a co-incineration plant either. There are two reasons. On the one hand, the gasifier thermally treats the waste to produce gas but it does not use the waste as fuel. That is, it does not incinerate the waste. Secondly, since the substance incinerated by the power plant is not waste, the gasifier may not be brought under the third paragraph of Article 3(5) WID. In other words, since no waste incineration takes place in the power plant, the gasifier connected to the power plant may not be regarded as a waste reception, storage, on site pretreatment facility being part of a co-incineration plant within the meaning of the third paragraph of Article 3(5) WID.

The second one is the situation in which the recovery is incomplete and the substance continues to be waste at the moment of its incineration in the power plant. In this case, the whole plant, thus the gasifier and the power plant, must be regarded as a co-incineration plant. The power plant is regarded as a co-incineration plant because it uses waste as fuel. Even though the gasifier itself is not a co-incineration plant since it does not use the waste as fuel, it must be regarded as part of the co-incineration plant within the meaning of the third paragraph of Article 3(5) WID. Since the power plant co-incinerates waste, the gasifier which is connected to the power plant and which supplies the waste to it must be regarded as a waste reception, storage, and on site pretreatment facility and hence, part of the co-incineration plant.

This section illustrates that the definitions of incineration and co-incineration plant provided within the WID are susceptible to different interpretations. It is, therefore, not unexpected that diverse interpretations are encountered in different Member States.

4.4 Implementation of the WID in the Netherlands[251]

Besluit Verbranden Afvalstoffen (the BVA) is the Dutch Decree implementing the WID in the Netherlands. Provisions of the WID as regards waste waters that result from flue gas cleaning are implemented by Regeling Lozingen Afvalwater van Rookgasreiniging.[252]

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[251] This section is confined to the implementation of the WID in the Netherlands as regard the definition of incineration and co-incineration plant.
[252] Sc. 247, 46.

4.4.1 Incineration Plants

The BVA distinguishes between waste incineration and co-incineration plants. Waste incineration plants are those that are exclusively or principally dedicated to thermal treatment of wastes. There are three types of waste incineration plants and these plants are regarded as waste incineration plants even if the heat generated is recovered. First of those is a plant where waste is incinerated through oxidation.[253] A thermal treatment process is regarded as incineration if it involves oxidation.[254] Thus, thermal treatment processes that do not involve oxidation are not regarded as incineration.

Second, a plant which thermally treats waste through a process other than oxidation is regarded as an incineration plant in so far the products of the thermal treatment are subsequently incinerated.[255] Thus, gasification, pyrolysis, and plasma treatment plants are considered to be incineration plants only if the products of gasification/pyrolysis/plasma processes (mostly gaseous) are subsequently incinerated.[256]

Thirdly, a plant which incinerates the products of thermal treatment of waste is regarded as waste incineration plant.[257] That is, a plant that incinerates the products (mostly gaseous) obtained from gasification/pyrolysis of waste is regarded as an incineration plant.

If the plant where waste is thermally treated through gasification/pyrolysis (second plant above) and the plant where the products of the gasification/pyrolysis (third plant above) are incinerated are connected, the whole plant will be regarded as one incineration plant.[258]

4.4.2 Co-incineration Plants

Article 1(1)(b) provides a definition of co-incineration plant. According to this definition, the following features must be present to be able to classify a plant as a co-incineration plant.

There must be a technical unit the principle purpose of which is either:
- the generation of energy, or
- the production of material products.

Furthermore, in these units

[253] Article 1(1)(a)(i) BVA.
[254] Chapter 11 Article 1(1)(a) Explanatory Memorandum of the BVA, p. 37. (Stb. 2004, 97).
[255] Article 1(1)(a)(ii) BVA.
[256] Chapter 11 Article 1(1)(a) Explanatory Memorandum of the BVA, p. 37. (Stb. 2004, 97).
[257] Article 1(1)(a)(iii) BVA.
[258] Chapter 11 Article 1(1)(c) Explanatory Memorandum of the BVA, p. 38. (Stb. 2004, 97).

- waste or products of thermal treatment of waste (gas derived from gasification of waste) must be used as fuel, or
- wastes must be thermally treated for the purpose of disposal.

Accordingly, there are four types of plants which are regarded as co-incineration plants by the BVA. First type is a plant which is principally dedicated to the generation of energy and in which waste or products of thermal treatment of waste are used as fuel. For instance, a power plant which directly co-incinerates waste, or which co-incinerates gas produced through gasification of waste as fuel is treated as a co-incineration plant irrespective of the quality of the gas co-incinerated. Secondly, a plant which is principally dedicated to the generation of energy but where waste is thermally treated for the purpose of disposal is regarded as a co-incineration plant. A power plant in which waste is thermally treated for the purpose of disposal is an example of the second type. Third type is a plant which is dedicated to the production of material products and in which waste or products of thermal treatment of waste is used as fuel. An example is a cement kiln which uses either waste or gas produced through thermal treatment of waste as fuel. The cement kiln is regarded as co-incineration plant regardless of the quality of the gas. Fourthly, a plant the principal purpose of which is the production of material products, where waste is thermally treated for the purpose of disposal is also considered as a co-incineration plant. For instance, a cement kiln which thermally treats waste for the purpose of disposal is such a plant.

As a final point, it must be stated that if the plant where waste is thermally treated through gasification/pyrolysis and the plant where the products of the gasification/pyrolysis are co-incinerated are connected, the whole plant will be regarded as one co-incineration plant. That is, if a power plant whose main purpose is the generation of energy is connected to a gasifier and the substance produced through gasification (producer gas) is subsequently co-incinerated in the power plant as fuel, the whole plant, thus the gasifier and the power plant, will be regarded as a co-incineration plant irrespective of the quality of the substance produced through gasification.[259]

4.4.3 Evaluation of the BVA in Light of the WID[260]

Scrutiny of the BVA in light of the WID exhibits that the BVA deviates from the WID in several respects and that the definition of co-incineration plant in the BVA is inconsistent with the definition provided in the WID. The first inconsistency concerns the treatment of any power plant or factory using the products of thermal treatment of waste as fuel as a co-

[259] Chapter 12 (1) (2) of the Explanatory Memorandum of the BVA p. 43-44 (Stb. 2004, 97).
[260] The evaluation is confined to the evaluation of the BVA as regards the definition of incineration and co-incineration plant.

incineration plant.[261] The WID defines co-incineration plant as a power plant or factory which uses waste as fuel or thermally treats waste for the purpose of disposal without mentioning products of thermal treatment of waste. However, the definition of co-incineration plant provided in the BVA specifically includes products of thermal treatment of waste.

As explained in section 3 above, this interpretation entails a generalization of the definition of incineration plant to co-incineration plant without any legal justification that may be found in the definition of co-incineration plant provided in the WID. Whereas a gasifier dedicated to thermal treatment of waste as explicitly included within the definition of incineration plant is always involved in disposal of waste, a gasifier not dedicated to thermal treatment of waste may be performing either a disposal or recovery operation. The fundamental difference between the two gasifiers is that the substances resulting from a thermal treatment of waste by a dedicated gasifier always remain waste but substances produced through thermal treatment of waste by a not dedicated gasifier may have lost their waste status and have become products.

By treating all the substances derived through gasification of waste as waste, the BVA totally disregards the case law of the ECJ and the Dutch Council of State on the question of when waste ceases to be waste, and it does so without any textual support that may be found within the definition of co-incineration plant provided in the WID. There is no compelling reason to treat gasification in the form of recovery differently than other forms of recovery which are also employed in the production of fuel from waste. If the production of energy pellets from waste for the purpose of use as fuel is capable of removing the waste status of the waste, the production of gas to be used as fuel through a thermal treatment of waste such as gasification should also be able to do so.[262] After all, they both are recovery operations geared towards obtaining fuel from waste. Therefore, the BVA is incompatible with the WID with regard to the definition of co-incineration plant.

The second inconsistency concerns the connected gasifier and power plants. According to the BVA, in the case of a gasifier connected to a power plant in which the products of gasifier are co-incinerated, the whole plant is always regarded as a co-incineration plant.[263] This issue was discussed in detail in section 3.2.3 and there is no reason to repeat the discussion. It suffices to say that the definition of co-incineration plant provided in the WID encompasses connected plants in two situations. First of those is the situation in which the thermal treatment of waste through gasification and the subsequent co-incineration of the substances in the power plant

[261] Article 1(1)(b)BVA.
[262] Council of State (ABRvS), *Icopower I,* 3 April 2002, 200103485/1; Council of State (ABvRS), *Icopower II,* 14 May 2003, 200205047/1, *AB* 2003, 235.
[263] Chapter 12 (1) (2) of the Explanatory Memorandum of the BVA p. 43-44 (Stb. 2004, 97).

occurs for the purpose of disposal of the waste. The second one is the situation in which the substance has the status of waste at the moment of its incineration in the power plant. However, the BVA treats all the connected gasifiers and power plants as a co-incineration plant even when the substance may have lost its waste status at the moment of its incineration in the power plant. This is contrary to the text of the WID according to which the decisive criterion is whether the substance is waste or not at the moment of incineration.

4.4.4 Evaluation of the BVA under the EC Treaty

The fact that the BVA is inconsistent with the WID does not necessarily imply that it is a legally incorrect implementation of the WID. In accordance with Article 176 EC, the Member States are empowered to maintain or introduce more stringent national rules than the measures adopted on the basis of Article 175 EC. Since the WID is based on Article 175 EC, the BVA may impose stricter rules than the WID.

4.4.4.1 The Eiterköpfe Test[264]: More Stringent Measures

Treating any plant co-incinerating the products of thermal treatment of waste as a co-incineration plant may be regarded as a provision more stringent than the definition provided in the WID if the conditions stipulated by the Court in *Eiterköpfe* are fulfilled. According to *Eiterköpfe,* the national provision in question must pursue the same objectives as the directive. This condition is fulfilled in the case of the BVA. The main objective of the WID is to prevent or limit as far as practicable negative effects on the environment, in particular pollution by emissions into air, soil, and water, and the resulting risks to human health from the incineration and co-incineration of waste.[265] For this purpose, the WID makes incineration plants including those thermally treating waste through gasification etc whose products are subsequently incinerated and co-incineration plants subject to ELVs and operating conditions. By extending the application of the WID to any plant co-incinerating the products of thermal treatment of waste and thereby subjecting them to ELVs as well, the BVA aims to achieve the same objectives pursued by the WID. Therefore, the definition of the BVA as regards co-incineration plant may be regarded as a more stringent measure.

Importantly, as long as no other provision of the EC Treaty is involved, a Member State which adopts a more stringent national measure is not bound by the Community principle of proportionality. This means that the Member States may determine how far they may go when they impose more stringent measures.

[264] C-6/03, *Deponiezweckverband Eiterköpfe v Land Rheinland-Pfalz*, 2005, ECR I-02753.
[265] Article 1 WID.

4.4.4.2 Failure to Notify a More Stringent Measure

As stated above, the BVA may be regarded as a measure more stringent than the WID. Member States which adopt more stringent measures are obliged to notify those measures to the Commission. However, the Netherlands have failed to do so as regards the more stringent definition of co-incineration plant provided within the BVA due to its presumption that the BVA did not entail a more stringent measure.

The question that arises is what the consequences of the Netherlands' failure of notification are for individuals. In other words, may the failure to notify render the BVA inapplicable *vis-à-vis* individuals? The answer to this question should be no. It may be inferred from *Securitel*[266] and *Sydhavnens*[267] cases that where the notification requirement entails a mere obligation on the Member State to inform the Commission about the measures taken, and lays down no procedure for Community monitoring of those measures and does not subject their entry into force to agreement or lack of objection on the part of the Commission, the failure to notify the more stringent measure does not confer on individuals the right which enables them to challenge the measure. In other words, in such a case, the failure to notify does not render the measure inapplicable *vis-à-vis* individuals.

Article 176 EC is confined to a mere obligation on the Member States to inform the Commission about the measures taken and to enable it to assess the compatibility of the measure with Community Law, and if necessary, to take the appropriate steps. It does not provide for a Community monitoring procedure. Neither does it require the approval or inaction of the Commission for the entry into force of the measure. Accordingly, it must be concluded that individuals does not derive a right to challenge the BVA on the ground that the Netherlands have failed to notify a more stringent measure as regards the definition of co-incineration plant

4.4.4.3 Compatibility with Article 28 EC

The power of the Member States to adopt more stringent measures is subject to a proviso. The more stringent national measure must be compatible with the EC Treaty.[268] The only relevant Treaty provision in the case of the BVA is Article 28 EC which forbids quantitative restrictions on imports and measures having equivalent effect. As mentioned earlier, the BVA is based on the assumption that products of thermal treatment always remain waste and that plants co-incinerating those products are co-incineration plants. That is, if the product is derived through thermal treatment of waste, the quality of the product is irrelevant. There is no cross-border trade in products of thermal treatment of waste as those products are

[266] C-194/94, *Securitel*, 1996, ECR I-02201, par. 32-55.
[267] C-209/98, *Sydhavnens Sten & Grus*, 2000, ECR I-3743, par. 96-102.
[268] See Article 176 EC.

produced for immediate use either in the form of fuel or in the form of raw material in chemical industry. However, had it been technically possible to transport those products, the BVA may have been regarded as a measure having equivalent effect even in the absence of cross-border trade in products of thermal treatment of waste. The reason is that in such a case the BVA may precisely be the reason that there is no cross-border trade.

According to the case law of the ECJ, national measures "which are capable of hindering, directly or indirectly, actually or potentially, intra-Community trade"[269] are regarded as measures having equivalent effect even if they are applicable to both national products and imports. The application of Article 28 EC is based on the principle of mutual recognition formulated in *Cassis de Dijon*[270] according to which products lawfully produced in a Member State must have market access in another. Even though treating products of thermal treatment of waste, which are produced and marketed lawfully in another Member State, as waste does not ban the access of those products to the Netherlands, it imposes a burden on the producer to export those products and makes export to the Netherlands an unattractive option. Thus, the BVA may be regarded as capable of hindering trade between the Member States.

The fact that the BVA is capable of hindering trade does not mean that it is contrary to Article 28 EC. Since the BVA is an indistinctly applicable measure, the Netherlands may rely on two grounds to justify the restriction. Firstly, it may rely on Article 30 EC. Being an explicit derogation from a fundamental freedom, Article 30 EC and the ground that might be relied on, the protection of human health and life of humans, animals, and plant, must be interpreted restrictively. This article requires the demonstration of a genuine danger to life and health of human beings, animals, or plants. Dangers following from the import of, for instance, gas derived from gasification of waste may be two-fold. One of them is the danger that may arise from the co-incineration of the gas. Inhibition of the imports on this ground is unlikely to be justified under article 30 EC as the incineration of products of thermal treatment of waste do not pose a genuine threat to health and life. Since they have already been compared to other primary fuels to determine whether they have ceased to be waste, the risk that they pose is not any greater than the risk that the primary fuel poses. However, the second danger, that is, the danger that flow from the transportation of those substances over long distances may pose a genuine threat to human health as those substances may be highly flammable. Nevertheless, the BVA does not distinguish between substances that may be dangerous and substances which may not be dangerous. That is, it inhibits the import of those substances even when they pose no danger. Under such circumstances, the BVA may not be regarded to be justified under article 30 EC.

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[269] 8/74, *Dasonville*, 1974, ECR 837.
[270] 120/78 *Rewe-Zentral AG,* 1979, ECR 649.

The second ground that may be relied on by the Netherlands to justify the BVA is the rule of reason exception. This ground was articulated by the Court in *Cassis de Dijon* as a justification for indistinctively applicable national measures capable of hindering trade, [271] and environmental protection is recognized as one of the grounds for exception.[272] It is broader than Article 30 EC. The ground of environmental protection as a justification for the restrictions that flow from the BVA is likely to be accepted. Anything that is incinerated has an environmental impact and if the products have a waste origin, there is a risk that the environmental impact may be greater. However, BVA which may be justified must also comply with the second prong of the test, namely proportionality. According to this test, the BVA must not only achieve its purpose of environmental protection but also not go further than necessary to protect the environment meaning that there must not be less restrictive measures capable of achieving the same purpose. It is highly doubtful that the BVA can stand the proportionality test. The reason is that the same purpose may be achieved with a less restrictive measure. Instead of treating those products as waste without distinction, the Netherlands may ask the producer to guarantee its quality and its comparability with other primary products. If its quality and comparability can be guaranteed, not only the environmental concerns of the Netherlands are addressed, but also the trade is not restricted more than necessary. The BVA is, therefore, disproportionate to the aim pursued.

In short, in its current form, the BVA not only deviates from the definition of co-incineration plant provided in the WID, but it also imposes a more stringent measure which is incompatible with Article 28 EC. Accordingly, the BVA does not constitute a legally correct implementation of the WID.

The Netherlands is not the only Member State having more stringent measures which are incompatible with article 28 EC. The implementing measures of some other Member States such as Germany also contain similar provisions.

4.5 Implementation of the WID in Some Member States[273]

Scrutiny of the implementing measures in other Member States reveals that the definitions provided in the WID are indeed vague. The vagueness and ambiguity of the definitions provided in the WID are reflected in the disparity of interpretation between the Member States as regards the definition of incineration and co-incineration plants when the waste is made subject to a thermal treatment such as gasification and the substances resulting from these processes are then incinerated or co-incinerated. Germany, Finland, and the UK are

[271] *Ibid.*
[272] 302/86, *Commission v Denmark*, 1988, ECR 4607.
[273] This section is confined to the implementation of the WID as regards the definition of incineration and co-incineration plant.

chosen not only because of linguistic reasons but also because of the availability of similar technologies.

4.5.1 Germany

The WID is implemented through *Siebzehnte Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes* (hereafter the *17. BImSchV*) in Germany. According to § 1 (1) of the *17.BImSchV*, the measure covers incineration and co-incineration plants that treat not only solid, liquid, or gaseous waste which is stored into tanks, but also solid, liquid, or gaseous substances that result from the gasification or pyrolysis of waste. § 2 (6) defines the incineration plant. According to this definition, incineration plant is a plant dedicated to the thermal treatment of wastes or substances in § 1 (1). Thermal treatment within the meaning of § 2 (6) covers not only oxidation but also gasification, pyrolysis, and plasma processes provided that the substances resulting from these processes are incinerated. § 2 (7) provides a definition of co-incineration plant. Co-incineration plant is defined as a plant whose purpose is the generation of energy or production of material products, which uses wastes or substances in § 1 (1) as a regular or additional fuel, or which thermally treats wastes or substances in § 1 (1) for the purpose of disposal.

The following conclusions may be drawn from the *17. BImSchV*. Firstly, any plant incinerating or co-incinerating waste or substances derived from the gasification of waste is treated as a waste incineration or co-incineration plant. If the plant is dedicated to thermal treatment of wastes or substances derived from the gasification of waste, it will be treated as an incineration plant. If the purpose of the plant is the generation of energy or production of material products, and wastes or substances derived from the gasification of waste are co-incinerated either as fuel or for the purpose of disposal, it will be treated as a co-incineration plant. In both cases, the plant incinerating or co-incinerating substances derived from gasification or pyrolysis of wastes will be treated as an incineration or co-incineration plant respectively regardless of the quality of the substance. Secondly, where the gasifier which thermally treats waste and the plant which incinerates or co-incinerates the substances derived from the gasification are connected, the whole plant, thus the gasifier and the plant incinerating or co-incinerating the substances derived from gasification will be regarded as one incineration or co-incineration plant irrespective of the quality of the substance derived from gasification.[274]

[274] Personal e-mail correspondence with Mr. Johnke Bernt from the German Umweltbundesambt (e-mail correspondence available upon request).

4.5.2 Finland

The Waste Incineration Decree 362/2003 is the measure transposing the WID into national law in Finland. § 2 (4) and (5) provide a definition of incineration and co-incineration plant respectively. Both provisions follow the wording of the WID as regards the definition of incineration and co-incineration plant.

A recent judgment of the Finnish Supreme Administrative Court (*Korkein hallinto-oikeus*) provides guidance as regards the implementation of the WID in Finland.[275] The case concerned the issue of whether a power plant which is connected to a gasifier thermally treating waste to produce clean gas must be regarded as a co-incineration plant if it co-incinerates the clean gas produced by the gasifier. The waste treated by the gasifier was municipal waste which was sorted and mechanically treated before the thermal treatment in the gasifier. The gas obtained through thermal treatment in the gasifier was clean and it was transmitted to the power plant where it was co-incinerated together with coal to produce energy. The Finnish Court came to the conclusion that the gas derived from waste through thermal treatment which was as clean as the gas in the particular case should be regarded as fuel and not as waste. Accordingly, a power plant co-incinerating the gas in question would be regarded as incinerating fuel and not waste, and hence would fall outside the scope of the WID despite the connection to the gasifier. According to the Finnish Court, the Large Combustion Plants Directive[276] would apply to the power plant co-incinerating the gas. The gasifier would fall outside the scope of the WID as well and it would be treated as a chemical plant where wastes were processed.

Briefly, the judgment recognizes the possibility that a substance derived from thermal treatment of waste through gasification may cease to be waste if some conditions are fulfilled. Furthermore, the gasifier and the power plant co-incinerating the gas may be treated as two separate plants if the gas supplied by the gasifier is no longer classified as waste. In such a case, both the power plant and the gasifier fall outside the ambit of the WID.

However, the judgment of the Finnish Court has initiated an amendment process of the Finnish Waste Incineration Decree 362/2003.[277] Even though no definitive predictions can be made at the moment, if the proposed amendments are adopted, the Finnish Court's judgment will be overruled. According to the proposal, any plant incinerating or co-incinerating

[275] Korkein hallinto-oikeus, 347/1/04, *Martinlaakso*, 09/09/2005. The judgment is only available in Finnish. The information presented here with regard to the judgment is obtained from legal counselor Oili Rahnasto from the Finnish Ministry of Environment (e-mail correspondence available upon request).
[276] Directive 2001/80/EC of the European Parliament and af the Council of 23 October 2001 on the Limitation of Emissions of Certain Pollutants into the Air from Large Combustion Plants [2001] OJ L309/1.
[277] Personal e-mail correspondence with legal counselor Oili Rahnasto from the Finnish Ministry of Environment (e-mail correspondence available upon request).

substances produced through thermal treatment of wastes (gasification, pyrolysis) will be regarded as a waste incineration or co-incineration plant irrespective of the quality of the substances. Where the plant thermally treating the waste (gasifier) and the plant incinerating or co-incinerating (power plant) the substances produced through thermal treatment of waste are connected, the whole plant will be regarded as one incineration or co-incineration plant. Yet, it remains to be seen whether the proposed amendments will be adopted.

4.5.3 The UK

In England and Wales, the WID is implemented by Waste Incineration (England and Wales) Regulation 2002[278] and the Pollution Prevention and Control (England and Wales) Direction 2002. In Scotland, it is implemented by Waste Incineration Regulations 2003[279]. The definitions of incineration and co-incinceration plant in both English and Scottish measures are literally taken over from the WID. Both the English and Scottish authorities issued guidelines in which the scope, interpretation, and application of the WID in England-Wales and Scotland are described.

4.5.3.1 England and Wales

The Guidance provides a description of incineration plant.[280] According to the Guidance, a waste processing plant must be regarded as an incineration plant if it thermally treats waste which irreversibly alters the chemical structure of the original waste.[281] This includes both incineration/combustion and gasification/pyrolysis plants. The latter is treated as an incineration plant only if the substances resulting from them are incinerated. If a gasification/pyrolysis plant produces products which are subsequently burnt in a connected plant, then the WID applies to the whole plant.[282] In cases where the products are burnt away from the gasification/ pyrolysis plant (remote units), the WID will apply both to the plants initially producing, as well as subsequently using, these products.[283] If the products of the gasifier are used as raw materials without being incinerated, neither the gasifier nor the plant using the product will be subject to the WID.[284]

The question whether the reasoning above also applies to co-incineration plants remains obscure. On the one hand, unfortunately, the Guidance provides no explanation with regard to co-incineration plants. On the other hand, it recognizes that in some cases, waste which is

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[278] SI n° 2980/2002.
[279] SSI 2003 n° 170 of 10/03/2003.
[280] DEFRA, *Guidance on Directive 2000/76/EC on the incineration of waste*, 3rd edition, 2006, p. 20. Available at www.defra.gov.uk/environment/ppc/wasteincin/pdf/wid-guidance-edition3.pdf [15.09.2006].
[281] *Ibid* p.20 and 22.
[282] *Ibid* p.21.
[283] *Ibid.*
[284] *Ibid.*

treated may cease to be waste prior to being burned.[285] However, whether this can be generalized to a thermal treatment process (gasification) which results in clean gas is not clear. Thus, whether a plant co-incinerating the substances produced through gasification of waste should be regarded as a co-incineration plant irrespective of the quality of the product that is co-incinerated is not answered in the Guidance.

4.5.3.2 Scotland

The Scottish Guideline[286] is very similar to the English Guidance but it also differs from it. According to the Guideline, thermal treatment of waste is a process which irreversibly alters the chemical structure of the original waste.[287] In the case of a gasification or pyrolysis plant which produces subtsances that are burnt on that site, the whole plant is regarded as an incineration plant. However, unlike the English Guidance, the Scotish Guideline states that if the gas derived from the gasification of waste is injected into a gas transmission system and it is burnt away from the site, the plant where the gas is incinerated will not be regarded as an incineration plant.[288]

Just like the English Guidance, the Scottish Guideline does not provide any explanation concerning co-incineration plants. However, the Scottish Guideline makes it clear that the reasoning explained above applies to plants whose main purpose is the disposal of waste, and hence not manufacturing processes.[289] Even though no definitive conclusions may be drawn from this statement, it implies that gasification plants that produce substances to be co-incinerated for energy production or manufacturing of products are outside the scope of the WID.

In short, the uncertainty and confusion surrounding the definition of incineration and co-incineration plant is visible. The variety of interpretation given to definition of incineration and co-incineration plant in various Member States is a confirmation of the need to clarify those definitions in the future.

4.6 Conclusion

The WID was adopted to eliminate the problems with which the predecessors of the WID were incapable of coping with due to the deficiencies they suffered from. Being responsible for serious amounts of harmful emissions, particularly dioxins, furans, and heavy metals,

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[285] *Ibid* p.17.
[286] SEPA, *Waste Incineration (Scotland) Regulations 2003 Practical Guidance*, 2nd edition, 2005. Available at www.scotland.gov.uk/Publications/2005/04/19140354 [17.09.2006].
[287] *Ibid* p.10.
[288] *Ibid.*
[289] *Ibid.*

waste incineration needed stricter regulation. It was also necessary to prevent the movement of waste to Member States where waste could be co-incinerated in power plants or cement kilns. Even though the WID represented a significant progress in many respects and it brought more clarity, the WID was not without its problems particularly with respect to the definition of incineration and co-incineration plants. In this regard, the following questions were asked: (1) how should the WID be interpreted with regard to the definition of incineration and co-incineration plant? (2) Is the BVA consistent with the WID as regards the definition of incineration and co-incineration plant (3) Is the BVA compatible with the EC Treaty?

The ambiguity of the definitions of incineration and co-incineration plant coupled with the lack of understanding of the ECJ's case law on the question of when waste ceases to be waste resulted in diversity of implementation among the Member States with respect to the definition of incineration and co-incineration plants. Some of those implementing measures are inconsistent with the WID. One of those measures is the Dutch implementing measure, namely the BVA. The definition of co-incineration plant provided within the BVA deviates from the one provided in the WID in two respects. Firstly, whereas the WID only includes the use of waste as fuel or disposal of waste in power plants or factories, the BVA includes not only the use as fuel and disposal of waste but also the use of the products derived from thermal treatment of waste irrespective of the quality of those substances. Secondly, unlike the WID which excludes the connected gasifiers and power plants if the substance is not waste at the moment of its incineration in the power plant, the BVA treats all the connected gasifiers and power plants as a co-incineration plant even when the substance may have lost its waste status at the moment of its incineration in the power plant.

The fact that the BVA deviates from the WID does not mean that it is a legally incorrect implementation. Pursuant to Article 176 EC, the Member States are empowered to enact more stringent measures than the measures adopted on the basis Article 175 EC such as the WID. The BVA is a measure more stringent than the WID as it extends the definition of co-incineration plant to plants co-incinerating the products of thermal treatment of waste and it thereby pursues the same objective as the WID, namely preventing environmental harm resulting from emissions to air, soil, and water by those plants. In light of *Eiterköpfe,* since the BVA pursues the same objective as the WID, it may be regarded as a more stringent measure. However, all of the more stringent measures must comply with the EC Treaty.

The BVA is a more stringent measure which may be contrary to Article 28 EC as it is a measure having equivalent effect. Treating all the substances derived through thermal treatment of waste is capable of inhibiting cross-border trade. BVA may not be justified on the basis of Article 30 as it does not distinguish between materials which may pose a genuine threat to human life and those which do not. It may not be justified via the rule of reason route due to the fact that it goes further than necessary. The Netherlands may, instead of treating all the substances derived through thermal treatment of waste as waste, may ask the producer to guarantee the quality and comparability of the substance with non-waste materials. Accordingly, the BVA may be regarded as a more stringent measure incompatible with the EC Treaty.

In accordance with the WID, the following steps must be taken to determine whether a particular plant is an incineration or co-incineration plant. Firstly, it must be determined whether the plant is an incineration or co-incineration plant. If the plant is dedicated to thermal treatment of waste, that is disposal of waste through thermal treatment, the plant is an incineration plant. If the plant is a power plant or factory using waste as fuel or thermally treating waste for the purpose of disposal, it will classified as a co-incineration plant.

The WID distinguishes between two types of incineration plants depending on the type of thermal treatment employed. The first type is a plant which is dedicated to incineration of waste by oxidation. This is incineration in its classic form. A plant which directly incinerates waste through oxidation with the purpose of destroying the waste is regarded as a waste incineration plant even if the heat generated is recovered.

Secondly, the definition of incineration plant also covers other thermal treatment processes dedicated to thermal treatment of waste such as gasification, pyrolysis, or plasma processes only in so far the substances resulting from these processes are subsequently incinerated. If the gasifier dedicated to thermal treatment of waste and the boiler in which the products of the gasifier are incinerated are connected, the whole plant must be regarded as a co-incineration plant. If they are separate, the plant incinerating the substances is to be considered as an incineration plant. The gasifier thermally treating the substances should not be regarded as an incineration plant.

If the plant concerns a power plant or a factory which uses waste as a fuel or in which waste is thermally treated for the purpose of disposal, the plant is a co-incineration plant. The most straightforward case is when the power plant directly co-incinerates waste as fuel or for the purpose of the disposal. In both cases, the plant must be regarded as a co-incineration plant.

Deciding whether the plant concerns a co-incineration plant becomes complicated where the waste is thermally treated by a gasifier prior to its use as fuel or disposal in the power plant or factory. In such a case, whether the power plant or the factory must be regarded as co-incineration plant depends on the classification of the thermal treatment by the gasifier as recovery or disposal. The essential difference between recovery and disposal is that waste that is subject to a recovery operation may cease to be waste but waste going through a disposal operation remains waste. Accordingly, it must first be determined whether the operation performed by the gasifier is recovery or disposal.

The test for determining whether an operation is a recovery or disposal operation was provided in *ASA*[290]. The details of the test have already been explained in the previous chapter and there is no need to repeat them.[291] If the gasification of waste in a particular case fulfills all the conditions, it may be classified as a recovery operation. Otherwise, it is a disposal operation.. Like in any other recovery operation, the waste which is gasified ceases to be waste the moment that it becomes analogous to the raw material which it intends to replace and capable of being used under the same environmental conditions as that raw material even if the substance obtained through recovery is incinerated in a connected power plant. A material which has been made analogous to a fuel so that it can be used as fuel cannot be considered to be discarded because of the mere fact that it is incinerated. When these conditions are fulfilled, the recovery is complete and the substance ceases to be waste prior to its use as fuel in the power plant.

A power plant which is not connected to the gasifier thermally treating waste but incinerating the products of the gasifier must be regarded as a co-incineration plant if the gasifier thermally treats waste for the purpose of disposal. In such a case, waste does not cease to be waste, and hence, the power plant uses waste as fuel. Therefore, it is a co- incineration plant. An unconnected power plant using the products of a gasifier performing a recovery operation may not be regarded as a co-incineration plant if the waste has ceased to be waste prior to the co-incineration in the power plant.

Where the gasifier and the power plant are connected, three scenarios are possible. Firstly, if the gasifier thermally treats the waste for the purpose of disposal and the substances resulting from the gasification are co-incinerated in the connected power plant, the whole plant must be regarded as a co-incineration plant. Secondly, if the gasifier thermally treats the waste for the purpose of recovery and the resulting substances have lost their waste status prior to their co-incineration as fuel in the power plant, thus the substances co-incinerated are not waste at the moment of co-incineration, the whole plant, the gasifier and the power plant, falls outside the definition of co-incineration plant, and thus outside the scope of the WID. Finally, if the recovery of the waste by the gasifier is incomplete, and hence, the substance is still waste at the moment of co-incineration in the power plant, the whole plant, thus the gasifier and the power plant, must be regarded as a co-incineration plant.

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[290] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 69. Emphasis added.
[291] See also chapter 6.

Chapter 5 Technical Considerations on the Wood Gasification Process

5.1 Introduction

The restriction of CO_2 emissions is one of the prime objectives in environmental policy, due to the increasing concern for global warming and the resulting climate change caused by CO_2 emissions from fossil fuel consumption.
The renewable and CO_2-neutral nature of biomass is a major motivation to use biomass materials for energy generation (e.g. green electricity and heat), thereby reducing the consumption of fossil fuels. In the policy agreement of the Dutch government and the Dutch energy sector, it is stated that by 2008-2012 the coal-fired power stations in the Netherlands need to have reduced their fossil CO_2 emission with 5.8 Mton/a. Half of this reduction, equivalent to approximately 13% coal replacement, should be accomplished by co-incineration of biomass.[292]

The co-incineration (e.g. the simultaneous combustion of a supplementary fuel with a base fuel) of solid biomass fuels is generally referred to as either co-combustion or co-firing, and different distinctions are drawn between these terms. In co-combustion solid biomass fuel is mixed together with the coal before or during the combustion process. Whereas the term co-firing refers to the co-incineration of a biomass fuel which underwent a thermal process prior to the combustion in which the biomass is converted into another phase (e.g. gasification). Due to the existence of the power cycle in the coal fired power plant, the overall costs for the co-firing of biomass is relatively low. In addition, co-firing has several advantages over co-combustion.

5.1.1 Formulation of the Problem

In the late nineties, Essent decided to install a gasifier next to its coal fired power plant Amercentrale unit 9 (hereafter AC-9) in Geertruidenberg. The purpose was to replace approximately 5% of the coal with waste and demolition wood, thus, reducing their net CO_2 emission.

In figure 5.1 a schematic depicture of the situation at the AC-9 plant is given. Demolition wood, a waste product on the yellow list (section 2.3), is fed to the gasifier. After gasification and a subsequent cleaning operation, the producer gas is fed to the AC-9 where it is co-fired.

[292] Convenant Kolencentrales en CO_2 reductie, april 24^{th} 2002.

The AC-9 is primarily run on coal but a small part of the fuel consists of clean biomass that is co-combusted with the coal.

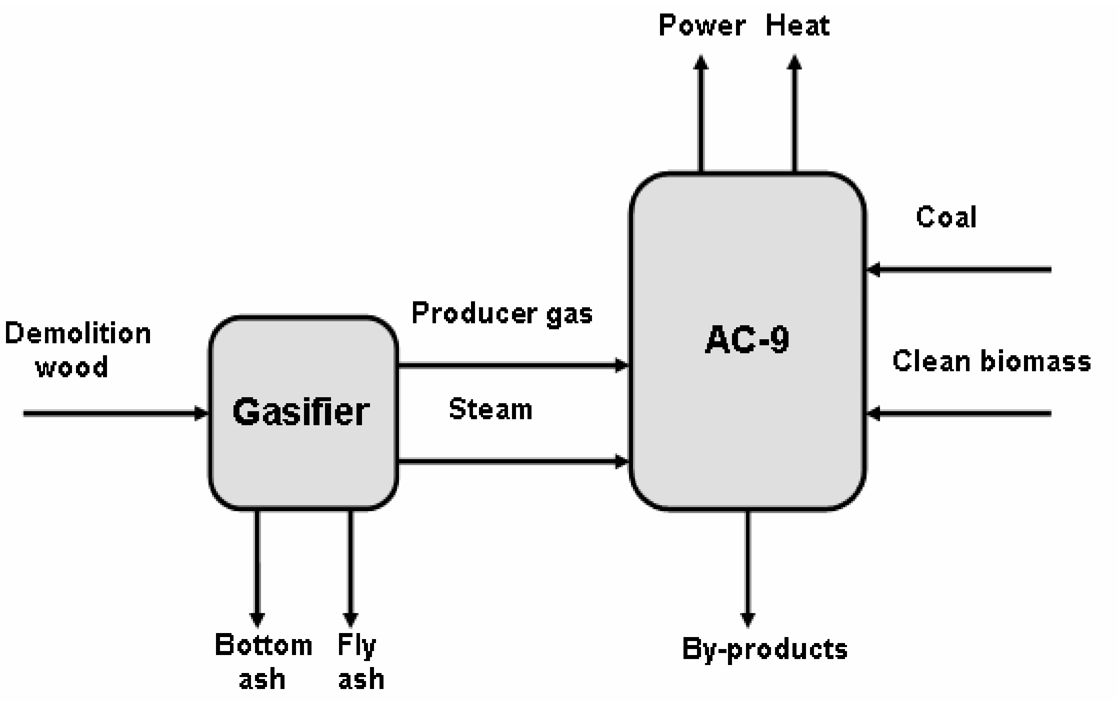

Figure 5.1 Schematic depicture of the considered process

The process at AC-9 is subject to a difference of opinion about the relevant environmental legislation. According to Essent, the gasification of demolition wood is subject to the BVA, whereas the power plant itself is subject to the BEES as the purified producer gas is not waste but a secondary fuel. However, according to the BVA, the entire plant (the gasifier and the power plant), is considered as a co-incineration plant due to the connection between the two units, and thus subjected to the stricter requirements of the BVA. The consequences of the interpretation of the entire plant as a co-incineration plant are far-reaching, so Essent decided to shut down the gasifier.

This section presents a technical evaluation on the question whether the process should be interpreted as co-incineration of waste, which is regulated by the BVA, or as co-firing of clean biomass, which is subject to the BEES.

5.1.2 Method

In order to find an answer to the question stated above, a comparison was made between the fully coal operated AC-9 on the one hand, and the AC-9 which operates on coal and producer gas on the other hand. It was investigated how the co-firing of producer gas affects the emissions of the AC-9. Furthermore, the properties of the purified producer gas from the gasifier were examined and compared with the properties of clean biomass. Secondly, a comparison was made between the emissions that arise from the combustion of either producer gas or clean biomass, thus answering the question whether the purified producer gas from the gasifier can be characterized as a ‘clean’ secondary fuel on which the BEES should be applicable.

5.2 Emission Requirements

5.2.1 BEES

BEES is the Dutch measure implementing the LCPD. BEES A and BEES B are applicable on combustion plants (boilers, gas turbines and gas engines). BEES A is applicable on Large Combustion Plants (LCP) with a total thermal capacity of 50 MW or more, as the AC-9. Only the emission of SO_2, NO_x and dust are subject to the emission requirements given in BEES (see table 5.1).[293] In appendix 5, some background information is given about the nature and origin of these substances.

Table 5.1 *BEES-A emission demands for solid fuels (daily average values, in mg/m$_0^3$, at 6% O_2)*

Component	Units in mg/m$_0^3$
SO_2	200
NO_x	200
dust	20

Source: Infomil SenterNovem, 2006.

5.2.2 BVA

On the 29th of December 2000, the WID entered into force. The main purpose of this directive is to reduce the impact of waste incineration on the environment caused by emissions to air, soil and water. Therefore, the WID introduces stringent emission limits and operating conditions for plants incinerating or co-incinerating waste.

The BVA is the Dutch implementing measure that transposes the WID into national legislation. It imposes requirements on the incineration and co-incineration of dangerous and non-dangerous wastes. Requirements for co-incineration are applicable at waste thermal energy values from 5 up to 40 %. BVA emission requirements to AC-9 are listed in table 5.2. The actual requirement is to be calculated on the actual mixture of primary and secondary fuels (on flue gas volume basis).

[293] A. van der Drift, C.M. van der Meijden, *Houtgas meestoken in de Amer-9, enkele beschouwingen*, ECN Biomass, Coal & Environmental Research, ECN BK&M 8.20358-06/GR 1, 2006.

These requirements have severe consequences for the LCPs that co-incinerate waste to generate energy in that once it is established that they incinerate or co-incinerate waste, they fall outside the ambit of BEES and become subject to the BVA with the consequence that they have to comply with much stricter emission limits and operating conditions. If the BVA is applicable to AC-9, the emission requirements given in table 5.1 will be extended with requirements on the emission of halogens and heavy metals, table 5.2. The emissions requirements are applicable if 5 % of the coal is replaced by a secondary fuel.

Table 5.2 *BVA requirements (daily average values, in mg/Nm^3, at 6% O_2)*

Element	**Units**	**C prim. fuel**	**C sec. fuel**
SO_2	mg/Nm^3	200	50
NO_x	mg/Nm^3	200	200
dust	mg/Nm^3	20	5
HCl	mg/Nm^3	30	10
HF	mg/Nm^3	10	1
Hg$^{(a)}$	mg/kg	0.3	
Cd + TI	mg/Nm^3	0.015	
Heavy metals$^{(b)}$	mg/Nm^3	0.15	

(a) Hg is input criterion to wood
(b) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni
Source: Infomil SenterNovem, 2006.

5.2.3 White/Yellow List Biomass

The incineration or co-incineration of biomass is subject to either the BEES or the BVA, according to the probability of contamination of the biomass, resulting in emissions at the incinerator. For this distinction, the Dutch government has redacted the so-called “white and yellow” lists. The white list includes biomass materials and wastes which are regarded as clean, whereas the yellow list includes biomass wastes which are regarded as contaminated. Biomass materials that satisfy the definition of biomass as given in the LCPD (appendix 1) are placed on the “white” list. The white list contains wastes as well as non-wastes. A combustion plant co-incinerating only white list substances is subject to BEES A and not the BVA (figure 5.2). Starting point of the white list is whether the biomass satisfies the definition of biomass given in the LCP Directive, rather than a kind of chemical analysis of the biomass. However, the fact that a biomass waste is enlisted in the white list does not change its status of being waste.

The biomass wastes included in the yellow list fall within the ambit of the WID. Mixtures of white and yellow list biomass streams are considered to be a yellow list stream.[294] Thus, combustion plants co-incinerating yellow list biomass waste are regarded as co-incineration plants within the meaning of the WID.

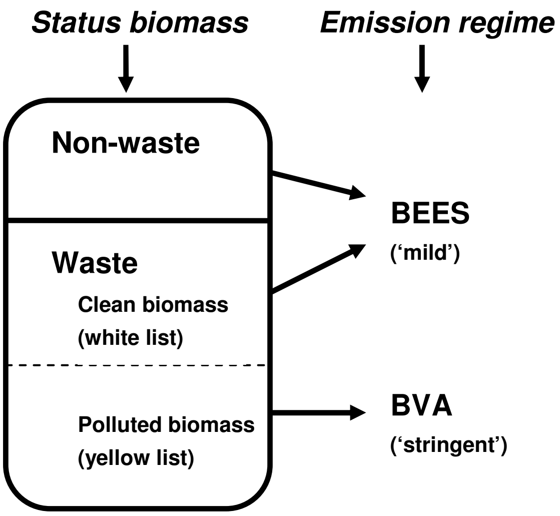

Figure 5.2 The distinction between the terms non-waste and waste and between the terms clean biomass and polluted biomass.
According to their category, a different emission regime is applicable.

5.2.4 Options for Waste Wood Managing and Resulting Greenhouse Gas Emissions

Demolition wood can be considered as a waste which could roughly be managed in three different ways:

1. Landfill;
2. Incineration in waste incineration plants;
3. Co-incineration in LCPs.

After demolition wood is land filled, the natural putrefaction transforms the wood into water, carbon dioxide (CO_2) and methane (CH_4). CO_2 and CH_4 are well known greenhouse gases (appendix 5). One molecule of CH_4 is equivalent to 23 molecules of CO_2 regarding its Greenhouse Warming Potential (GWP). Fugitive CH_4 emissions from landfill cannot be measured and can therefore only be determined by calculation. The considerable contribution of CH_4 to Greenhouse Warming determines landfill of demolition wood as an unattractive option.

The second option is the incineration of the demolition wood in a waste incineration plant. The main objective of incineration is to treat the demolition wood to reduce its volume and

[294] *Ibid.*

hazard, whilst capturing (and thus concentrating) or destroying potentially harmful substances that are, or may be, released during incineration. In addition, some of the energy that results from incineration may be recovered. In fully oxidative incineration, the main constituents of the flue-gas are: water vapour, nitrogen oxides (NO_x), CO_2 and oxygen (O_2). The energy recovery in combination with the avoided emission of CH_4 that occurs during landfill, leads to a considerable reduction of the overall greenhouse gas emission.

Finally, besides combustion in specially designed and operated waste incineration plants, the demolition wood may be co-combusted in regular LCPs such as power plants. In this way, part of the fossil fuel can be replaced and the net fossil CO_2 emission is reduced. Due to the overall higher energy efficiency of LCPs compared to waste incinerators, the net reduction of CO_2 emission increases further. This is schematically depictured in figure 5.3.

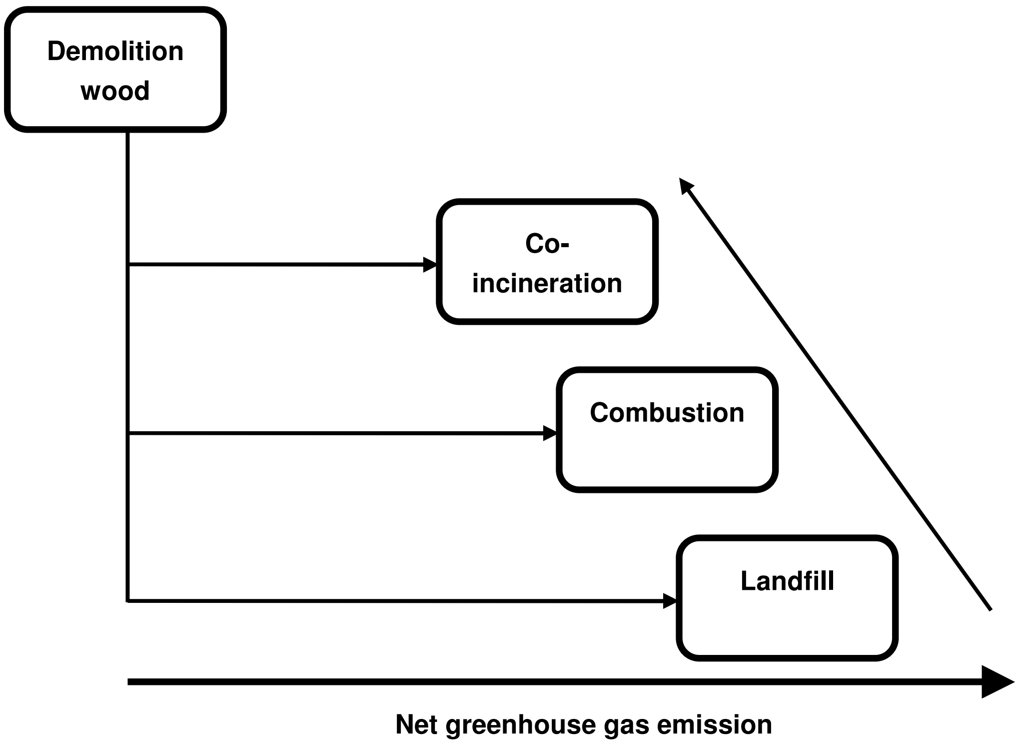

Figure 5.3 Net greenhouse gas emission for different demolition wood managing options

The co-incineration of renewable wastes (biomass) in LCPs is an attractive option for reducing the Greenhouse Warming emissions.

5.3 Fuel Composition

5.3.1 Introduction

The emissions of LCPs are determined by the composition of the fuels, the combustion process and the flue gas treatment. Therefore, the composition of the primary and secondary fuels that are used in the AC-9 will be discussed in this section.

5.3.2 Composition of Primary Fuel

The composition and the quality of the coal that is incinerated in AC-9 may vary due to different origins. Table 5.3 presents the composition and heating value of the coal that is being used in expected average values and worst case values.

Table 5.3 *Expected average and worst case composition of coal as received*

Element	**Units**	**Coal Expected average**	**Coal Worst case**
Heating value	MJ/kg	23.0	20.0
H_2O	g/MJ	5.22	8.0
inert	g/MJ	5.74	10.0
C	g/MJ	26.1	26.0
H (ex. H_2O)	g/MJ	1.4	1.5
O (ex. H_2O)	g/MJ	4.0	3.0
N	g/MJ	0.52	1.0
S	g/MJ	0.3	0.75
Cl	mg/MJ	87.0	150
F	mg/MJ	6.5	25
Hg	mg/MJ	0.013	0.015
Cd + Tl	mg/MJ	0.0038	0.25
Heavy metals[(a)]	mg/MJ	4.52	22.5

(a) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni

Source: Voets, H.A.M, 2001.

Developments in the international fossil fuel market and the resulting change in the purchase policy of coal will eventually cause changes in the average composition and quality of the coal. Although it is expected that on the long term the ash, sulphur and fluoride concentration will increase and the heating value will decrease, for the time being the coal quality is expected to be continuous.

5.3.3 Composition of Secondary Fuel

Secondary wood fuel such as waste wood, demolition wood (with and without wood preservatives) and pressboard residues has many different origins. Therefore, the impurities and contamination levels may vary widely. However, a reliable range of concentrations of the minor elements in secondary wood fuels can be found in the extensive database of Phyllis.

This database is available since 1998 and contains the composition of almost 2600 individual biomass fuels.[295]

Table 5.4 presents the range in the composition of demolition wood (e.g. the elements that are subject to the BVA) according to Phyllis and the average composition of the demolition wood used in the AC-9 between 2001 and 2005. The range of the average values to the average values plus two times the standard deviation is given in the table.

Table 5.4 *Demolition wood compositions (Units, mg/MJ)*

Element	Demolition wood (Phyllis) (mg/MJ)		Demolition wood AC-9 (mg/MJ)
Cl	80 – 320	n 30	63
F	2.9 – 11	n 13	1.8
Hg	0.007 – 0.02	n 9	0.019
Cd	0.1 – 0.27	n 16	0.10(a)
Heavy metals[(b)]	40 – 120	n 18[(c)]	38

(a) Including TI
(b) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni
(c) n is the number of analyses on which the average and the deviation are based.
Source: Drift en van der Meijden, ECN BK&M 8.20358-06/GR 1, 2006.

From table 5.4 it can be concluded that the composition of the demolition wood used in the AC-9 is well within the range of the average composition of demolition wood according to the Phyllis database regarding the concentration of the elements mentioned in the BVA. The concentrations of most elements, except Hg, are even lower.

5.4 Producer Gas and Clean Biomass Compared

5.4.1 Introduction

The demolition wood that is used in AC-9 contains impurities in such quantities (table 5.4) that it is considered to be a polluted biomass (yellow list) stream, and therefore the BVA should be applicable. However, before the demolition wood is actually co-fired in the boiler, it undergoes gasification and subsequent purification in a hot gas cyclone. As a result of this pre-treatment of the polluted demolition wood, the properties and chemical composition of the product (e.g. producer gas) differ from the original polluted demolition wood. The question is whether gasification can convert polluted biomass waste in such a way that the product, e.g. producer gas can be considered as a clean fuel on which the BEES should be applicable

In this section, it is investigated whether the gasification process applied by Essent results in a producer gas that is comparable with clean biomass. First, the composition of the produced

[295] Biomass and waste composition database: www.phyllis.nl, ECN, 2005.

product gas is compared to the composition of clean biomass. Secondly, a comparison is made between the emissions that arise from the co-firing of producer gas and the co-combustion of clean biomass. Third, the separation efficiency of the hot gas cyclone, which determines to a large extend the composition of the producer gas, is compared with the efficiency of a well tested pilot scale cyclone.

5.4.2 Composition of Producer Gas and Clean Biomass

In table 5.5 a comparison is made between the composition of clean biomass on one side and the composition of the producer gas that is co-fired in AC-9 on the other side. The range given for the clean biomass composition is determined using the compositions of wood, palm seed flakes, cocoa shells, empty soy bunches and citrus pulp. The values in the table are given per MJ for a better comparison, because there is a large difference in heating values.

Table 5.5 *Compositions of clean biomass and producer gas*

Element	Units	Clean biomass	Producer gas
Heating value	J/kg	14.1 – 18.5	6.5
Cl	mg/MJ	1.40 – 104	28.5
F	mg/MJ	0.26 – 5.44	0.24
Hg	mg/MJ	0.000 – 0.007	0.015(a)
Cd + TI	mg/MJ	0.007 – 0.38	0.072
Heavy metals[(b)]	mg/MJ	2.95 – 22.9	15.9

(a) Hg is input criterion to wood, BVA
(b) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni
Source: Willeboer en Spanjers, Essent Energie Productie B.V., 2006.

It can be seen from table 5.5, that on the whole, the composition of the producer gas lies within the composition range for clean biomass. In other words, the producer gas fed to the AC-9 is comparable with clean biomass.

In the table it can be seen that the input criterion for Hg that is given for the producer gas lies a factor two above the Hg concentration of clean biomass. Therefore it may be possible that the actual Hg concentration in the producer gas is somewhat higher than the values found in clean biomass. This element is known as a long-range transboundary pollutant which can create pollution problems in far distant areas from the emission source due to its volatile character. Therefore, an input criterion, that depends on the amount of co-fired producer gas, is given for this element. As mentioned before, the composition of the clean biomass is determined from wood, palm seed flakes, cocoa shells, empty soy bunches and citrus pulp. However some white list biomass materials which are not included in the selection of the range in table 5.5, may contain even higher concentrations of Hg (table 5.6).

Table 5.6 *Compositions of some selected white list biomasses and producer gas (mg/MJ)*

Element	Straw and grass		Nutshells		Producer gas
Cl	300 – 910	n 244	56 – 190	n 52	28.5
F	2.6 – 7.2	n 10	0.4 – 1.3	n 2	0.24
Hg	0.003 – 0.03	n 111	0.02	n 1	0.015(a)
Cd	0.02 – 0.09	n 186	0.1	n 1	0.072(d)
Heavy metals(b)	20 – 69	n 79	70	n 1(c)	15.9

(a) Hg is input criterion to wood
(b) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni
(c) n is the number of analyses on which the average and the deviation are based
(d) including TI
Source: Willeboer en Spanjers, Essent Energie Productie B.V., 2006.

For Hg the same input criterion as for the co-combustion of secondary fuels from the white list applies. Up to 14 weight % of the applied secondary fuel with respect to the total input of solid fuel, a maximum Hg concentration of 0.3 mg/kg is allowed. It can be concluded from table 5.6 that the concentrations of impurities in the producer gas are within the range of impurities found in biomass materials from the white list, or even lower.

5.4.3 Separation Efficiency of the Hot Gas Cyclone

The producer gas that leaves the gasifier is subsequently led through a hot gas cyclone that separates the fly ashes from the producer gas (appendix 4). Furthermore, with the fly ashes, a considerable amount of the harmful elements, that condensate onto the fly ash particles, are also removed from the producer gas. Therefore, the calculated composition of the producer gas (as presented in table 5.5) is highly dependent on the separation efficiency of the cyclone.

The Energy research Centre of the Netherlands (ECN) has done several tests on a pilot scale 0.5 MW_{th} CFB-gasifier, which uses the same technology as the gasifier from the AC-9. Furthermore, this gasifier is able to gasify fuels with the same dimensions (several centimetres) as the AC-9 gasifier. Table 5.7 presents the average separation efficiency of the cyclone for several elements in the raw producer gas, as compared to the used efficiency of the AC-9 cyclone. The data from ECN are based on the pilot scale CFB-gasifier operated at 800 ^{o}C.

Table 5.7 *Separation efficiency of several elements from raw producer gas in ECN and Essent cyclones*

Element	**ECN data 0.5 MW_{th} CFB gasifier**			**Essent data**
	Average separation into the ash from cyclone *(%)*	Standard deviation/average *(%)*	Number of tests	Separation into the ash from cyclone *(%)*
Cl	48	117	9	48
F	n.a.*			85
Hg	n.a.			11
Cd	11	104	12	8
Ti	n.a.			80
As	62	34	9	44
Co	54	47	13	75
Cr	71	75	13	62
Cu	67	55	13	87
Mn	70	29	13	74
Ni	87	81	13	90
Pb	29	160	10	40
Sb	97	113	13	22
V	70	26	13	78

** n.a.: not available*

Source: Drift en van der Meijden, ECN BK&M 8.20358-06/GR 1, 2006.

From the data presented in table 5.7, the composition of the producer gas that leaves the AC-9 gasifier is calculated (as presented in table 5.5). It has to be mentioned that this is an overestimation of the concentrations, because a fraction of the metals is removed from the system with the bottom ash from the gasifier. Furthermore, the calculation method applied considers an entire mass balance, in which the total mass of an element that enters the system with the fuel is the same as the sum of the three flows that leave the gasification process. However, in practice deviations occur due to flaws in the measurements for the concentrations, the flow rates and problems that occur during the sampling from inhomogeneous samples.[296]

It can be seen from the values presented in table 5.7, that a considerable fraction of all elements regulated in the BVA is separated from the producer gas by the hot gas cyclone. Based on the data from the ECN pilot gasifier, it can be concluded that the Essent data on the separation efficiency of the AC-9 gasifier are realistic. Therefore, the calculated composition of the producer gas presented in table 5.2 can be considered as realistic. However, it has to be mentioned that the separation efficiency of the hot gas cyclone regarding to Hg is poor. The volatile character of Hg makes it difficult to remove this element with the fly ash. The

[296] *Ibid.*

element Cd is also separated poorly from the producer gas. However, the separation efficiency is sufficient to bring the Cd concentration down to levels found in clean biomass (table 5.5).

5.4.4 Quality Monitoring

The composition of the obtained producer gas at AC-9 varies with the composition of the biomass that is fed to the gasifier and the separation efficiency of the hot gas cyclone. Therefore, in order to ensure the quality of the producer gas, monitoring of the feedstock is necessary. On a regular basis, samples are taken from the feedstock and are analysed.

For the clean biomass stream the random sampling frequency is once every ten cargo-boats (lighters). For the demolition wood that is transported by truck, the random sampling frequency is once a week, and therefore the sampling frequency is two to four times higher than for the clean biomass sampling. The analyses that are carried out for both types of fuel are exactly the same. However, there may be large differences between different shipments meaning that this could affect the composition of the derived producer gas in such a way that it may not always be comparable to clean biomass. Therefore, it is necessary to increase the sampling frequency of the delivered demolition wood in order to guarantee the comparability of the gas prior to its co-incineration in the power plant.

The process conditions for the gasification are fixed, except for the separation efficiency of the hot gas cyclone which is susceptible for wear. Therefore, the cyclone is continuously monitored during operation. If the dust concentration exceeds the limit of 18 g/m_0^3 for more than 24 hours, the installation will be shut down.[297]

5.4.5 Composition Comparison between Coal, Demolition Wood, Producer Gas and Clean Wood

Table 5.8 summarizes the data on the composition of coal (expected average), demolition wood at AC-9 and producer gas at AC-9, for the elements regulated in the BVA.

Furthermore, in the table, the producer gas composition is compared with the composition of clean (untreated) wood.[298]

[297] W. Willeboer, M.A.J.C.M. Spanjers, *Notitie Vergassingsinstallatie Amercentrale*, Essent Energie Productie B.V., 2006.

[298] Biomass and waste composition database: *www.phyllis.nl*, ECN, 2005.

Table 5.8 *Composition comparison between coal, demolition wood, producer gas and clean wood*

Element	Units	Coal Expected average	Demolition wood	Producer gas	Clean wood (Phyllis)	
Heating value	MJ/kg	23	16.3	6.5	15 - 19	
Cl	mg/MJ	87.0	63.0	28.5	25 – 160	n 147
F	mg/MJ	6.5	1.8	0.24	1.1 – 2.8	n 5
Hg	mg/MJ	0.013	0.019	0.015(d)	0.002 -0.008	n 5
Cd + TI	mg/MJ	0.0038	0.10	0.072	0.03 – 0.1[(c)]	n 9
Heavy metals[(a)]	mg/MJ	4.52	38	15.9	5.3 – 23	n 5[(b)]

(a) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni
(b) n is the number of analyses on which the average and the deviation are based
(c) without TI
(d) Hg is input criterion for wood
Source: based on tables 5.3, 5.4 and 5.5.

Table 5.8 shows that the gasification of the demolition wood is an efficient purification technique. The concentrations of all harmful components are lower in the producer gas than in the demolition wood. Compared to coal, the producer gas contains less Cl and F. The concentration of Hg in the producer gas is comparable with that of coal. The maximum concentration of Hg, based on the input criterion for Hg in the producer gas, is higher than the Hg concentration of clean wood. However, this value is within the range of the concentration in clean biomass materials as was concluded in section 5.4.2. The concentration of heavy metals in the producer gas is higher than for coal. However, this will not cause much problems in the final emission values, because most of the less volatile heavy metals will end up in the bottom and fly ashes as they condensate onto the surface of ash particles in the flue-gas stream. Furthermore, the amount of co-fired producer gas is too low to give any increase in the emission of heavy metals.

5.5 Emissions Compared

5.5.1 Introduction

For a conclusive consideration whether the polluted stream of biomass that enters the gasifier of the AC-9 is being converted in such a way that the stream can be considered as a clean stream, a closer look to the expected emissions of the AC-9 is necessary. Therefore, in this section a comparison is made between the emissions that arise from co-fired producer gas and co-combusted clean biomass respectively. Finally, in section 5.5.3 the emissions (per MJ) that occur when the AC-9 is fully operated on coal and when producer gas is co-fired are compared.

5.5.2 Emissions from the Combustion of Producer Gas and Clean Biomass

In table 5.9 a comparison is made between the emissions of AC-9 that arise from the co-firing of the producer gas on one side and the emissions that arise from the co-combustion of clean biomass (white list) in the AC-9 on the other side.

Table 5.9 *Emissions that arise from co-fired producer gas and co-combusted clean biomass*

Element	Units	Producer gas		Clean biomass	
		Average	*Worst-cas*	*Range*	*Worst case*
Cl	mg/Nm^3	0.799	1.775	0.599 – 1.401	1.648
F	mg/Nm^3	0.133	0.060	0.060 – 1.886	14.74
Hg$^{(a)}$	mg/Nm^3	0.021	0.023	0.000 – 0.010	0.025
Cd + TI	mg/Nm^3	0.000	0.000	0.000 – 0.000	0.000
Heavy metals$^{(b)}$	mg/Nm^3	0.003	0.009	0.001 – 0.004	0.026

(a) Hg is input criterion of wood and depends on the amount of co-firing and co-combustion
(b) sum heavy metals: Sb + Pb + Cr + Cu + Mn + V + As + Co + Ni
Source: Willeboer en Spanjers, Essent Energie Productie B.V., 2006.

From table 5.9 it can be concluded that the average emissions that are assigned to the co-fired producer gas are well within the range of the emissions from clean biomass that is co-combusted in the AC-9. One exception has to be made for Hg. The average Hg concentration in the flue-gas, as calculated by the input criterion, is twice as large as the Hg concentration range given for clean biomass. The emissions are also far below the maximum emission requirements given in the BVA (table 5.2). Together with the conclusions drawn from the composition comparison between the producer gas and clean biomasses (section 5.4.2), it can be concluded that the producer gas is comparable with clean biomass.

5.5.3 Emissions AC-9 Compared

In this section the emissions that occur per generated MJ, when the AC-9 is fully operated on coal and when producer gas is co-fired, are being described.

If the AC-9 is fully operated on coal, the energy balance can be depictured as in figure 5.4.

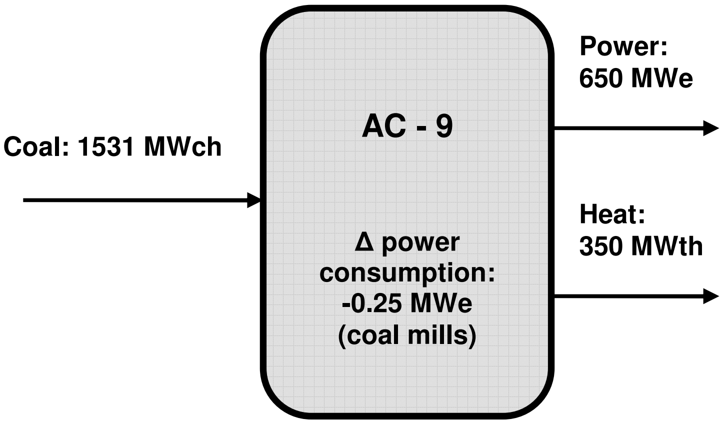

Figure 5.4 Energy balance over the AC-9 when operating on coal

When producer gas is co-fired, the energy balance is as represented as in figure 5.5.

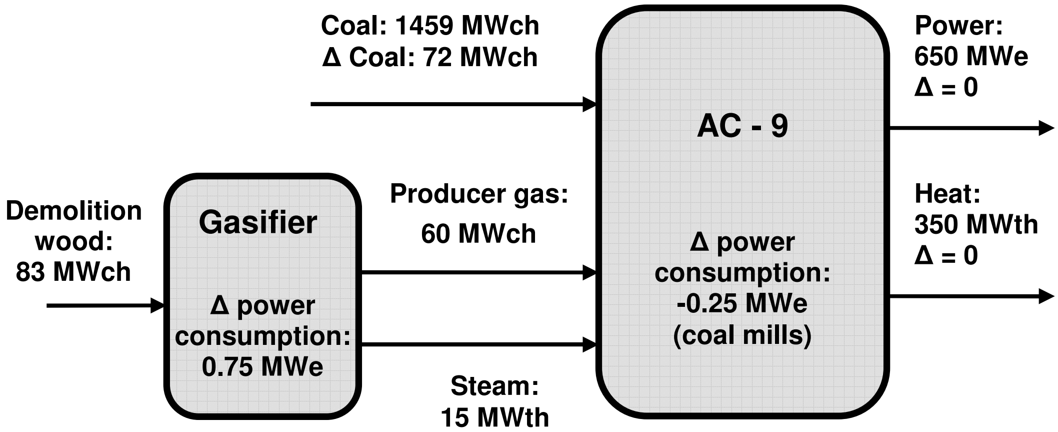

Figure 5.5 Energy balance over the AC-9 when co-firing of producer gas

In this figure, it can be seen that the co-firing of the producer gas replaces approximately 5 % of the energy value of the coal (72 MW_{ch}). The power and heat output of the AC-9 does not change.

Table 5.10 presents the emissions of AC-9 when coal is fired as a single fuel and when 150 kilotons of demolition wood are co-fired through gasification. The emissions in the table are calculated from data given in the MER report.[299] In addition to the emission of Cl, F and Hg, the emissions that are mentioned in BEES (e.g. NO_x, SO_2 and dust) are also mentioned. In the table, the emissions are given in mass per MJ units. For this, the heat and power output

[299] R. Boudewijn, W. F. Koopmans, *Milieu-effectrapport: Mee- en/of bijstoken van secundaire brandstoffen op het Amercentralecomplex te Geertruidenberg*, Essent Energie Productie B.V., 2001

presented in the energy balances (figures 5.4 and 5.5) are combined using the net electrical efficiency of the AC-9 (appendix 4). It follows that the total energy output equals 800 MW_e.

Table 5.10 *Emissions of AC-9 with and without co-firing of producer gas*

Component	Units	Emissions of fully coal fired AC-9	Emissions AC-9 with co-firing of producer gas
CO_2	g/MJ	175.1	177.3
avoided CO_2	g/MJ	0	7.335
NO_x	g/MJ	0.220	0 211
SO_2	g/MJ	0.179	0.171
Dust	mg/MJ	0.486	0.464
Cl	mg/MJ	0.447	0.408
F	mg/MJ	1.194	1.141
Hg	mg/MJ	0.0048	0.0039

Source: Own calculations based on Boudewijn and. Koopmans, Essent Energie Productie B.V., 2001.

Table 5.10 shows that in addition to the reduced net CO_2 emission, the co-firing of the producer gas enables the coal-fired AC-9 to reduce the SO_2 and NO_x emissions. This could be expected because biofuels generally contain less sulphur and nitrogen than coal (appendix 5). It can be concluded that the co-firing of the producer gas improves the emissions that are mentioned in BEES. As expected, the emissions of Cl and F are also a little lower because the concentration of these elements in the producer gas is also lower as compared to coal. However, it can be concluded that the co-firing of producer gas has a minor positive influence on the expected emission levels because the producer gas only replaces 5 % of the energy value of the coal.

5.6 Conclusions

The process applied by Essent in the gasification of demolition wood at AC-9 can be considered as an adequate purification step. The concentrations of all the harmful components in the producer gas are lower as compared to the demolition wood. Furthermore, the obtained producer gas, which is subsequently co-fired in the AC-9, has an average composition that lies within the composition range for clean biomass.

The composition of the producer gas largely depends on the separation efficiency of the hot gas cyclone. Based on data from an ECN pilot scale gasifier, it can be concluded that the estimated separation efficiency of the hot gas cyclone connected to the AC-9 gasifier is realistic. It can be concluded that the calculated composition of the producer gas can be considered as realistic.

The comparison between the emissions that arise from the combustion of producer gas and clean biomass shows that the average emissions that are assigned to the co-fired producer gas are well within the range of the emissions of clean biomass that is co-combusted in the AC-9. Furthermore, the co-firing of the producer gas in the AC-9 results in an improvement of the emissions that are regulated in BEES.

Finally, it can be concluded that the purified producer gas from the gasifier can be characterized as a ‘clean’ secondary fuel, which is comparable to clean biomass on which the BEES should be applicable.

Chapter 6 The Evaluation of Essent's Plant under the WID

6.1 Introduction

Today's modern world is highly dependent on energy. Entire industries need continuous supply of energy to be able to function properly. Almost every household possesses more than one electronic apparatus that works with electricity. The high demand for energy determines its supply, and hence its production. However, the production of energy entails high costs in terms of environmental harm, which justifies the environmental regulation of energy production to find a balance between these costs and the benefits that accrue from its production.

The activities of large combustion plants that are involved in the production of energy are regulated by the Large Combustion Plants Directive[300] (hereafter the LCPD) at the European level.[301] The LCPD covers combustion plants that have a rated thermal input of 50 MW or higher irrespective of the fuel type used (solid, liquid, and gaseous) including clean biomass.[302] The biomass list provided in the LCPD corresponds to the list of biomass wastes that are excluded from the scope of the WID, meaning that combustion plants co-incinerating only these biomass wastes are subject to the LCPD and not the WID. The LCPD imposes emission limit values (ELVs) for SO_2, NOx, and dust upon combustion plants depending on the type of fuel used.[303] It also prescribes the measurement requirements that must be observed.[304] The national measure transposing the LCPD into national law in the Netherlands is the decree BEES A.[305]

As long as the power plant co-incinerates fuels, and the biomass wastes exempted from the WID, it is subject to the rules imposed by the LCPD. However, co-incineration of waste is sometimes an attractive alternative to primary fuels used for the generation of energy, not only due the lower price of waste but also its high calorific value. If a power plant co-incinerates waste as fuel, it becomes subject to the WID. The ELVs imposed by the WID are wider in scope than the ELVs imposed by the LCPD. Furthermore, a power plant co-

300 Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants [2001] OJ L309/1.

301 It should be kept in mind that large combustion plants that fall within the ambit of the LCPD must also comply with the IPPC Directive (Directive 96/61/EC, [1996] L257/26).

302 Art 2 (1) and (11) LCPD

303 See Annex I to Annex VII LCPD.

304 See Annex VIII LCPD.

305 Besluit van 23 februari 2005, houdende wijziging van het Besluit emissie-eisen stookinstallaties milieubeheer A, Stb 2005, 114.

incinerating waste may have serious difficulties in complying with the operating conditions stipulated in the WID, particularly with the condition which requires the shut down of the operations as soon as practicable in case of a breakdown.[306] Accordingly, the consequences of co-incinerating waste, and thus, being subject to the WID instead of LCPD may negate the cost advantage of the co-incineration of waste and may turn it into an unfavorable option.

Essent, an energy company, operates a combustion plant (hereafter AC-9) in the Netherlands, in Geertruidenberg, in which it combusts coal and clean biomass to generate energy. Essent built a gasifier next to AC-9 and started gasifying demolition wood. Demolition wood belongs to the so-called “yellow list” of biomass waste, which is not excluded from the scope of the WID.[307] The gasifier is connected to AC-9 and the gas (hereafter producer gas) produced through gasification of the demolition wood is transmitted to AC-9 in which it is co-incinerated with coal and clean biomass to generate energy.

However, after the entry into force of the BVA, Essent had to stop the gasification of Demolition wood and the subsequent co-incineration of the producer gas derived from the gasification in the combustion plant. As it was explained in the previous chapter, according to the BVA, the national measure implementing the WID in the Netherlands, any combustion plant co-incinerating the products of thermal treatment of waste is subject to the BVA.[308] Accordingly, AC-9 is treated as a co-incineration plant irrespective of the quality of the producer gas, and thus, it is subject to the ELVs and operating conditions stipulated in the BVA which are more stringent than the conditions stipulated in BEES A. More specifically, since the gasifier and the combustion plant are connected to each other, the whole plant is regarded as a co-incineration plant regardless of the quality of the producer gas used as fuel.[309] The question is: is the whole plant which is treated as a co-incineration plant by the BVA regarded as a co-incineration plant by the WID as well?

6.2 Brief Description of the Process

Two main processes are involved. First one is the gasification of the demolition wood and the cleaning of the producer gas. The second one is the co-incineration of the producer gas with coal and clean biomass in AC-9 to generate heat used for the purpose of electricity production.

Demolition wood in the form of wood chips is fed into the gasifier. The demolition wood used as feedstock is subject to some quality criteria determined by Essent and the compliance

[306] Article 13 (2) WID.
[307] See chapter 5, section 2.3.
[308] Article 1(1)(b)BVA.
[309] Chapter 12 (1) (2) of the Explanatory Memorandum of the BVA p. 43-44 (Stb. 2004, 97)

with the quality criteria is ensured through weekly sample analysis. Compliance with the quality criteria is important because the quality (composition) of the producer gas largely depends on the quality (composition) of the demolition wood.

Appendix 4 provides an extensive description of the gasification process. Basically, demolition wood is exposed to a temperature between 800- 950 °C depending on the quality of the wood waste. As a result of this exposure to heat, demolition wood turns into producer gas. Even though there are four different processes involved in the transformation of demolition wood into producer gas through thermal treatment, they cannot be distinguished. A gas cooler reduces the temperature of the resulting producer gas to 450 °C. Following the cooling, the producer gas is cleaned by making it pass through a hot gas cyclone. The hot gas cyclone removes the harmful components and impurities together with the fly ashes that are present in the producer gas. The cleaned producer gas is then transmitted to the combustion plant in which it is co-incinerated with coal to generate heat for the purpose of electricity production.

6.3 The Evaluation of the Plant under the WID

It was shown in the previous chapter that the BVA deviated from the WID in two respects: (1) the classification of every combustion plant co-incinerating products of thermal treatment of waste as a co-incineration plant irrespective of the quality of the producer gas and, (2) in the case of a connected waste gasifier and combustion plant, the treatment of the whole plant as a co-incineration plant regardless of the quality of the producer gas co-incinerated in the combustion plant. Since the reasons why these interpretations deviate from the WID are explained in detail in Chapter 4 (see sections 3 and 4), there is no need to repeat them here. Basically, these interpretations are based on the assumption that every gasifier producing gas to be incinerated performs a disposal operation and the gas produced through gasification of waste never loses its waste status. However, these interpretations overlook both the text of the WID and the case law of the ECJ on the question of when waste ceases to be waste.

The plant of Essent cannot be classified as an incineration plant since it is not dedicated to thermal treatment of waste. The main purpose of the plant is to generate energy. Therefore, it must be evaluated whether the plant may be regarded as a co-incineration plant. A plant whose main purpose is the generation of energy is regarded as a co-incineration plant in two situations: (1) if it uses waste as a fuel or, (2) if it thermally treats waste for the purpose of disposal.

Deciding whether the whole plant of Essent must be regarded as co-incineration plant depends on the classification of the gasification process as recovery or disposal. The essential difference between recovery and disposal is that waste that is subject to a recovery operation may cease to be waste but waste going through a disposal operation remains waste.

Three scenarios may be identified. These scenarios were already explained in the previous chapter but they must be repeated due to their importance. Firstly, if the gasifier thermally treats the demolition wood for the purpose of disposal and the producer gas resulting from the gasification is co-incinerated in the connected AC-9, the whole plant must be regarded as a co-incineration plant. Thermal treatment for the purpose of disposal as stated in the second indent of Article 3(5) WID refers to thermal treatment in the broad sense, meaning that it covers gasification of waste and the subsequent incineration of the resulting substances as well. However, as clearly stated in the second indent of article 3(5) WID, such thermal treatment in the broad sense is covered by the definition of co-incineration plant only if the gasification occurs for the purpose of disposal. The underlying reason is that if a gasifier connected to a power plant thermally treats waste for the purpose of disposal, the substances resulting from the gasification never lose their waste status. Accordingly, the connected power plant will be co-incinerating waste. In such a case, the whole plant is carrying out the same process, namely the disposal of waste, even if the heat generated is recovered.

Secondly, if the gasifier thermally treats the demolition wood for the purpose of recovery and the resulting producer gas have lost the waste status prior to being co-incinerated as fuel in AC-9, thus the producer gas co-incinerated is not waste at the moment of co-incineration, the whole plant, the gasifier and AC-9, falls outside the definition of co-incineration plant. Gasification of waste may also take place for the purpose of recovery. A gasifier which is connected to a power plant may be thermally treating the waste in order to create a fuel capable of being used in the power plant. In such a case, the gasification of waste concerns a recovery operation and, depending on the circumstances, the waste may or may not cease to be waste prior to its use in the power plant. Pursuant to the first indent of Article 3(2) WID, it is the use of waste as fuel that determines whether a power plant is a co-incineration plant. Use of waste as fuel refers to incineration in its classic form which is oxidation. Thus, the decisive factor that determines whether AC-9 is a co-incineration plant is the classification of the producer gas as waste or non-waste at the moment of co-incineration in AC-9. If the recovery through gasification is complete and the producer gas is not waste at the moment of co-incineration in AC-9, neither AC-9 nor the gasifier may be regarded as a co-incineration plant. AC-9 may not because it will not be co-incinerating waste. The gasifier may not be regarded as (part of) a co-incineration plant either for two reasons. Firstly, the gasifier thermally treats demolition wood to produce gas but it does not use the demolition wood as fuel. That is, it does not incinerate the demolition wood. Secondly, since no waste incineration takes place in AC-9, the gasifier connected to AC-9 may not be regarded as a waste reception, storage, on site pretreatment facility being part of a co-incineration plant within the meaning of the third paragraph of Article 3(5) WID.

Finally, where recovery of demolition wood through gasification is incomplete, and hence, the producer gas remains waste at the moment of co-incineration in AC-9, the whole plant, thus the gasifier and AC-9, must be treated as a co-incineration plant. AC-9 is regarded as a co-incineration plant because it uses waste as fuel. The gasifier itself does not use the Demolition wood as fuel. Nevertheless, it must be regarded as part of the co-incineration plant within the meaning of the third paragraph of Article 3(5) WID. Since the power plant co-incinerates waste, the gasifier which is connected to the power plant and which supplies the waste to it must be regarded as a waste reception, storage, and on site pretreatment facility and hence, part of the co-incineration plant.

Accordingly, it must first be determined whether the operation performed by the gasifier is recovery or disposal. If it is disposal, the whole plant, AC-9 and the gasifier, must be regarded as a co-incineration plant. If it is recovery, it must further be determined whether the recovery is complete and hence, the producer gas has lost its waste status prior to being co-incinerated in AC-9.

6.3.1 Gasification Process of Essent: Recovery or Disposal?

As already mentioned several times, the test for determining whether an operation is a recovery or disposal operation was provided in *ASA*[310]. According to *ASA,* recovery has the *principal objective* that the waste serves a useful purpose in *replacing other materials* which would have had to be used for that purpose, thereby conserving natural resources. The test was applied by the Court in *Commission v Germany (German Waste)*[311] and *Commission v Luxembourg*[312]. The conditions that must be satisfied for an operation to be able to pass the *ASA* test may be distilled from these cases.

Firstly, the waste must substitute a non-waste material which would have been used if the waste had been absent and this substitution must lead to conservation of natural resources. The replacement does not necessarily need to occur during the recovery operation in question and the moment of actual replacement may lie in the future. Essent uses the waste, demolition wood, to produce producer gas. The producer gas derived from demolition wood replaces coal and clean biomass which are the two fuel types used in AC-9. Thus, the replacement leads to a decrease in coal and clean biomass use. Accordingly, the first condition is satisfied.

[310] C-6/00, *Abfall Service AG (ASA)*, 2002, ECR I-01961, par. 69. Emphasis added.
[311] C-228/00, *Commission v Germany*, 2003, ECR I-01439
[312] C-458/00, *Commission v Luxembourg*, 2003, ECR I-01553

However, it must be stated that the main reason that Essent gasifies only demolition wood, thus contaminated biomass, is to comply with the obligations that it undertook *vis-à-vis* the Dutch Government and other electricity producers operating coal-fired power plants to reduce its CO_2 emissions by 0.931 Mton by the year 2012 through the use of 147,37 Mwe biomass.[313] If demolition wood had not been converted into producer gas and the producer gas had not been used as fuel, clean biomass, not coal, would have had to be used instead because only the use of clean biomass, not coal, would enable Essent to reduce its CO_2 emissions and thereby comply with its obligations. In other words, producer gas replaces clean biomass which in turn replaces coal.

Secondly, replacing other materials, and thereby protecting natural resources must be the principal purpose of the operation in question. That is, production of the producer gas which replaces other materials must be the main purpose of the gasification process. One factor which is regarded as strong evidence by the ECJ is whether the person who processes the waste pays or gets paid. The processor is very likely to pay the holder of the waste in the case of recovery. Essent pays for the demolition wood which is fed into the gasifier wherein it is converted into producer gas. Therefore, the gasification process has the principal purpose of replacing other materials.

Thirdly, the conditions in which the operation takes place must give reason to believe that the operation does indeed what it is claimed to do. This condition requires a case by case analysis depending on the operation in question. In the case of gasification of waste to produce producer gas, several factors may indicate that the gasification of waste result in a substance which replaces other materials. One such indication may be the types of waste gasified. If, for instance, several waste types are gasified without checking whether they may be suitable or not, it may be reason to believe that the operation does not occur with the intention to produce gas but to dispose of waste. Essent uses a single type of waste, namely demolition wood. The waste is subject to quality criteria and Essent monitors the compliance with the quality criteria on a weekly basis. Another indication may be the suitability of the gas for use as fuel. The producer gas of Essent is capable of being used instead of other fuels. Furthermore, if the costs of producing the gas exceed the benefits that may be derived from its use as fuel, it may be an indication that the operation is a disposal operation. Essent pays for the demolition wood that it gasifies to produce producer gas. In such a case, it may be expected that the benefits of using producer gas as fuel exceeds the costs of producing it. Otherwise, Essent would have no incentive to produce producer gas. After all, why would Essent pay for

[313] ME/ESV/02015662, Convenant Kolencentrales en CO_2 Reductie, 28 Maart 2002, p.5. Available at: http://www.ez.nl/content.jsp?objectid=15736 [25.09.2006].

something that it intends to destroy or the costs of which exceed the benefits that may be derived from its use? Therefore, the third condition is satisfied as well.

It may be concluded that the operation performed by Essent, that is, the thermal treatment of demolition wood through gasification with the intention to produce producer gas to be co-incinerated in AC-9, is a recovery operation. Since the thermal treatment through gasification is not a disposal operation, the first scenario explained above does not take place. In other words, the second indent of Article 3(5) WID is not applicable to the thermal treatment of waste performed by Essent. Therefore, it must be investigated which of the other scenarios, second or third, takes place. For that purpose, it must be determined whether the recovery operation performed by Essent through gasification of demolition wood is complete prior to the co-incineration of the producer gas in AC-9. That is, it must be determined whether the producer gas is waste or not.

6.3.2 Producer Gas of Essent: Waste or Not?

One of the essential features which distinguishes recovery from disposal is that waste going through a recovery operation may cease to be waste. Gasification in the form of recovery, as in the case of Essent's gasification process, may be capable of removing the waste status of the waste depending on the circumstances. In other words, demolition wood which is transformed into producer gas may, at some point, cease to be waste.

The test to be applied to ascertain whether a material has ceased to be waste is the "analogous material test" proposed by the ECJ in *ARCO*[314]. According to this test, waste ceases to be waste the moment it is transformed into a material analogous to a raw material with the same characteristics as that raw material and capable of being used in the same environmental conditions unless it is discarded. When determining whether the waste has ceased to be waste, the obtained material must be compared with the raw material that it intends to replace. If the material obtained from waste contains impurities and, therefore, needs further processing before it can be used in the production of a product, the material remains waste at least until the end of such processing (*Mayer Parry*)[315].

The gasification process of Essent is aimed at producing producer gas from demolition wood with the intention to use the producer gas as fuel in AC-9. The producer gas replaces two types of fuels, namely coal and clean biomass. However, as explained above, the reason that Essent gasifies demolition wood is to reduce CO_2 emissions and thereby comply with its

[314] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475.
[315] C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163

obligations *vis-à-vis* the Dutch government and other coal-fired power plant operators.[316] Since the CO_2 emissions can be reduced through the use of biomass, the producer gas derived from demolition wood, thus biomass, replaces clean biomass and not coal. Had there been no producer gas produced from demolition wood, clean biomass would have had to be used to reduce CO_2. Accordingly, producer gas must be compared with clean biomass and not coal.

The moment that demolition wood is transformed into producer gas analogous to clean biomass, with the same characteristics as clean biomass and capable of being used in the same environmental conditions, recovery becomes complete and the producer gas loses its waste status unless it is discarded. The product rules imposed upon clean biomass may be used to determine whether the producer gas has become analogous to clean biomass. Where the producer gas fulfills the conditions stipulated for the fuel it intends to replace, thus, clean biomass, it may cease to be classified as waste. However, where it fails to do so, it must continue to be classified as waste without interruption until fully recovered or disposed of.

The producer gas which has been made analogous to clean biomass so that it can be used as fuel cannot be considered to be discarded because of the mere fact it is made subject to incineration which happens to be one of the explicitly listed recovery operations in Annex IIB WFD. If the producer gas contains impurities and, therefore, needs further processing before it can be used as fuel in AC-9, it remains waste at least until the end of such processing (*Mayer Parry*)[317]. The producer gas may not be regarded as analogous to clean biomass if it contains impurities even when it can be used without there being a need for extra measures to protect the environment.

In accordance with what is said above, it is necessary to compare the producer gas with clean biomass to find out whether the producer gas derived from demolition wood has lost the waste status. Even though both coal and clean biomass are used as fuels in AC-9, producer gas intends to replace clean biomass due to the reasons explained above. A comparison between demolition wood and producer gas is also necessary as it must be demonstrated that the gasification process does not lead to a mere transformation of the waste (demolition wood) into another form.

The compositions of demolition wood, producer gas, and clean biomass must be compared to find out whether producer gas is waste or not. Tables 5.5 en 5.8 show the components present in those materials.

[316] ME/ESV/02015662, Convenant Kolencentrales en CO_2 Reductie, 28 Maart 2002, p.5. Available at: http://www.ez.nl/content.jsp?objectid=15736 [25.09.2006].
[317] C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163.

The comparison between demolition wood and producer gas demonstrates that the gasification of demolition wood as done by Essent does not entail a mere transformation of the form of waste (see table 5.5). It goes further than a mere change of form. As it can be seen from the table above, the harmful elements which are present in demolition wood experience a decrease after being treated through gasification.

Further, it may be concluded that gasification is capable of transforming demolition wood into a substance, producer gas, analogous to clean biomass with the same characteristics as clean biomass and capable of being used under the same environmental conditions (see tables 5.5 and 5.8). One difference between producer gas and clean biomass is the heating values. The heating value of clean biomass is twice as much as producer gas. However, this does not mean that producer gas and clean biomass are not analogous and that they do not have the same characteristics. The criteria of being analogous and having the same characteristics should not be interpreted as such that the substances must be identical. Even though the calorific value of producer gas is lower, it is a suitable substance capable of being used as fuel in a power plant just like clean biomass.

Similarly, a comparison between the compositions of producer gas and clean biomass reveals that except mercury (hereafter Hg), all the other components remain within the range of clean biomass, meaning that producer gas, overall, is analogous to clean biomass (see table 5.8). However, the fact that producer gas contains twice as much as mercury is not a negligible detail. As mentioned above, if a material recovered from waste contains impurities that are not present in the material which it intends to replace, the recovery is incomplete and the material does not cease to be waste even if the material is capable of being used as the non-waste material without there being a need for extra measures to protect the environment. In this case, even though the Hg level present in the producer gas is higher than that of clean biomass, it remains within the limits of the input criterion that applies to clean biomass. According to this criterion, a maximum Hg concentration of 0.3 mg/kg is allowed up to 14 weight % of clean biomass input of the total solid fuel input.[318] Since the Hg level in the producer gas is 0.015 mg/MJ, thus lower than the maximum Hg level prescribed for clean biomass, the producer gas of Essent complies with the product rules applied to clean biomass. In other words, impurities present in the producer gas are not greater than the impurities that clean biomass is entitled to contain. As long as the Hg level of the producer gas remains within the range stipulated for clean biomass, the producer gas may be regarded as analogous to clean biomass.

[318] There is no legislation prescribing input criterion for clean biomass. However, Provincial States in the Netherlands are empowered to stipulate such conditions when they issue permits to industrial plants. In the permit of Essent, the Provincial State of Noord-Brabant stipulates that clean biomass used as fuel for the generation of electricity may not exceed 0.3 mg/kg in the case of 14 weight % of clean biomass input of the total solid fuel input.

In light of the foregoing considerations, it may be concluded that the producer gas of Essent is analogous to clean biomass with the same characteristics and capable of being used under the same environmental conditions. Therefore, unless it is discarded, the producer gas of Essent may not be classified as waste.

For the purpose of determining whether the whole power plant of Essent must be regarded as a co-incineration plant, the moment that the producer gas becomes analogous to clean biomass is decisive. This moment must be prior to co-incineration. If the producer gas contains impurities at the moment of co-incineration, the recovery process has not been completed meaning that it has not become analogous to clean biomass at the moment of its co-incineration in AC-9. In such a case, the producer gas remains waste even if the emissions that result from the co-incineration may be comparable or even lower than co-incineration of biomass. In table 5.9 in the previous chapter, emissions that result from the co-incineration of producer gas and clean biomass are given. The emissions from co-incineration of producer gas and clean biomass are comparable. However, it must be kept in mind that if the producer gas had not been analogous to clean biomass due to some impurities, it would have remained waste despite the fact that the eventual emissions resulting from the co-incineration were comparable.

Table 5.10 which shows the annual emissions from AC-9 when only coal is fired and when producer gas is co-incinerated may make the comparison complete. It is visible that apart from the net reduction in CO_2 emissions, the co-firing of producer gas leads to a decrease in all the other emissions. Nevertheless, it must, once more, be underlined that the fact that the emissions resulting from the co-incineration of producer gas are lower (or equal) than the emissions resulting from the firing of coal or clean biomass is not relevant if the producer gas is not analogous to clean biomass at the moment of co-incineration.

6.3.3 Essent's Plant: Co-incineration Plant or Not?

In light of the of the conclusion drawn above according to which producer gas of Essent is completely recovered and therefore, ceases to be waste prior to its co-incineration in AC-9, the whole plant falls outside the ambit of the WID. The classification of the substance as waste or not at the moment of its co-incineration through oxidation in AC-9 determines whether the whole plant must be regarded as a co-incineration plant. Since the recovery is complete and the producer gas is not waste but a fuel at the moment of its co-incineration, neither AC-9 nor the gasifier may be regarded as a co-incineration plant. AC-9 may not because it will not be co-incinerating waste. The gasifier may not be regarded as (part of) a co-incineration plant either for two reasons. Firstly, the gasifier thermally treats demolition wood to produce gas but it does not use the demolition wood as fuel. That is, it does not co-incinerate the demolition wood. Secondly, since no waste incineration takes place in AC-9, the gasifier connected to AC-9 may not be regarded as a waste reception, storage, on site pretreatment facility being part of a co-incineration plant within the meaning of the third paragraph of Article 3(5) WID. In short, the whole plant of Essent which is regarded as a co-incineration plant by the BVA is not considered to be a co-incineration plant by the WID.

Had there been no connection between the gasifier and AC-9, the conclusion as regards the classification of AC-9 would have remained the same. Since the producer gas of Essent may not be regarded as waste at the moment of its co-incineration, AC-9 does not co-incinerate waste but fuel. Accordingly, it may not be considered to be a co-incineration plant

This means that AC-9 must be subject to BEES A, the decree implementing the LCPD, and to the ELVs and operating conditions stipulated therein. The consequence is that only NOx, $SO_{2,}$ and dust emissions will be subject to ELVs and only those emissions will be monitored as BEES A, unlike the BVA, does not imposes limits upon heavy metals, and dioxins and furans. As long as the input into AC-9, thus producer gas, is analogous to clean biomass, and hence not waste, this is not a problem because the heavy metal and dioxin and furan emissions cannot be higher than such emissions caused by clean biomass. Since the co-incineration of clean biomass is subject to BEES A, co-incineration of producer gas analogous to clean biomass may also be regulated by BEES A.

However, a caveat must be entered here. Unless producer gas is analogous to clean biomass, subjecting producer gas to BEES A instead of the BVA would amount to a circumvention of the heavy metal, and dioxin and furan ELVs. Accordingly, for the BEES to be applicable, and thus the BVA to be inapplicable on the producer gas of Essent, it must be ensured that the producer gas is analogous to clean biomass before its co-incineration in AC-9. Furthermore, it is imperative that the quality of the producer gas which makes it analogous to clean biomass is always maintained. Otherwise, the producer gas will have to be regarded as waste and hence, the whole plant will have to be treated as a co-incineration plant.

Since the quality of the producer gas is largely determined by the input, thus, by the quality of the demolition wood, and the process conditions of gasification are fixed, the quality of the producer gas may be monitored by checking the quality of the demolition wood (chapter 5, section 4.4). However, the quality control of demolition wood by Essent which is done once a week through taking samples from the demolition wood and analyzing those samples is unlikely to ensure that the quality of the producer gas is constantly maintained. There may be large differences between different shipments of demolition wood that occur with an interval of less than a week, which would imply that the quality of producer gas may not be guaranteed all the time.

Essent should find more efficient and convincing ways of ensuring that the quality of its producer gas remains comparable to clean biomass. This may be achieved through increasing the sampling frequency of the delivered demolition wood. Unless this is done, as the ECJ made clear several times,[319] the aim of high level of protection, and the precautionary principle and the principle of preventive action would justify a broad interpretation of the concept of waste, which would require that the producer gas of Essent be regarded as waste. The consequence would be the application of the WID to the whole plant of Essent.

6.4 Conclusion

The WID requires that a whole plant, which includes the power plant and the connected gasifer thermally treating waste, be treated as a co-incineration plant if the gas produced through gasification which is fed into the power plant is waste at the moment that the gas is co-incinerated in the power plant. Whether the gas is waste depends on whether the gasifier is performing a recovery or disposal operation. The gasifier of Essent performs a recovery operation. The producer gas derived from the gasification of demolition wood is analogous to clean biomass and it has the same characteristics with clean biomass and capable of being used under the same environmental conditions. Accordingly, demolition wood ceases to be waste when it is transformed into producer gas which is analogous to clean biomass. Since the producer gas is not classified as waste but fuel at the moment of its co-incineration in AC-9, the whole plant of Essent, thus both the gasifier and AC-9, fall outside the ambit of the WID. Therefore, the plant of Essent may not be regarded as co-incineration plant within the meaning of the WID. The same holds in the absence of a connection between AC-9 and the gasifier meaning that AC-9 may not be regarded as a co-incineration plant. However, this conclusion is only justified if Essent ensures that the quality of the producer gas remains analogous to clean biomass all the time. Otherwise, the producer gas must be regarded as waste with the consequence that the whole plant of Essent will be treated as a co-incineration plant.

[319] See for instance, Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475

Chapter 7 Concluding Remarks

Almost every production and consumption activity generates waste. When something is not wanted by its holder, it poses a genuine risk of environmental harm because the holder who does not want the substance may attempt to get rid of it as cheaply as possible or use it inefficiently. This provides the main justification for waste regulation. However, the determination of when a substance becomes unwanted by its holder, and thus the moment that the substance must become subject to waste laws, has vexed both authorities including courts and persons involved in waste management. Another issue which is as perplexing as when something becomes waste is the issue of when something that is waste ceases to be waste.

The answers to those questions, that is, the definition of waste, is central to the entire waste management systems in Europe and defines the scope of several other directives aimed at waste regulation.[320] The consequences of subjecting industrial activities to waste laws may be significant and it may be a major cost factor for businesses. Thus, having a too broad waste definition may unnecessarily inhibit businesses in their activities. However, if the definition is held narrow, there is a risk that substances and activities posing genuine risks of environmental harm which the waste laws aim to prevent may fall outside the control mechanisms provided in waste laws.

The efforts to find a balance between these two objectives have not always achieved desired results. The definitions provided in the directives are ambiguous and unclear, which make it difficult for businesses to operate and for authorities to apply waste laws properly. The clarification of these ambiguous definitions may be expected to be done by the ECJ. However, the ECJ's rulings on waste have sometimes increased the already existing complexity and added more to the ambiguity of waste laws through judgments which are ambiguous themselves and prone to speculation.

There are two features that are distinctively visible within the area of European waste law. Firstly, the concept of waste is interpreted broadly to achieve the aim of high level of protection on the basis of the precautionary principle and the principle of preventive action.[321] The second one is lack of clarity and legal uncertainty not only within the legislative measures but also in the case law of the ECJ. The two are closely related as the lack of clarity is also partly attributable to the broad definition of waste.

[320]See for instance, Directive 2000/76 of the European Parliament of the Council of 4 December 2000 on the Incineration of Waste [2000] OJ L332/91; Council Directive 94/62 on Packaging and Packaging Waste [1994] OJ L365/10; Directive 91/157 [1991] OJ L/78/38 on Batteries and Accumulators Containing Dangerous Substances.

[321] Joined Cases C-418/97 and C-419/97, *ARCO Chemie*, 2000, ECR I-4475

It is questionable whether the broad interpretation of the concept of waste always serves the aim of high level of protection as worded in Article 174(2) EC. There is a risk that such an interpretation may result in overregulation which may encourage practices that attempt to avoid waste laws. Complying with the obligations imposed by waste laws may be harsh. When the concept is interpreted too broadly, substances that do not actually possess the characteristic of waste may fall within the ambit of waste laws. A possible effect of this may be that instead of complying with waste laws, holders of waste may seek methods such as illegal dumping. Another effect of an expanding concept of waste the boundaries of which is not clear is that businesses may have to comply with waste rules even in cases where there may be no need. The compliance with waste laws may result in an increase in operation costs. Where the substances concerned pose a threat to the environment or human health, the application of waste laws and the resulting cost increase are justified. However, where the risk of environmental harm is not greater than the risk of environmental harm posed by any other substance not treated as waste, the increase in costs that the businesses have to make is not justified and imposes an unnecessary burden.

Lack of clarity and the legal uncertainty surrounding the concept of waste and the related concepts and definitions within the field of waste law are unacceptable. A certain degree of uncertainty and the risks resulting there from belong to any business activity. However, the legal uncertainty that a particular industrial activity may suddenly be regarded as waste processing does not belong to the ordinary risks that businesses have to endure. Charging farmers with the criminal offence of illegal waste dumping because they use the residues of plants as fertilizers, as they have been doing for hundreds of years, is only acceptable if the definition of waste is clear and the farmers can determine that the residues they use as fertilizers are waste.

Any business needs to know the legal boundaries within which it needs to operate. Where these boundaries are extremely vague as in the concept of waste and related definitions, businesses may be unnecessarily inhibited. A high level of legal uncertainty may have a serious deterrent effect on investment in new technologies and hence, chill innovation. Investment in new technologies and innovation only occurs if the investor can recoup its costs and make some returns in the future through exploiting the technology in which he has invested. If the boundaries within which the future technology needs to operate are extremely vague and the investor cannot know with a degree of certainty that he will be able to exploit the technology, the innovative efforts and the fruits that may result from those efforts will be unlikely to be realized. This is exactly what happened in Finland with regard to the waste gasification plant connected to a coal-fired power plant that was intended to be built. The investors refrained from building the plant despite the decision of the Supreme Administrative Court of Finland according to which the power plant was not to be regarded as a co-incineration plant. The legal uncertainty concerning the definition of co-incineration plant and the lengthy judicial proceedings were sufficient ground for the investors to refrain from investing in a technology the future of which was blurred.

Even though it must be accepted that there is an inherent difficulty with the concept of waste as it includes a subjective factor, namely the intention of the holder, legal certainty can certainly be increased. In this respect, the efforts of the Court in *Palin Granit*[322] and *Mayer Parry*[323] and *Niselli*[324] are examples and they are highly welcome judgments. However, they are not sufficient as they also contain uncertain points. The efforts of the Court to enhance the legal certainty and remove the lack of clarity and ambiguity surrounding the definition of waste and the related concepts must also be followed by the legislator. Detailed explanatory memorandums explaining the background and the prospective application of the measure should be published. Where the uncertainty remains, the Commission should issue a guidance explaining the application of the measure.

The consequences of lack of clarity and ambiguous definitions in directives may be severe. When the definitions are unclear and ambiguous, the Member States give their own interpretation to Community concepts that should be uniform throughout the Community. It is not acceptable that the concepts which are central to the application of directives have different meanings and consequences in different Member States. Bringing uniformity and thereby creating a level playing field is one of the purposes of harmonization but unclear and ambiguous definitions undermine the achievement of these objectives. It is visible from the implementation of the WID in some other Member States and the Netherlands that there are differences between the Member States as regards the definition of incineration and co-incineration plants. This provides proof that the definitions of incineration and co-incineration plants laid down in the WID are indeed vague and ambiguous.

Gasification is an effective way of transforming waste into a fuel comparable to other fuels. However, the quality and comparability of the resulting gas is largely dependent on the waste from which the gas is made. This means that the waste input into the gasifier should be strictly monitored to guarantee the comparability of the output to the non-waste fuel which it replaces. The quality monitoring of Essent which entails weekly analysis of samples taken from the shipment of demolition wood is not sufficient to guarantee the quality and comparability of the producer gas to clean biomass. There may be large differences between different shipments meaning that the producer gas may not always be comparable to clean biomass. However, it is imperative that the comparability of the gas be constantly maintained.

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[322] C-9/00, *Palin Granit Oy,* 2002, ECR I-3533
[323] C-444/00, *Mayer Parry Recycling,* 2003, ECR I-06163
[324] C-457-02, *Criminal proceedings against Antonio Niselli,* 2004, ECR I-10853.

Thus, Essent should increase the sampling frequency of the delivered demolition wood to guarantee the comparability of the gas prior to its co-incineration in the power plant.

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Appendix 1 Biomass

LCP Directive Definition of Biomass

All organic carbon-containing materials produced by photosynthesis in plants are termed biomass.

In the LCP Directive, biomass is defined as "products consisting of the whole of part of any vegetable matter from agriculture or forestry which can be used as a fuel for the purpose of recovering its energy content".[325] The following types of biomasses are used as a fuel:

1) Vegetable residues from agriculture and forestry;
2) Vegetable residues from the food processing industry;
3) Vegetable residues from virgin pulp production and from the production of paper from pulp;
4) Cork waste;
5) Wood with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste.

The biomass wastes listed above are excluded from the scope of the WID. Accordingly, plants incinerating these biomass waste streams are subject to the LCPD and not the WID.

Renew ability of Biomass

Biomass can be considered as a renewable material, as, during growth of plants, crops, and trees, carbon dioxide (CO_2) is withdrawn from the atmosphere and is subsequently stored in the biomass as chemical energy. During the conversion and the use of derived products of the biomass the CO_2 is being released again and the carbon dioxide circle is closed again. Therefore, biomass is, by definition, considered to be a renewable material.

As the concern of global warming and the resulting climate change enhanced by CO_2 emissions resulting from fossil fuel consumption, the restriction of CO_2 emissions has been one of the prime objectives in environmental legislation.

Therefore, the renewable and CO_2-neutral nature of biomass has been the major motivation to use this material for energy generation (e.g. green electricity and heat).

[325] Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants [2001] OJ L309/1

Appendix 2 Thermal Gasification of Biomass

Principle of Gasification

Gasification is a thermal process in which the biomass is maximally converted into a gaseous phase. This conversion is a result of the partial oxidation of the carbon present in the feedstock due to the presence of an under- stoichiometric amount of oxygen at elevated temperatures. Regarding to the composition and the typical applications of the gaseous product, two main types of products can be distinguished: 'biosyngas' and 'producer gas'.

Producer gas is produced by low temperature gasification (700 to 900 °C) and contains CO, H_2, N_2, CH_4, C_xH_y aliphatic hydrocarbons, benzene, toluene, and tars (besides CO_2 and H_2O). The producer gas components H_2 and CO typically contain only ~50% of the energy in the gas, while the remainder is contained in CH_4 and higher (aromatic) hydrocarbons.

On the other hand, biosyngas contains only H_2 and CO (besides CO_2 and H_2O) and is produced by high temperature (above 1200°C) or catalytic gasification. Biosyngas is chemically similar to producer gas derived from fossil sources, and can replace its fossil equivalent in all applications. Biosyngas can also be made from producer gas by heating, thermal cracking or catalytic reforming.

The differences between these two main types of gasification products lead to different applications. The major application of producer gas is the direct use for the generation of power (and heat). This can either be in stand-alone combined heat and power (CHP) plants or by co-firing of the producer gas in large-scale power plants.

The second major application of producer gas is the production of synthetic natural gas (SNG). Biosyngas is the feedstock for the more advanced applications like Fischer-Tropsch synthesis, ammonia and hydrogen production, and in processes like olefin hydroformylation and mixed alcohol synthesis.[326]

Gasification can be considered as a key conversion technology in all processes for the production of energy, fuels, and chemicals from biomass. Compared to direct biomass combustion, the advantage of the gasification route is a higher overall electrical efficiency. Furthermore, a far less volume of gas has to be purified in comparison with direct combustion. The biomass residual ash is not mixed with the coal ash, which has an existing market as a construction material.

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[326] H. Boerrigter, R. Rauch, Review of applications of gases from biomass gasification, ECN, ECN-RX--06-066, 2006

Upon low temperature gasification, four different processes can be distinguished (figure A1):

1. Drying: moisture removal;
2. Pyrolysis: removal of volatile matter;
3. Combustion: partial oxidation of the char and heterogeneous reactions with CO_2, H_2O;
4. Reduction: reactions involving the gaseous components formed in the previous processes.

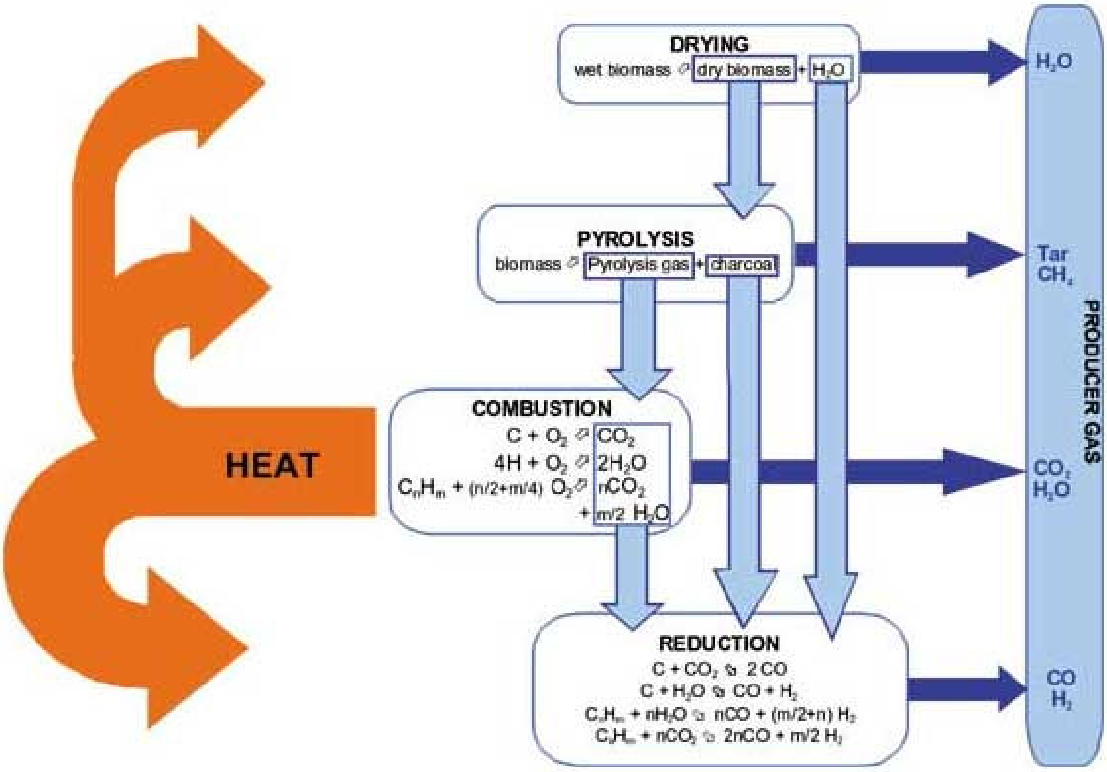

Figure A1 Schematic depicture of the different processes involved in gasification [327]

The water-gas shift reaction determines the final gas composition to a large extent:

$$CO(g) + H_2O(g) \leftrightarrow H_2(g) + CO_2(g)$$

Gasification technology consists of several unit operations, the most critical of which is gas cleaning and conditioning for utilisation in power production engines. The composition of the producer gas is very dependent on the type of gasification process, the gasification temperature and, above all the composition of the feedstock.

[327] Biomass Technology Group, *www.btgworld.com/technologies/gasification.html*, 2006

Gasification Processes

There are several existing gasification processes and new developments are being made. These gasification processes can be differentiated in direct and indirect processes. The direct processes are typically operated with air as gasification medium and are generally used for biomass applications. The main direct and indirect processes that can be distinguished are:

- Fixed-bed updraft;
- Fixed-bed downdraft;
- Fluidised bed (bubbling and circulating, i.e. BFB and CFB);
- Indirect fluidised bed (steam-blown).

In most biomass applications the gasifiers are operated with air as gasification medium affording a producer gas diluted with nitrogen. When a nitrogen-free producer gas is required, oxygen-blown gasification or alternatively an indirect process is used.[328]

[328] H. Boerrigter, R. Rauch, Review of applications of gases from biomass gasification, ECN, ECN-RX--06-066, 2006

Appendix 3 Large Scale Atmospheric CFB Gasifier

Working Principle

The gasifier connected to the AC-9 plant is a Circulating Fluidized Bed (CFB) gasifier. Basically, the CFB gasifier consists of 1; a refractory-lined reactor where the gasification takes place, 2; a cyclone to separate the circulating material from the gas and 3; a return leg for returning the circulating material to the bottom part of the reactor, figure A2.

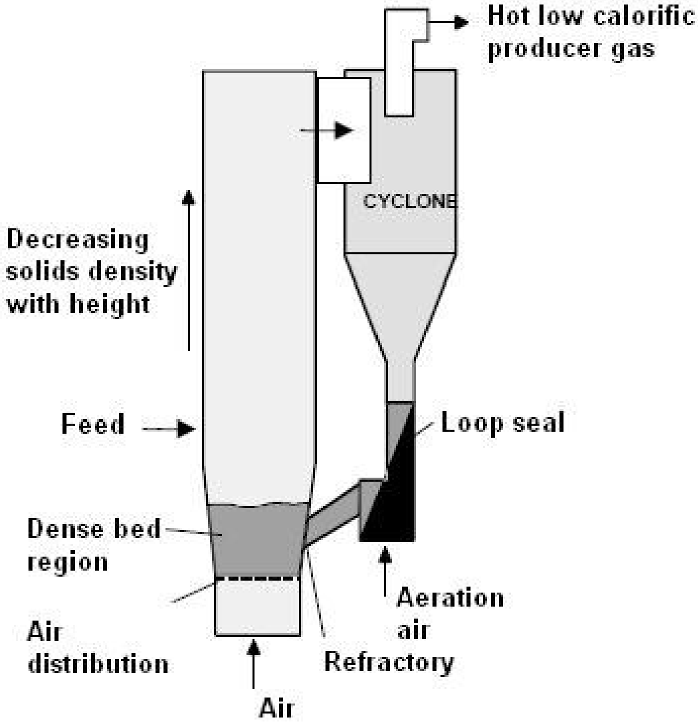

Figure A2 Circulating fluidized bed gasifier

The biomass is fed into the gasifier at a certain distance above the air distribution grid. When entering the reactor the biomass particles start to participate in the four processes that are involved in gasification. Due to the intense mixing, the different processes - drying, pyrolysis, oxidation, and reduction - cannot be distinguished into zones; the temperature is uniform throughout the bed. The bed consists of sand mixed with limestone or dolomite. The air-biomass ratio can be varied, and as a result the bed temperature can be controlled.

The gaseous products flow upwards the reactor and part of the charcoal flows down to the more dense part of the fluidised bed. Another part of the charcoal flows up together with the circulating media into the uniflow cyclone, where most of the solids are being separated from the gas and return to the bottom of the bed. There, the returned charcoal is combusted with the air that is introduced through the grid nozzles to fluidise the bed. This combustion process generates the heat required for the pyrolysis process and the subsequent endothermic reactions. The gas velocity in the gasifier is high, therefore, the velocity differential between the solids and gas is also high, which leads to maximum heat and mass transfer between gas and solids, resulting in very uniform bed conditions.

The coarse ash accumulates in the gasifier and is removed from the bottom of the gasifier.

The CFB gasifier is extremely flexible with regard to fuel requirements. It is suitable for almost any type of solid/waste fuel as well as for liquids/gases to a certain extent. Feedstock preparation is minimal. Depending on the type of material, crushing or shredding to a certain size is required (a few centimetres in case of the AC-9 gasifier).

However, fluidised beds are quite sensitive to the low softening temperature of the biofuel ash. The reducing atmosphere inside the gasifier further decreases the softening temperatures of the ash. This limits the gasification temperature from above. To avoid incomplete gasification and an increase in the formation of tar, the gasification temperature is limited from below. Therefore, the technical operating temperature window of biofuel gasification is quite limited.

Producer Gas Composition

The composition of the obtained producer gas is very dependent on the origin of the biomass used and the gasification temperature. Table A1 presents a typical producer gas composition from a CFB gasifier operated at 850 °C.

Table A1 *Typical producer gas compositions from a CFB gasifier at 850 ^{0}C*

Component	Units	
CO	vol%	21
H_2	vol%	14
CO_2	vol%	14
CH_4	vol%	5
C_2 + hydrocarbons	vol%	2
Benzene (i.e. C_6H_y)	vol%	0.4
N_2	vol %	44
Tar	g/m_n^3, wet	8
H_2O	vol%, wet	11
Heating value	MJ/m_n^3, dry	7.7

Source: Den Uil, et all, ECN, 2004.

Appendix 4 Process Description AC-9

Introduction

The AC-9 unit is a coal-fired power plant that was first taken into operation in 1993. In the year 2000 an atmospheric CFB gasifier for the gasification of 150 000 tons waste and demolition wood a year was taken in operation to provide the producer gas that is subsequently co-fired in the AC-9.

This combination of the gasification process with a subsequent combustion process with energy recovery and flue-gas treatment is in line with the Best Available Techniques (BAT) for waste treatment given in the IPPC Directive 96/61/EC. In order to avoid the generation of waste, it is BAT to combine the gasification stage with a subsequent combustion stage. This combination should be provided with energy recovery and flue-gas treatment that provides for operational emission levels to air within the BAT associated emission ranges. It is also necessary to recover or supply for the use of the substances (e.g. ashes) that are not combusted, which is the case for the AC-9 unit. This appendix presents a process description of the AC-9 and the gasifier. In appendix 7.1 an overview of processes in other member states, that are very similar to the process described here, is given.

Basic Operation Conditions AC-9

In table A2 the basic operating conditions are given without the co-incineration of secondary fuels for the AC-9 unit.

Table A2 *Basic operating conditions of the AC-9 unit*

	Units	AC-9
Operation		
Full power operation hours	h/y	8000
Coal (primary fuel)		
Average heating value	MJ/kg	23
Heating value range	MJ/kg	19-31
Coal usage	kt/y	1917
Natural gas		
Average heating value		
Heating value range		
Gas usage	m^3/h	185 000
Generated energy		
Mounted net electrical capacity	MW_e	650
Electricity production	PJ_e/y	17.3
Thermal capacity	MW_{th}	350
Own expenditure	PJ_e/y	1.1
Net electrical capacity, yearly average	%	42.46

Steam temperature	ºC	540
Steam pressure	bar	270
Emissions to air		
Amount of flue-gas, yearly average (dry, 6% O_2)	m_0^3/s	547
Flue-gas input temperature chimney	ºC	52
By-products		
Fly ash	kt/y	199
Bottom ash	kt/y	19
gypsum (dry)	kt/y	87
Cooling water		
Drawn off heat	PJ/y	22.6

Source: Boudewijnen Koopmans, Milieu-effectrapport:, Essent Energie Productie B.V., 2000.

In the environmental-effect report (MER) on the co-combustion of secondary fuels in the AC-9 that was published in the year 2001, it has been shown that the co-firing of producer gas has a minor effect on the heat and mass balances of the AC-9. This is obvious because only approximately 5 % of the coal is being replaced by biomass.

Summarized Process Description AC-9

The coal-fired AC-9 unit produces electricity by burning coal and secondary fuels in a boiler to heat water to produce steam. The steam, at a tremendous pressure of 270 bar, flows into a turbine, which drives a generator to produce electricity.

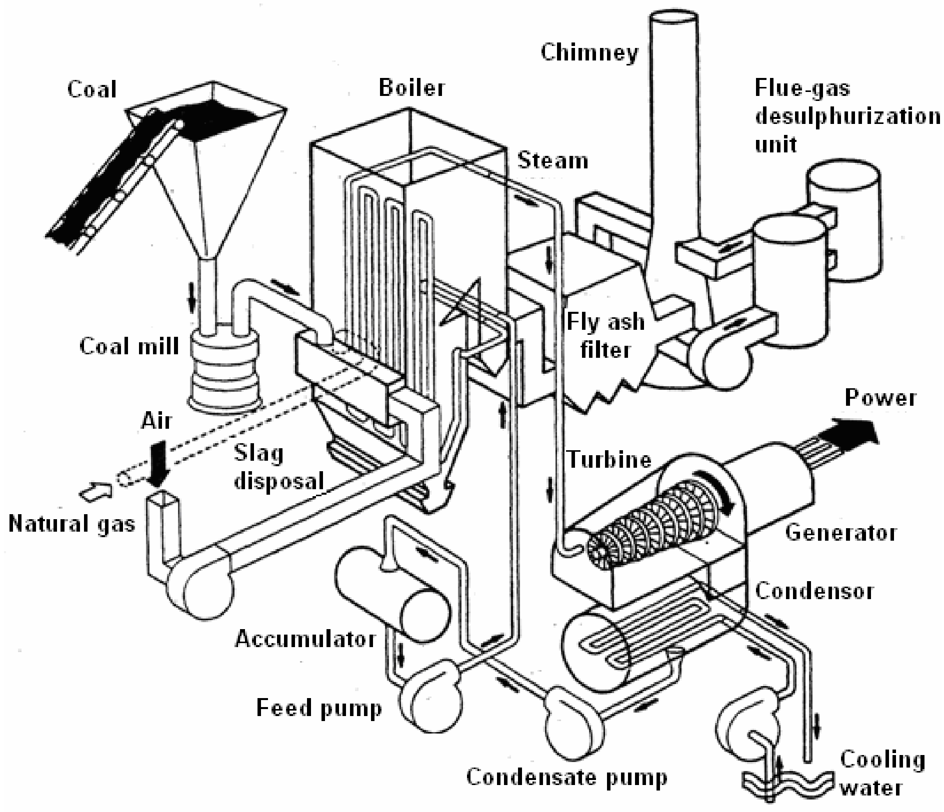

Figure A3 Simplified depicture of a coal fired boiler

The steam is cooled, condensed, and recycled to the boiler. In figure A3 a simplified depicture is given of a coal fired boiler.

In order to lower the nitrogen oxide (NO_x) emissions, the boiler of the AC-9 is equipped with low-NO_x-burners. The specially designed boiler also contributes to a lower NO_x formation in the hearth.

Parallel to the power generation, heat is produced to increase the overall energetic efficiency. This is done by drawing off part of the steam halfway the turbine and leading the steam through a heat exchanger. The produced hot water is used for heat consumption.

Flue-gas Treatment at AC-9

The flue-gas from the boiler of AC-9 is pre-treated before it is emitted through the 175 meters high chimney. Several flue-gas treatment techniques are applied primarily to reduce the amount of dust and SO_2 in the flue-gas.

Electrostatic fly-ash filter

The AC-9 is equipped with an electrostatic fly-ash filter which has an efficiency of more than 99.5 %. The filter is located directly behind the boiler. Dust particles in the flue-gas are loaded with a negative charge, after which they are separated from the flue-gas by an electrostatic field. The fly ash is collected in a hopper and then transported to a storage silo using compressed air.

Flue-gas desulphurization unit

After the electrostatic fly-ash filter, the flue-gas is treated in a desulphurization unit. This wet scrubber washes the flue-gas with a mixture of water and limestone. The SO_2 in the flue-gas reacts with the limestone through which gypsum is being formed that can be used as a substitute for natural gypsum after dewatering. This treatment removes 85 to 90% of the SO_2 in the flue-gas. Furthermore, approximately 90% of the remaining dust particles are being removed, so that the flue-gas is eventually stripped off for 99.95 % of the fly-ash. Harmful components such as chlorine and fluoride are also being removed with an efficiency of 75%.

Basic Operation Conditions of the Gasifier

In table A3 some indicative values are presented for the operated gasifier at the AC-9.

Table A3 *Indicative values on operation conditions gasifier*

	Units	Gasifier
Operation time	h/y	7000
Mechanical throughput	kt/y	150
Average heating value	MJ/kg	14
Thermal input	MW_{th}	84
Electrical output	MW_e	31
Net electrical efficiency*	%	36.5
Production producer gas	kg/s	18.3
Volumetric flow rate flue-gas	m_0^3/h	--

* For the net electrical efficiency of the conversion of secondary fuels, the power consumption of the gasifier (circa 0.8 MW) and the savings on the power consumption of the coal mills (circa 0.2 MW) were taken into account.

Process Description of the Gasification Process

Chipped demolition wood is transported to the plant by ship and by truck. The wood is stored in silos. From the storage silos the chips are continuously transported to 2-day silos, feeding the screw conveyor feeding systems of the gasifier. The gasifier operates at an almost atmospheric pressure of 1.2-1.5 bar at 800 – 950 °C (depending on the feedstock) with the addition of sand as bed material. These relatively low temperatures lead to a decrease of NO_x emissions. The bed is preheated using an external burner fired by fuel oil. As the wood is introduced into the bed, the majority of the organics pyrolytically vaporize and are partially combusted in the bed. The exothermic combustion provides the heat to maintain the bed at the desired temperature and to volatilise additional wood. Combustion is completed in the freeboard space above the bed, resulting in freeboard temperatures approaching 980 °C.
The raw producer gas is cooled down in a gas cooler to a temperature of about 450 °C. In the cooler intermediate pressure steam is produced and slightly superheated. Next, the producer gas is led through a hot gas cyclone. The hot gas cyclone separates the fly ashes form the producer gas. Part of the produced fly ash can be recycled to the gasifier, the majority is being stored in a silo. After this hot gas cyclone, the gas is fed to special burners in the coal fired boiler of the AC-9. During the gas cleaning operation, steam is produced that is fed to the steam turbine which results in an increased efficiency.[329]

Figure A4 presents the flow sheet of the wood gasification process at the AC-9.

[329] H.A.M. Voets, *Aanvraag vergunningen ingevolge de Wet milieubeheer, Wet verontreiniging oppervlaktewateren en Wet op de waterhuishouding; Amercentrale te Geertruidenberg,* Essent Energie Productie B.V., 2001

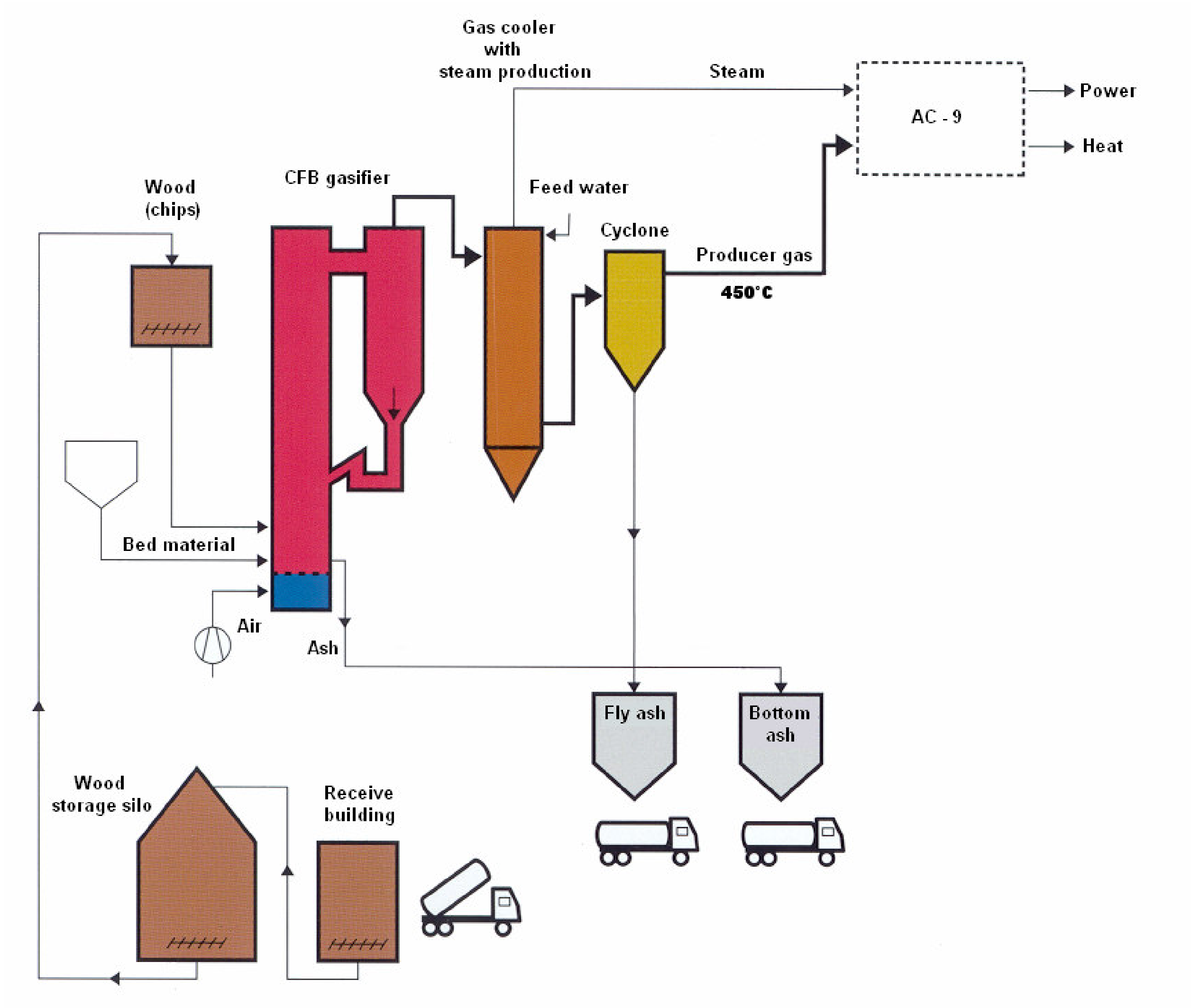

Figure A4 Process flow sheet wood gasification

Appendix 5 Basic Information on Emissions

Introduction

Inevitably, the combustion of fossil fuels and/or biomass in an LCP results in the emission of various substances in different amounts depending on the fuel composition and process conditions. This section will provide some basic information into the origin and nature of these emissions. The major emissions to air that have to be considered are SO_2, NO_x, CO, particulate matter and the greenhouse gases, such as CO_2. Although they are emitted in smaller quantities, BVA-regulated substances such as hydrogen fluoride, halide compounds and heavy metals are also important, because they may also have a significant influence on the environment due to their toxicity or their persistence.

Emissions

Sulphur oxides

Fossil fuels contain sulphur as inorganic sulphides or organic compounds. In coal, sulphur appears as pyrictic sulphur, organic sulphur, sulphur salts and elemental sulphur. In combustion processes sulphur is mainly converted into sulphur dioxide (SO_2). In solid and liquid fuels, 3 to 4 % of the sulphur is oxidized to sulphur trioxide in the presence of transition metals as a catalyst. The emission of particulate compounds is increased because SO_3 is being absorbed by these particles.

Natural gas is generally considered free from sulphur. This is clearly not the case for certain industrial gases such as producer gas derived from biomass.

Nitrogen oxides

Nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O) are the principal oxides of nitrogen that are emitted during combustion of fossil fuels. NO and NO_2 form the mixture known as NO_x. Several mechanisms are responsible for the formation of NO_x:

- Fuel NO_x is formed from nitrogen present in the fuel;
- Thermal NO_x results from the reaction between the oxygen and nitrogen present in the air at elevated temperatures, and is highly dependent on the reaction temperature;
- Prompt NO_x is formed by the conversion of molecular nitrogen in the flame front in the presence of intermediate hydrocarbon compounds.

In general, the first two mechanisms are mainly responsible for the produced NO_x. The nitrogen content of the fuel and the oxygen concentration of the reaction medium are the two important factors that direct the formation of fuel NO_x. As already mentioned in section 4.5.3, these NO_x formation mechanisms are suppressed at the AC-9 by the use of low-NO_x-burners and a special boiler design.

The mechanism that is responsible for the formation of N_2O is not yet fully clarified. However, it is known that lower combustion temperatures cause higher N_2O emissions. N_2O contributes to the greenhouse warming. In the presence of O_3, N_2O is decomposed and forms NO_x.

Carbon monoxide

Carbon monoxide (CO) always appears as an intermediate product of the combustion process. The formation of CO has to be minimised, because CO is an indicator of corrosion risk and unburned fuel, therefore signifying a loss of efficiency.

Dust and particulate matter

The emission of dust during the combustion of coal, peat and biomass arises almost entirely from the mineral fraction in the fuel. The condensation of organic compounds that are vaporized during combustion may also lead to the formation of very small particles. The type of combustion process has a considerable effect on the proportion of ash entrained in the flue-gas emissions from boilers.

Greenhouse gases

Two important greenhouse gases that are formed during combustion of fossil fuels or biomass in LCP's are carbon dioxide (CO_2) and nitrous oxide (N_2O). It is believed that the accumulation of greenhouse gases in the atmosphere causes the observed increase of the global mean temperature since the beginning of industrialisation. It is thought that this rise in global mean temperature will change the earth's climate if the emissions of such gases, mainly CO_2, will not be reduced.

Hydrogen fluoride

Fluoride is a natural element present in both fossil and biomass derived fuels. When combusting these fuels, fluoride is released to the flue-gas as HF.

Hydrochloric acid

Like fluoride, chloride is also a natural element present in both fossil and biomass derived fuels. When these fuels are burned, small amounts of chloride are released that combine with hydrogen to form hydrogen chloride. Together with the moisture in the air, hydrogen chloride transforms to hydrochloric acid aerosol that contributes to acidification problems in the atmosphere. The emissions of hydrochloric acid as well as hydrogen fluoride, is drastically reduced when a flue-gas desulphurisation unit is installed.

Heavy metals

The presence of heavy metals as a natural component in both fossil fuels as well as biomass derived fuels, results in the emission of these components. In waste wood, paint and wood preservatives contributes to the concentration of some heavy metals (e.g. Pb, Cu, Cr, As).

Most of the heavy metals are normally released as compounds (e.g. oxides, chlorides) in adsorbed onto particulates. Only Hg and Se are at least partly present in the vapour phase. Less volatile elements tend to condense onto the surface of smaller particles in the flue-gas stream. Therefore, enrichment in the finest particle fractions is observed. These particles are hard to separate form the producer gas in the hot gas cyclone.

Appendix 6 Overview of Similar Biomass Gasification Projects

Overview

Several processes have been proposed for the advanced biomass gasification over the past 10 years. However, there are only few processes in the EU that have incorporated the co-firing of producer gas in a coal-fired power plant. Table A4 gives an overview of coal-fired power plants where the co-firing of producer gas in the boiler is (or was) being applied.

Table A4 *Overview of coal-fired power plants co-firing producer gas in the EU*

Gasification technology	**Supplier**	**Coal-fired power plants with co-firing of producer gas in boiler**			
		Name	**Place/Since**	**Feed**	**Capacity**
Air-blown low-pressure gasifiers	Foster Wheeler	Kymijärvi	Lahti, Finland, 1998	Wood waste, peat and REF	50 MW_{th}
	Lurgi	AC-9	Geertruidenberg, Netherlands, 2000	Wood waste, spruce bark	83 MW_{th}
	Austrian Energy	BioCoComb*	Zeltweg, Austria, 1997-2002	Chopped wood and sawdust	10 MW_{th}
	Foster Wheeler	Electrabel	Ruien, Belgium, 2002	Wood chips from fresh wood, bark	50 MW_{th}

* Plant no longer in operation anymore

Process Descriptions

The Kymijärvi power plant in Lathi (Finland) has been equipped with a Foster Wheeler CFB-gasifier that operates between 830 and 860 ^{0}C. One third of the gasifier fuel mass is recycled fuel (REF), which is in origin classified refuse from households and industries and the other two- third are various biomass materials such as waste wood, chips, and fuel peat. The objective of the gasifier is to replace 50 MW_{th} of the 350 MW_{th} power station's capacity by biofuels. The producer gas is fed directly (without any additional purification steps) from the gasifier through the air preheater to two burners that are located below the coal burners in the boiler. In order to improve the purity of the flue-gases, the producer gas is burned in the steam boiler with a high flame temperature. However, apart from reducing the fossil CO_2 emission, co-firing has little influence on the emissions, because the main boiler is equipped with neither a deNOx nor a deSOx installation.[330]

The BioCoComb demonstration plant has been installed at the Zeltweg power plant (Austria), operated by Draukraft. The plant is equipped with a CFB gasifier from Austrian Energy which uses mainly spruce bark and some chopped wood and sawdust as fuel. The contribution of biofuels reaches to about 3–5% of the total thermal input, which corresponds to 10 MW_{th}. The fluidizing medium of the CFB is hot air, derived from the air preheater of the power plant. The CFB reactor operates at conditions where the biomass is partly combusted and partly gasified at temperatures between 750 and 850 °C. The efficient combustion system of the boiler, combined with the very efficient flue gas cleaning system of the plant, guarantees a minimal impact on the environment. There is a high potential for the producer gas to be used as a reducing gas in the reburning zone of the combustion chamber, thus reducing or even avoiding other additional de-NOx measures.

The Electrabel power plant in Ruinen (Belgium) is equipped with the same Foster Wheeler CFB-gasifier as the one at the Kymijärvi power plant. The feed consists of wood chips from recycled fresh wood, bark, hard and soft board residues. These are white list fuels, and therefore the WID is not applicable. The gasifier operates between 830 and 860 ^{0}C. Again, the producer gas is led directly (without any additional purification steps) from the gasifier through the air preheater to two burners that are located below the coal burners in the boiler. Besides the reduction in the fossil CO_2 emission, only a small reduction in the SO_2 emission can be observed.[331]

[330] CRE Group Ltd, Technical review on opportunities and markets for co-utilisation of biomass and waste with fossil fuels for power generation, Report prepare for European Commission, Brussels, 2000
[331] P. Savat, Electrabel – Ruien; Belgian gasification project, Laborelec, IEA Bioenergy task 33, 2003