

**WAS-G-DEF-10**

**End of waste for syngas**

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## Introduction

​This guidance provides advice on the end-of-waste criteria for syngas produced from waste. It describes the evidence required to show that syngas produced from pyrolysis and gasification of waste meets the conditions laid out in Article 42(1) of Directive 2010/75/EU on Industrial Emissions (‘IED’).

## End-of-waste criteria

​Waste which has undergone a recycling or other recovery operation is considered to have ceased to be waste if it complies with all of the following conditions:

* ​The substance or object is to be used for specific purposes.
* ​A market or demand exists for such a substance or object.
* ​The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products.
* ​The use of the substance or object will not lead to overall adverse environmental or human health impacts.

## Evidence requirements

​Demonstration that syngas specification will be met on an ongoing basis through a combination of the following evidence:

* ​The syngas has verified performance data from another facility burning the same waste feedstock using the same technology.
* ​There is pilot plan reference data evidencing that it is demonstrably scalable.
* ​There is an engineering design specification for purifying technology.
* ​It has performance guarantees from the technology provider.

## Syngas quality specification

​The use of syngas must not lead to overall adverse environmental or human health impacts. Applicants must demonstrate though compositional data and technology choice that the syngas will always be able to meet the required specification. The composition of raw syngas is influenced by the origin, nature and composition of the waste feedstock, moisture content, process temperatures, pressure and residence times and any gasification agent used in the process.

​The Environment Agency has produced a syngas specification (Table 1) based on the maximum results obtained from testing natural gas from one location in England. It also includes substances normally associated with the gasification and pyrolysis of waste. The levels of contaminants could be different in other samples of natural gas and the specification may change in response to new evidence, provided those results can be shown to representative of UK pipeline gas. SEPA will keep the substances and limits specified in Table 1 under review.

## Process evidence

​Syngas must be capable of being burned in a plant that could equally burn natural gas. The combustion plant can undergo normal adjustments to account for difference in the fuel properties such as air/fuel ratio or engine ignition timing. However, there should be no special measures applied such as additional combustion stages, increased residence time or additional exhaust gas abatement. Applicants must also demonstrate that syngas clean up techniques will be sufficient for the plant to meet the natural gas specification on an ongoing basis. Evidence should include the fate of substances produced through the thermal treatment process, referencing process temperatures, pressures and residence times. Applications should be supported by design specifications and/or performance guarantees from the technology provider, as well as any verified performance data from comparable plants. Common syngas clean-up techniques are outlined in Chapters 2 and 3 of the Ricardo technical document ‘Establishing a methodology that supports the assessment of the impact of ATT processes’ commissioned by the Environment Agency. Applicants should refer to comparable processes, facilities or methods of operation which have been tried with success at a commercial scale to justify the chosen techniques in relation to achieving Article 42(1) quality syngas. Data from pilot plant and/or other commercially operational plant used to support the application must be using the same feedstock, thermal treatment and gas clean up techniques, and pilot plants must be demonstrably scalable. If verified performance data from another facility or pilot plant reference data is unavailable, in the BAT assessment the application should address:

* ​The sizing of scrubbers/vessels/other abatement plant is appropriate to achieve cleaned syngas specification.
* ​How controls on waste feedstock (on or off-site) will limit contamination in the feedstock that may impact syngas or char/ash quality and/or impact material handling systems (i.e. blockages).
* ​The fate of contaminates likely to arise from the thermal treatment of waste in relation to processing temperature, pressure and residence time, waste feedstock composition, moisture content and choice of gasification agent and whether substances arising from thermal treatment and gas clean-up will be present in wastewaters or ash/char.
* ​Whether thermal treatment techniques support recovery of the char (e.g., as a vitrified ash).
* ​Whether further treatment of thermal treatment residual outputs (e.g. char) are recovery processes and residues are not simply burned for disposal.

## Processing of products such as syngas, synoil and char

Waste thermal treatment plants designed to principally produce synthetic oils or char (and whose syngas meets the Article 42(1) requirements) can be considered to be in the scope of Section 1.2A(c) where the oil or chars are not burned, or where they meet a bespoke End-of-Waste opinion for each output prior to any combustion (on or off-site).

## Commissioning and ongoing performance

​Syngas composition must be demonstrated during the commissioning phase of the plant. Demonstration on an ongoing basis that the syngas meets Article 42(1) will normally be required on a sliding scale, with frequency of sampling and analysis of syngas decreasing as consistent composition is demonstrated, but for the potential for the frequency to once again be increased should any failures occur. Other indirect measurements will also be required to be monitored to ensure syngas composition remains within agreed spec.

## Definitions

**​Incineration** – the combustion of waste under conditions which ensure the destruction and oxidation of molecules, to the extent required in a waste incineration or waste co-incineration plant. This includes thermal treatment plant where resultant syngas is burnt and doesn’t meet Article 42(1) requirements

**​Output** – constituent outputs from the alternative thermal treatment of waste e.g. synthetic gas, wax, synthetic oil (synoil) and char, all of which may or may not be waste.

**​Syngas** – gases resulting from the thermal treatment of carbonaceous material. The term is used here to cover pyrogas (from pyrolysis) and syngas (from gasification).

**​Thermal treatmen**t – the application of heat to result in irreversible molecular change

**​Table 1:  Article 42 Syngas specification**

|  |  |  |  |
| --- | --- | --- | --- |
| ​Parameter | ​Source | ​Current limit (mg/m3)\* | ​Basis of Limit |
| ​Total Sulphur | 1. ​Data from National grid PLC continuous monitors over two day period (119 samples 2. Analysis of 9 natural gas samples | ​3.85 | ​Odorised Concentration from JEP Report 1 |
| ​Hydrogen sulphide | ​Data from National Grid PLC continuous monitors over two day period (119 samples) | ​0.4 | ​Top of range from natural gas analysis |
| ​Total halogenated hydrocarbons | ​Analysis of 9 natural gas samples | ​0.07 | ​Top of range from natural gas analysis |
| ​Heavy metals Hg, Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total) | ​Analysis of 9 natural gas samples  ​ | ​0.16 | ​Top of range from natural gas analysis, excluding outlier |
| ​Total aromatic hydrocarbons expressed as Xylene | ​Analysis of 9 natural gas samples  ​ | ​2.6 | ​Top of range from natural gas analysis  ​ |
| ​HF | ​ | ​5 | ​ Not likely to be present in natural gas, but could be present in syngas depending on the type of waste that is treated. Limits from Biomethane Quality Protocol |
| ​HCI | ​ | ​1.5 | Not likely to be present in natural gas, but could be present in syngas depending on the type of waste that is treated. Limits from Biomethane Quality Protocol |
| ​Calorific value | ​Analysis of 9 natural gas samples  ​ | ​Monitor | ​No limit but monitored so that syngas results can be adjusted to account for lower CV than natural gas |

​\* These limits will apply unless the applicant can propose and justify an alternative limit e.g. further test results on natural gas composition

​1 JEP11SG01: EMISSION FACTORS FOR SULPHUR IN NATURAL GAS – February 2012

## Disclaimer

​The terms of this position may be subject to periodical review and be changed or withdrawn in light of technological, regulatory or legislative changes, future government guidance or experience of its use. SEPA reserves its discretion to depart from the position outlined here and to take appropriate action to avoid any risk of pollution or harm to human health or the environment.

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