DRAFT FOR CONSULTATION

Australian Government
Department of the Environment and Energy

Safeguard Mechanism: Prescribed production variables and default emissions intensities

Abbreviations and acronyms

CO_2	Carbon dioxide
CCS	Carbon Capture and Storage
CMWG	Coal mine waste gas
GJ	Gigajoules
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
NGER	National Greenhouse and Energy Reporting
t	tonnes
t CO_2-e	tonnes of CO_2 equivalent

PURPOSE OF THIS DOCUMENT

The purpose of this document is to **define production variables** for use in calculated baseline applications made under the Safeguard Mechanism.

They will be used for setting baselines using the following formula:

For all relevant production variables:

Facility baseline = Σ (Production x Emissions Intensity)

Each production variable definition identifies the emissions sources that can contribute to the calculation of an emissions intensity value.

There are two types of emissions intensity values:

- **Default emissions intensity values**: are set by the Government and published in the Safeguard Mechanism Rule. They represent the industry average emissions intensity of production over five years.
- **Estimated (site-specific) emissions intensity values**: are set by businesses. They represent the emissions intensity of production at an individual facility.

This document can help businesses to understand which emissions sources have been used in the development of the default emissions intensity values, and which emissions sources can be used in an estimated (site-specific) emissions intensity value calculation.

Background

Sources of emissions used in setting default emissions intensity values

Production variable definitions and default emissions intensity values are published in Schedules 2 and 3 of the *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015* (Safeguard Rule).

- **Schedule 2 production variables** result in baselines that can be updated each year for actual production.
- **Schedule 3 production variables** result in baselines that are fixed.

Almost all production variables are in Schedule 2. Schedule 3 is intended to allow for circumstances where an appropriate output-based production variable could not be found, so a proxy has been used that is not appropriate for annual adjustment.

All facilities can access a transitional calculated baseline in 2018-19 or 2019-20. During this transitional phase, the use of default emissions intensity values is optional.

A facility with multiple outputs could use a combination of default and estimated (site-specific) emissions intensity values. In these cases, it is important that emissions are not counted twice. That is, emissions should only be assigned to one production variable. In some cases, emissions from a particular process will need to be apportioned among two or more production variables.

This document defines the production variables and specifies the sources of emissions used by the Department to calculate default emissions intensity values. It provides guidance for businesses and auditors on the emissions sources facilities can use in site-specific emissions intensity calculations and how apportioning should be done.

Sources of emissions that can be used by Responsible Emitters when setting an estimated (site-specific) emissions intensity for a prescribed production variable

The proposed amendment to subsection 6(8B) of the Safeguard Rule establishes that where a facility uses an estimated (site-specific) emissions intensity value, the facility can only include emissions relevant to the calculation of the default emissions intensity value. The inclusion lists, which are presented in this document, will help businesses calculate estimated (site-specific) emissions intensity values.

Defining prescribed production variables and default emissions intensities

The process of defining the proposed production variables and default emissions intensity values in the current exposure draft Rule amendment has involved extensive stakeholder consultation and independent technical expert review. It was undertaken in accordance with the *Framework for developing default production variables and emissions-intensity value*[1] (the Framework document). The Framework document was consulted on publicly as part of the consultation for the March 2019 amendments to the Safeguard Rule.

Each production variable and default emissions intensity value was individually reviewed by an independent expert for adherence to the Framework document. In addition, all production variables and default emissions intensity values were reviewed together to check that the principles in the Framework document were applied consistently across sectors.

Production variable definitions and emissions source boundaries

The following sections set out the emissions sources that were either included in or excluded from default emissions intensity calculations, and specify which emissions sources can be included in the calculation of an estimated (site-specific) emissions intensity value for a prescribed production variable. Additional information is provided for most production variables in the mining, oil and gas sectors, as there are a wide variety of facility structures, with many facilities producing multiple products.

Note: Throughout this document, the terms ‘on-site’ and ‘off-site’ refer to the site of a facility.

[1] The Framework document is available here: http://www.environment.gov.au/system/files/consultations/56b64cc6-6455-4aa1-9b72-d00b7e09bfb3/files/safeguard-mechanism-rule-amendment-explanatory-document.pdf (see Appendix A).

SCHEDULE 2 PRODUCTION VARIABLES

Manufacturing (other than steel)

1. Bulk flat glass

1.1. Production variable definition

1. Tonnes of bulk flat glass that:
   (a) is produced as part of carrying on the bulk flat glass activity at the facility; and
   (b) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing bulk flat glass through the physical and chemical transformation of silica (silicon dioxide (SiO2)) and other raw and recycled materials (such as cullet) to produce bulk flat glass products, including wired glass and patterned glass, by controlled melting and forming in a contiguous process (the ***bulk flat glass activity***).
3. The default emissions intensity is 0.774 t CO_2-e per tonne of bulk flat glass.

1.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- melting, refining and conditioning;
- primary colouring, coating and trimming/cutting;
- secondary finishing of bulk flat glass such as secondary coating, laminating, toughening, mirroring, printing, cutting, edgeworking, insulating, glazing, encapsulating, extrusion assembling and moulding;
- complementary processes, such as packaging, head office, administrative and marketing operations where they are undertaken at the facility;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the facility or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity;
  - furnaces, including to melt raw materials;
- cleaning of flat glass for reuse in its same physical form; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

Bulk flat glass production includes the float glass and rolled glass methods of production, as well as the sheet and plate glass methods of production.

The default emissions intensity value for the bulk flat glass activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

1.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes that do not occur within the facility:
  - off-site cutting, polishing, and washing of glass;
  - off-site processes such as: the extraction of silica; collection, sorting and transport of cullet; and secondary processing of flat glass products (such as secondary coating, laminating, toughening, mirroring, printing, cutting, polishing, washing, edge working, insulating, glazing, encapsulating, extrusion assembling and moulding);
- on-site electricity generation.

2. Glass containers

2.1. Production variable definition

1. Tonnes of blown and pressed glass containers that:
   (a) are produced as part of carrying on the glass containers activity at the facility; and
   (b) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing glass containers through the physical and chemical transformation of silica (silicon dioxide (SiO_2)) and other raw and recycled materials (such as cullet) to produce blown or pressed glass containers, by controlled melting and forming in a contiguous process (the ***glass containers activity***).
3. The default emissions intensity is 0.521 t CO_2e per tonne of glass containers.

2.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- secondary finishing of glass containers such as printing / labelling, treatment for chemical resistance and coating;
- complementary processes, such as packaging, head office, administrative and marketing operations;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the facility or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity;
  - furnaces;
- the washing and cleaning of a glass container for reuse in its same physical form; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The production of glass containers includes the alternative processes of the production of borosilicate glass to produce borosilicate glass containers (such as pyrex) and the production of glass containers entirely from cullet.

To produce glass containers, the controlled melting and forming may use both the ‘blow and blow’ method and/or the ‘press and blow’ method.

The default emissions intensity value for the glass containers activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

2.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- the quarrying of silica;
- processes that do not occur within the facility:
  - the off-site sorting and processing of cullet, or
  - the off-site processing of glass containers (such as labelling, treatment for chemical resistance and coating);
- on-site electricity generation.

3. Aluminium

3.1. Production variable definition

1. Tonnes of primary aluminium (Al) that:
   (a) has a concentration of aluminium equal to or greater than 98%; and
   (b) is produced as part of carrying on the aluminium smelting activity at the facility; and
   (c) is weighed after electrolysis but before casting.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of aluminium smelting through the physical and chemical transformation of alumina (aluminium oxide (Al_2O_3)) into saleable aluminium metal (Al) (the ***aluminium smelting activity***).
3. The default emissions intensity is 1.86 t CO_2-e per tonne of primary aluminium.

3.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity;
- electrolysis, including using a process commonly referred to as the Hall-Héroult Process;
- alloying and casting of primary aluminium into saleable aluminium metal;
- the production of anodes;
- waste heat recovery within the facility; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the aluminium smelting activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

3.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- the production of alumina (aluminium oxide, Al203);
- the production of cathodes;
- the production of alloying materials;
- the smelting and associated casting of secondary aluminium metal (Al);
- processes that do not occur within the facility, such as downstream processing of aluminium metal (Al) beyond the facility;
- on-site electricity generation.

4. Alumina

4.1. Production variable definition

1. Tonnes of alumina (aluminium oxide, Al_2O_3) that:
   (a) has a concentration of aluminium oxide equal to or greater than 95%; and
   (b) is produced as part of carrying on the alumina refining activity at the facility; and
   (c) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of alumina refining through the physical and chemical transformation of bauxite (which is an ore containing mineralised aluminium compounds) into alumina (aluminium oxide, Al_2O_3) with a concentration of aluminium oxide equal to or greater than 95% (the ***alumina refining activity***).
3. The default emissions intensity is 0.545 t CO_2-e per tonne of alumina.

4.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

Note that this production variable includes production of specialty aluminas and hydrate (alumina trihydrate, $Al(OH)_3$).

- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, for example:
  - machinery used to move materials within and as part of the activity;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where it involves the recovery of materials for re-use within the activity or is necessary for the activity to proceed as described;
  - processing of waste materials from the activity;
- wet grinding, digestion, clarification, precipitation and calcination, including using a process commonly referred to as the ‘Bayer Process’;
- any bauxite residue processing which involves caustic liquor recovery for reuse in the activity;
- waste heat recovery within the facility;
- production of lime (calcium oxide compounds);
- production of feedstock caustic soda (sodium hydroxide, NaOH) besides that which is generated or recovered in the activity;
- the production of steam; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the alumina refining activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

4.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- extraction (e.g. mining) and pre-processing (e.g. crushing) of bauxite prior to wet grinding, including washing and crushing at the bauxite mine;
- processes that do not occur within the facility;
- on-site electricity generation.

5. Ammonia

5.1. Production variable definition

1. Tonnes of 100% equivalent anhydrous ammonia (NH_3) contained within anhydrous ammonia that:
   (a) has a concentration of ammonia equal to or greater than 98%; and
   (b) is produced as part of carrying on the ammonia production activity at the facility; and
   (c) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing ammonia through the chemical transformation of hydrocarbons (or other hydrogen feedstock) to hydrogen (H_2) that is subsequently reacted with nitrogen (N_2) to produce anhydrous ammonia (NH_3) that has a concentration of ammonia (NH_3) equal to or greater than 98% (the ***ammonia production activity***).
3. The default emissions intensity is 1.87 t CO_2e per tonne of 100% equivalent anhydrous ammonia.

5.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- chemical transformation of a hydrocarbon feedstock (or other hydrogen feedstock) to hydrogen;
- extraction of nitrogen from air, where the nitrogen is used for the ammonia production process;
- removal of carbon dioxide gas prior to the synthesis of ammonia;
- liquefaction of ammonia product;
- transfer and refrigeration of ammonia to/from storage within the facility;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all Scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating an estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

5.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of the hydrogen feedstock (such as natural gas extraction and distribution or synthesis gas production);
- downstream processing of the ammonia into ammonium nitrate, urea or any other product;
- processes which do not occur within the facility;
- on-site electricity generation.

6. Ammonium nitrate

6.1. Production variable definition

1. Tonnes of 100% equivalent ammonium nitrate (NH_4NO_3) contained within ammonium nitrate solution ($NH_4NO_{3(aq)}$) that:
   (a) has a concentration of ammonium nitrate (NH_4NO_3) equal to or greater than 60%; and
   (b) is produced as part of carrying on the ammonium nitrate production activity at the facility; and
   (c) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing ammonium nitrate through the chemical transformation of anhydrous ammonia (NH_3) to ammonium nitrate solution ($NH_4NO_{3(aq)}$) that has a concentration of ammonium nitrate (NH_4NO_3) equal to or greater than 60% (the ***ammonium nitrate production activity***).
3. The default emissions intensity is 0.352 t CO_2-e per tonne of 100% equivalent ammonium nitrate.

6.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- catalytic oxidisation of ammonia to create nitric acid;
- reaction of nitric acid and ammonia to create ammonium nitrate;
- product prilling (drying and coating or conditioning), storage and despatch;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all Scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

6.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of the anhydrous ammonia feedstock;
- production of ammonium nitrate using nitric acid imported from a source off-site;
- processes that do not occur within the facility;
- on-site electricity generation.

7. Urea

7.1. Production variable definition

1. Tonnes of 100% equivalent carbamide (urea ($CO(NH_2)_2$)) on a dry weight basis that is:
   (a) contained within either of the following products:
      (i) carbamide solutions (urea ($CO(NH_2)_{2(aq)}$));
      (ii) saleable, granulated, prilled or other solid forms of carbamide (urea ($CO(NH_2)_{2(s)}$)); and
   (b) produced as part of carrying on the urea production activity at the facility; and
   (c) contained within products of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing carbamide (urea ($CO(NH_2)_2$)) through the chemical transformation of carbon dioxide (CO_2) and anhydrous ammonia (NH_3) to produce carbamide solution (urea ($CO(NH_2)_{2(aq)}$)) that:
   (a) has a concentration of carbamide (urea ($CO(NH_2)_2$)) equal to or greater than 80%; and
   (b) is subsequently used to produce either or both of:
      (i) carbamide solutions (urea ($CO(NH_2)_{2(aq)}$)); and
      (ii) saleable granulated, prilled or other solid forms of carbamide (urea ($CO(NH_2)_{2(s)}$)).
3. The activity in subsection (2) is the ***urea production activity***.
4. The default emissions intensity is 0.566 t CO_2e per tonne of 100% equivalent carbamide.

7.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- reaction of carbon dioxide with anhydrous ammonia to create a carbamide solution;
- production of finished products through prilling, granulation etc.;
- product drying / conditioning, storage and despatch;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

7.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of the anhydrous ammonia feedstock;
- production of carbon dioxide;
- processes that do not occur within the facility;
- on-site electricity generation.

8. Ammonium phosphates

8.1. Production variable definition

1. Tonnes of 100% equivalent diammonium phosphate ($(NH_4)_2HPO_4$) and monoammonium phosphate ($(NH_4)H_2PO_4$) on a dry weight basis that is contained within ammonium phosphate products:
   (a) produced as part of carrying on the ammonium phosphate production activity at the facility; and
   (b) of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing either or both of diammonium phosphate and monoammonium phosphate through:
   (a) the chemical transformation phosphate rock to phosphoric acid (H_3PO_4); and
   (b) the chemical transformation of that phosphoric acid and anhydrous ammonia (NH_3) to produce either or both of diammonium phosphate ($(NH_4)_2H_2PO_4$) and monoammonium phosphate ($(NH_4)H_2PO_4$).
3. The activity in subsection (2) is the ***ammonium phosphate production activity***.
4. The default emissions intensity is:
   (a) 0.078 t CO_2-e per tonne of 100% equivalent diammonium phosphate; and
   (b) 0.088 t CO_2-e per tonne of 100% equivalent monoammonium phosphate.

8.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the mining and beneficiation of phosphate rock;
- the reaction of phosphate rock with sulphuric acid to create phosphoric acid;
- reaction of phosphoric acid and ammonia to produce ammonium phosphates;
- product drying / conditioning, storage and despatch;
- by-product (gypsum) handling and storage;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

8.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of the anhydrous ammonia feedstock;
- production of sulphuric acid used as in an input into the conversion of phosphate rock to phosphoric acid;
- production of ammonium phosphates using phosphoric acid imported from a source off-site;
- processes that do not occur within the facility;
- on-site electricity generation.

9. Sodium cyanide

9.1. Production variable definition

1. Tonnes of 100% equivalent sodium cyanide (NaCN) on a dry weight basis that is contained within sodium cyanide products:
   (a) produced as part of carrying on the sodium cyanide production activity at the facility; and
   (b) of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing sodium cyanide through all of the following processes:
   (a) the chemical transformation methane, anhydrous ammonia (NH_3) and air to produce hydrogen isocyanine (HCN);
   (b) electrolysis of sodium chloride (NaCl) solution to produce caustic soda (NaOH);
   (c) the chemical transformation of hydrogen isocyanine (HCN) and caustic soda produce sodium cyanide (NaCN).
3. The activity in subsection (2) is the ***sodium cyanide production activity***.
4. [The default emissions intensity is XX t CO_2-e per tonne of 100% equivalent sodium cyanide.]

9.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- production of hydrogen isocyanine;
- production of caustic soda;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all Scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

9.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of the anhydrous ammonia feedstock;
- upstream production of the hydrogen feedstock (such as natural gas extraction and distribution or synthesis gas production);
- processes that do not occur within the facility;
- on-site electricity generation.

10. Synthetic rutile

10.1. Production variable definition

1. Tonnes of synthetic rutile that:
   (a) has a titanium dioxide (TiO_2) concentration equal to or greater than 88% and less than 95.5%; and
   (b) has an iron (Fe) concentration greater than 0.5%; and
   (c) are produced as part of carrying on the synthetic rutile production activity at the facility; and
   (d) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing synthetic rutile through the chemical transformation of ilmenite ore (ore containing $FeTiO_3$) through the reduction of iron oxides in order to increase the titanium dioxide (TiO_2) concentration to produce synthetic rutile that:
   (a) has a titanium dioxide (TiO_2) concentration equal to or greater than 88% and less than 95.5%; and
   (b) has an iron (Fe) concentration greater than 0.5%.

   Note: The transformation described in subsection (2) is known as the Becher process.
3. The activity in subsection (2) is the ***synthetic rutile production activity***.
4. The default emissions intensity is 1.15 t CO_2-e per tonne of synthetic rutile.

10.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- oxidation process that involves heating the ilmenite in a rotary kiln with air to convert the iron in the ilmenite grains to iron(III) oxide;
- reduction process that involves further heating the oxidated ilmenite, with coal being used as reductant, in a rotary kiln to reduce the iron oxide in the mineral grains to metallic iron;
- aeration process that involves the removal of the metallic iron by rusting it out, commonly achieved in a continuously agitated tank that contain mile ammonium chloride solution with air being pumped through the tank;
- acid leaching process that involves removal of the remainder of iron oxide using mild sulfuric acid;
- mechanical handling and processing materials for the purpose undertaking the above processes;
- mineral separation process;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:

  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the facility or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity;
  - furnaces;
  - flaring; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the synthetic rutile production activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

10.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of the ilmenite feedstock, such as mining;
- upstream production materials that are used in the oxidation, reduction, aeration and acid leaching processes, such as mining of coal, production of ammonium chloride or sulfuric acid;
- downstream processing of the synthetic rutile into products, such as titanium dioxide pigment, with a purity of titanium dioxide that is higher than 99.5%;
- processes that do not occur within the facility;
- on-site electricity generation.

11. White titanium dioxide pigment

11.1. Production variable definition

1. Tonnes of white titanium dioxide (TiO_2) pigment that:
   (a) conforms with ASTM classification D476-00 (2011); and
   (b) has an iron (Fe) concentration greater than 0.5%; and
   (c) are produced as part of carrying on the white titanium dioxide pigment production activity at the facility; and
   (d) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing white titanium dioxide (TiO_2) pigment through the chemical transformation of 1 or more of the following:
   (a) rutile (TiO_2);
   (b) synthetic rutile (TiO_2);
   (c) ilmenite ($FeTiO_3$);
   (d) leucoxene; and
   (e) titanium slag that has an iron (Fe) concentration of greater than or equal to 7%;

   to produce white titanium dioxide (TiO_2) pigment.
3. The activity in subsection (2) is the ***white titanium dioxide pigment production activity***.
4. The default emissions intensity is 1.68 t CO_2-e per tonne of white titanium dioxide pigment.

11.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the reduction of inputs with carbon and oxidisation with chlorine to produce titanium tetrachloride;
- the distillation of titanium tetrachloride and re-oxidisation to produce white titanium dioxide pigment while re-generating chlorine for re-use;
- the use of machinery, equipment and processes for the chemical transformation described in the activity, including for example:
  - machinery used to move materials within and as part of the activity;
  - control rooms, laboratories maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - on-site processing of by-products and waste materials required to comply with Commonwealth, State or Territory obligations.
- waste heat recovery;
- production of nitrogen and oxygen consumed within the activity; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the white titanium dioxide pigment activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

11.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream production of rutile, synthetic rutile, ilmenite, titanium slag or leucoxene;
- production of hydrated titanium dioxide pigment (raw pigment) that is not further processed into saleable white titanium dioxide pigment;
- production of white titanium dioxide pigment that is produced from hydrated titanium dioxide pigment (raw pigment) that is not produced on site;
- processes that do not occur within the facility;
- on-site electricity generation.

Coal mining

12. Run of mine coal

12.1. Production variable definition

1. Tonnes of run-of-mine coal that is produced as part of carrying on the coal mining activity at the facility.

   Note: The coal may be sold with or without beneficiation.

2. The metric in subsection (1) is applicable to a facility that:

   (a) conducts the ***coal mining activity***; and

   (b) uses the ***coal mine waste gas*** production variable.

3. [The default emissions intensity is XX t CO_2-e per tonne of run-of-mine coal.]

Definition of coal mining activity

Where the activity of ***coal mining*** is the physical extraction of coal in an open-cut or underground coal mine.

12.2. Scope of the activity

Saleable coal is the primary output from a coal mine. In some cases, the run-of-mine (ROM) coal is the saleable product, while in other circumstances the ROM coal requires beneficiation. Therefore, ROM coal can be an output or intermediate product depending on the facility circumstances.

The production variable is for the production of coal from underground and open-cut mining processes. The scope of the production variable includes the processes required to extract the coal and to prepare for and undertake beneficiation.

Beneficiation can include:

- crushing so that the product coal is of relatively uniform size;
- washing and flotation to remove partings and lower ash content; and
- disposal of waste.

The production variable includes all development processes required to allow extraction of the coal, including development of new mining areas through the life of the facility. This includes land clearing, removal and storage of topsoil for later use, and rehabilitation of mined areas that occurs during the continued operation of the mine.

Coal is mined from both open-cut and underground mines, based on the physical characteristics of the mine geology and the most economically efficient mining method. Both open-cut and underground mining may be used for any particular coal seam, and separate seams mined at a single facility. Both mining methods are covered by this production variable.

Fugitive coal mine waste gas

Emissions from coal mine waste gas are excluded from the production variable. A coal mine waste gas production variable is available to provide a baseline component for fugitive emissions.

Open-cut mining of coal

Open-cut mining includes all forms of extraction that are not conducted underground. Open-cut mining involves the removal and storage of overburden and interburden material to allow access to the production coal seams. The overburden, interburden and coal are mined using drill and blasting techniques to break up the materials to allow extraction. Mining equipment includes draglines, hydraulic shovels, excavators, haul trucks, earth moving equipment and conveyor systems.

The primary source of scope 1 emissions is the combustion of liquid fuel – usually diesel – used in hydraulic shovels, excavators, bulldozers, haul trucks, drilling rigs and stationary diesel engines used for water management, electricity generation, and sometimes in-pit or primary ROM crushing. Major equipment items such as draglines commonly use electric power.

Emissions from blasting include the oxidation of hydrocarbons (diesel) mixed with other materials, usually ammonium nitrate, to generate the explosive reaction.

During the life of the mine, waste material will require multiple movements as the mine plan evolves. All movement of waste material within the facility is covered by the production variable.

The movement of coal within the mine may involve temporary storage intended to provide buffering for the crushing and beneficiation process and short-term storage of saleable coal (either ROM or washed coal) prior to shipment. Washery tailings are usually stored in a tailings pond.

As mining is completed in different parts of the facility the mined area is rehabilitated by profiling the surface to a finished level, replacing topsoil, and revegetation. The emissions from rehabilitation are included in the production variable.

Underground mining of coal

Underground mining, like open-cut mining, requires significant activity to prepare for the extraction of coal. Shallow underground mines may include the development of an access ramp allowing vehicles to access the underground mining areas for haulage of coal and waste material (during development) to the surface. Deeper mines would generally be developed with one or more vertical shafts to lift coal and possibly waste material (during development) to the surface. Underground mines also include vertical shafts for ventilation including powerful ventilation fans, and sometimes cooling water supply and other services such as electricity and communications.

Different mining techniques can be employed underground depending on the characteristics of the mine geology. The most common techniques are long-wall mining and continuous mining. In each case the primary mining equipment is electrically operated. There is minimal waste material during normal mining operations. Waste material is, when possible, left underground as backfill of previous voids. Coal, and waste when required, is brought to the surface for treatment (coal) or storage (coal and waste).

The primary source of scope 1 emissions from underground mining is from the combustion of liquid fuel – usually diesel – used in underground vehicles, haul trucks, and drilling rigs when access ramps are available, stationary engines used for water management, electricity generation and sometimes underground primary ROM crushing. Emissions from blasting will occur.

Beneficiation of ROM coal

A coal preparation plant (CPP; also known as a coal handling and preparation plant (CHPP), coal handling plant, prep plant, tipple or wash plant) is a facility that washes coal of soil and rock, crushes it into graded sized chunks (sorting), stockpiles grades preparing it for sale.

Measurement of ROM coal

The output of the activity is defined as tonnes of ROM coal, that is coal that is produced in the mining operations before screening, crushing or preparation of the coal has occurred. The measurement of this output is expected to be based on company records of the quantity of ROM coal mined and received for beneficiation or sale. The measurement of the output for the issue of a baseline is by tonne of ROM coal that is suitable to be: further processed on-site (or transferred to another facility) to produce a saleable product; or sold directly from the facility, where the coal was mined.

Mine rehabilitation

Rehabilitation for an individual mine or part of a mine may occur at a facility while other parts of the mine continue in operation, or at the end of life of the facility. The rehabilitation that occurs during the continued operation of the mine are included in the production variable. End of mine life rehabilitation is not included in the production variable.

12.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of on-site machinery, equipment and processes for the extraction and treatment of the ore described in the activity definition, including, for example:
    - machinery used to:
        - prepare and remove topsoil and overburden to allow mining of ore;
        - develop underground access roadways;
        - install equipment required to move materials;
        - allow drainage of coal mine waste gas;
    - machinery used to move materials within the facility, including mobile equipment;
    - control rooms, laboratories, maintenance workshops;
    - machinery used to create non-electrical energy for use in the activity;
    - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
    - on-site processing of waste materials from the activity;

- beneficiation of coal including:
  - crushing to size the coal;
  - washing to remove waste material;
  - sorting by coal quality;
- the supply of utilities such as, but not limited to, compressed air, cooling and water where these are used in support of the activity and within the facility;
- the regeneration of any solvents used within the activity;
- the storage and loading of the saleable coal into a medium of transportation such as trucks or rail trains;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

12.4. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- on-site electricity generation;
- processes that are included in the definition of another production variable, such as fugitive emissions from coal mine waste gas (CMWG); and
- processes that do not occur within the facility.

13. Coal mine waste gas

13.1. Production variable definition

1. Tonnes of CO_2-e of unmitigated coal mine waste gas generated at the facility as part of carrying on the coal mining activity at the facility.

   Note: This includes pre-mine drainage, mining phase activities and post mining activities creating coal mine waste gas in the relevant reporting period.

2. The metric in subsection (1) is applicable to a facility that:

   (a) conducts the coal mining activity; and

   (b) uses the ***run-of-mine coal*** production variable.

3. [The default emissions intensity is XX t CO_2-e per t CO_2-e of unmitigated coal mine waste gas.]

4. The t of CO_2-e of unmitigated coal mine waste gas generated must be measured consistently with the NGER (Measurement) Determination.

Definition of coal mine waste gas

Where ***coal mine waste gas*** means a substance that:

- consists of:
  - naturally occurring hydrocarbons; or
  - a naturally occurring mixture of hydrocarbons and non-hydrocarbons; and
- is:
  - drained from:
    - a coal mine that is covered by a lease (however described) that authorises coal mining; or
    - a closed coal mine that is, or was, covered by a lease (however described) that authorises, or authorised, coal mining; or
  - conveyed in a ventilation air shaft or duct to the surface of a mine mentioned in subparagraph (i).

Emissions-intensity calculation method

The method to allocate a baseline for fugitive emissions from an operating mine is to multiply the amount of fugitive emissions generated by a factor that represents a proportion to be captured and destroyed. Under this approach, fugitive emissions can be considered the 'production variable' and the factor representing the amount to capture and destroy the 'emissions intensity'. This is an alternate approach to an output-based production variable because fugitive emissions are a waste stream (although some fugitive emissions captured can be sold as natural gas of saleable quality), not a final output or intermediate product, so the conventional meaning of emissions intensity cannot apply.

This alternative approach achieves a similar outcome to the standard method of allocating baselines: [amount of coal mine waste gas generated: "production"] x [factor representing amount to capture and destroy: "emissions intensity"]

The default emissions intensity is worked out as 1 – default capture rate, where this rate is calculated as the ratio of the amount of methane in CMWG destroyed to the amount generated.

13.2. Scope of the activity

The variable that is equivalent to the production variable is coal mine waste gas generated in the relevant reporting period as part of the extraction of coal from underground and open-cut mining processes. The scope of the variable includes all sources of fugitive emissions:

- surface in-seam pre-mining drainage;
- underground in-seam pre-mining drainage;
- drainage of waste coal mine gas from the goaf (the mined area of an underground mine);
- waste coal mine gas entrained in ventilation air (VAM), excluding naturally occurring CO_2 and emissions from fuels combusted underground;
- fugitive emissions from post-mining storage of coal from an underground mine where the average annual percentage of methane in VAM exceeds 0.1%; and
- fugitive emissions from the extraction of coal from an open-cut mine.

The default CMWG capture rate takes into account all methods used for the destruction (beneficial or otherwise) of waste coal mine gas including but not limited to:

- combustion in a flare;
- combustion in a generator to produce electricity;
- combustion in a boiler;
- catalytic combustion (or similar) of VAM; and
- sale of waste coal mine gas that is of saleable quality.

CMWG generated and CMWG captured are measured in accordance with the methods described in the NGER (Measurement) Determination authorised for use in each reporting period.

Measurement of CMWG

The output metric of the activity is defined as tonnes of coal mine waste gas generated from mining processes at the facility during the reporting period expressed in t CO_2-e before any emission abatement or transfer processes. The amount of CMWG is estimated in accordance with the methods described in the NGER (Measurement) Determination authorised for use in each reporting period. Measurement and records of CMWG generated is as required by the methods described in the NGER (Measurement) Determination authorised for use in the reporting period.

13.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- CMWG emissions.

13.4. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes that are included in the definition of another production variable, including the ROM coal production variable;
- processes that do not occur within the facility;
- on-site electricity generation; and
- CMWG from a decommissioned underground mine.

14. Fugitive emissions at a decommissioned coal mine

14.1. Production variable definition

1. Tonnes of CO_2-e emissions reported under Division 3.2.4 of the NGER (Measurement) Determination for the facility.
2. The metric in subsection (1) is applicable to a facility that is a decommissioned underground mine.
3. The default emissions intensity is 1 t CO_2-e per t CO_2-e of reported emissions.
4. The t of CO_2-e of emissions must be measured consistently with the NGER (Measurement) Determination.

Definition of decommissioned underground mine

Where ***decommissioned underground mine*** means an underground coal mine where the following activities have ceased to occur and are not expected to occur in the future:

- coal production;
- active mine ventilation, including the operation of ventilation fans at the mine.

Emissions-intensity calculation method

The method to allocate a baseline for fugitive emissions at a decommissioned coal mine is for the baseline to equal the amount of fugitive emissions reported by the facility. This is achieved by multiplying the amount of fugitive emissions generated at the decommissioned mine by 1. Under this approach, fugitive emissions can be considered the 'production variable' and the factor of 1 the 'emissions intensity'. This is an alternative approach to using an output-based production variable because fugitive emissions are a waste stream, not a final output or intermediate product, so the correct interpretation of emissions intensity does not apply. This approach also recognises that the fugitive emissions at a decommissioned coal mine cannot be mitigated by a facility in a reporting sense, as they are reported on the basis of a decay curve based on the emissions in the final year of operation.

This alternative approach achieves a similar outcome to the standard method of allocating baselines: [amount of CMWG generated at the decommissioned mine: "production"] x [1: "emissions intensity"].

The metric for fugitive emissions at a decommissioned coal mine is applicable to a facility that is (or includes) a decommissioned underground coal mine on-site. The default 'emissions intensity' is 1.0 t CO_2-e per tonne of fugitive emissions for the decommissioned underground coal mine.

14.2. Scope of the activity

This production variable is intended to provide a baseline equal to the reported fugitive emissions from a decommissioned coal mine.

The NGER (Measurement) Determination provides methods to report coal mine waste gas (CMWG) emissions for decommissioned underground coal mines that are dependent on the

level of fugitive emissions prior to decommissioning, and decrease over time. The appropriate method should be used.

Measurement of fugitive emissions from decommissioned mines

The output of the activity is defined as tonnes of fugitive coal mine waste gas estimated in accordance with the methods described in the NGER (Measurement) Determination authorised for use in each reporting period.

14.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the fugitive emissions as estimated by the applicable NGER method for decommissioned underground coal mines.

14.4. Exclusions

Scope 1 emissions excluded from the prescribed production variable for fugitive emissions from decommissioned mines are those not reported as fugitive emissions from a decommissioned underground coal mine.

Iron ore mining

15. Iron ore

15.1. Production variable definition

1. Tonnes of iron ore, on a wet basis, that:
   (a) is produced as part of carrying on the iron ore mining activity at the facility; and
   (b) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of mining iron ore through:
   (a) the physical extraction of mineral ores that contain iron ore metal; and
   (b) the processing of the extracted ores to produce an iron ore product of saleable quality.

   Note: The processes may include crushing, screening, grinding, separation, concentrating, filtration and waste to tailings.
3. The activity in subsection (2) is the ***iron ore mining activity***.
4. [The default emissions intensity is XX t CO_2-e per tonne of iron ore.]

15.2. Scope of the activity

Hematite ore is the most common oxide mineral form requiring limited processing including crushing and screening. Magnetite ore requires additional processing to remove impurities. Magnetite ore processing leads to a concentrate.

The production variable includes all development processes required to allow extraction of the iron ore, including development of new mining areas through the life of the facility. This includes land clearing and removal and storage of topsoil for later use.

Iron ores are presently mined from open-cut mines in Australia. This production variable would apply to underground mines should they be developed.

Open-cut mining of iron ore

Open-cut mining involves the removal and storage of overburden material that allows access to the iron ore. The overburden and ore are mined using drill and blasting techniques to break up the materials to allow extraction, usually via excavator loading into trucks.

Dewatering is a significant activity at mines that are below the natural water table.

The primary source of scope 1 emissions is the combustion of liquid fuel – usually diesel – used in excavators, bulldozers, haul trucks, drilling rigs and stationary diesel engines used for water management, electricity generation, and sometimes in-pit or primary ROM crushing.

Emissions from blasting include the oxidation of hydrocarbons mixed with other materials, usually ammonium nitrate, to generate the explosive reaction.

During the life of the mine, material may require multiple movements as the mine plan evolves. All movement of waste material within the facility is covered by the production variable.

The hauling of ore for treatment may involve temporary storage intended to provide buffering for the milling process, or for longer-term storage of lower grade ores for later blending or treatment, often at the end of the mine life.

Underground mining of iron ore

Underground mining, like open-cut mining, requires significant activity to prepare for the extraction of ore for treatment. Shallow underground mines may include the development of an access ramp allowing vehicles to access the underground mining areas for haulage of ore and possibly waste to the surface. Deeper mines would generally be developed with one or more vertical shafts to lift ore and possibly waste material to the surface. Underground mines would also include vertical shafts for ventilation, and sometimes cooling water supply and other services such as electricity and communications.

Different mining techniques can be employed underground depending on the characteristics of the ore body. All involve drilling, blasting and movement of any waste required to access the ore. Waste material is, when possible, left underground as backfill of previous voids. Ore, and waste when required, is brought to the surface for treatment (ore) or storage (ore and waste).

The primary source of scope 1 emissions from underground mining is from the combustion of liquid fuel – usually diesel – used in underground vehicles, haul trucks, and drilling rigs when access ramps are available, stationary engines used for water management, electricity generation and sometimes underground primary ROM crushing. Emissions from blasting will occur.

Processing of iron ore

Some iron ore mines require limited or no additional processing. Crushing, screening to separate waste material and ore into fines and lumps for sale and washing. Large material may undergo further crushing and return to the separation process.

Other iron ore mines may require more significant processing which could include crushing, grinding, separation and filtration to produce a concentrate for sale with waste going to a tailings facility.

The processing of iron ore is primarily electrically driven machinery. Scope 1 emissions are primarily related to ore and material handling processes.

Measurement of saleable iron ore

The output of the activity is defined as tonnes of saleable iron ore. The measurement of this output is expected to be based on records of the quantity of saleable iron ore produced, measured on a wet basis (for magnetite concentrate measurement would occur after dewatering) using calibrated instruments or other industry standards as applicable. Evidence of the measurement may include third party transport bill of lading records or internal company production records. The measurement of the production variable is by tonne of saleable iron ore that is produced at the facility where the iron ore was mined.

Mine rehabilitation

Rehabilitation for individual mines may occur at a facility while other mines are operated, or at the end of life of the facility. The rehabilitation which occurs during the continued operation of the mine are included in the production variable. End of mine life rehabilitation is not included in the production variable.

15.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of on-site machinery, equipment and processes for the extraction and treatment of the ore to produce the iron ore product at the facility described in the activity definition, including, for example:
  - machinery used to:
    - prepare and remove topsoil and overburden to allow mining of ore;
    - develop underground access pathways;
    - dewater mine areas;
    - install equipment required to move materials;
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - on-site processing of waste materials;
- the treatment of mined iron ore to size and separate iron ore from waste materials, including:
  - crushing, grinding, screening and filtration to separate waste material and appropriately size material for sale or further processing;
  - washing of ore;
  - mineral recovery processes intended to return iron ore to the crushing and screening process;
- the supply of utilities such as, but not limited to, compressed air, cooling and water where these are used in support of the activity and within the facility;
- drilling and blasting using explosives and other equipment;
- the storage and loading of the iron ore product into a medium of transportation such as trucks or rail trains;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;

- complementary processes, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility which is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

15.4. Exclusions

Scope 1 emissions from the following processes were not included in the calculation of the default emissions intensity for the iron ore prescribed production variable:

- on-site electricity generation; and
- processes that do not occur within the facility.

Other mining

16. Manganese ore

16.1. Production variable definition

1. Tonnes of manganese ore product, on a wet basis, that:
   (a) is produced as part of carrying on the manganese ore mining activity at the facility; and
   (b) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of mining manganese ore through:
   (a) the physical extraction of mineral ores that contain manganese metal; and
   (b) the processing of the extracted ores by crushing and separation into a manganese ore product.
3. The activity in subsection (2) is the ***manganese ore mining activity***.
4. [The default emissions intensity is XX t CO_2-e per tonne of manganese ore product.]

16.2. Scope of the activity

Manganese ore is mined in open-cut mines and undergoes crushing, screening and washing.

The production variable includes all development processes required to allow extraction of the manganese ore, including development of new mining areas through the life of the facility. This includes land clearing and removal and storage of topsoil for later use.

Open-cut mining of manganese ore

Open-cut mining involves the removal and storage of overburden material that allows access to the iron ore. The overburden and ore are mined using drill and blasting techniques to break up the materials to allow extraction, usually via excavator loading into trucks.

The primary source of scope 1 emissions is liquid fuel – usually diesel – used in excavators, bulldozers, haul trucks and stationary engines used for drilling, water management, and sometimes in-pit crushing.

Emissions from blasting include the oxidation of hydrocarbons mixed with other materials, usually ammonium nitrate, to generate the explosive reaction.

During the life of the mine, movement of waste material may require multiple movements as the mine plan evolves. All movement of waste material within the facility is covered by the production variable.

The hauling of ore for treatment may involve temporary storage intended to provide buffering for the milling process, or longer-term storage of lower grade ores for later blending or treatment, often at the end of the mine life.

Processing of manganese ore

Manganese ore mines require limited processing with some ore exported directly without processing. Crushing and the separation via screening of ore by fines and lump ore and removal of waste clay material by washing and gravity and cyclonic separation techniques.

The processing of manganese ore is primarily electrically driven machinery. Scope 1 emissions are limited to ore handling processes.

Measurement of saleable manganese

The output of the activity is defined as tonnes of saleable manganese. The measurement of this output is expected to be based on records of the quantity of saleable manganese measured on a wet basis using calibrated instruments or other industry standards as applicable. Evidence of the measurement may include third party transport bill of lading records or internal company production records. The measurement of the output for the issue of a baseline is by tonne of saleable manganese that is produced: at the facility; or transported away from the facility, where the manganese ore was mined.

Mine rehabilitation

Rehabilitation for individual mines may occur at a facility while other mines are operated, or at the end of life of the facility. The rehabilitation which occurs during the continued operation of the mine are included in the production variable. End of mine life rehabilitation is not included in the production variable.

16.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of on-site machinery, equipment and processes for the extraction and treatment of the ore described in the activity definition, including, for example:
  - machinery used to:
    - prepare and remove topsoil and overburden to allow mining of ore;
    - dewatering of mine areas;
    - install equipment required to move materials;
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - on-site processing of waste materials from the;
- the treatment of mined manganese ore to size and separate manganese ore from waste materials, including:
  - crushing to produced fines and lumps of required size;
  - washing process and separation processes for removal of waste material.
- the supply of utilities such as, but not limited to, compressed air, cooling and water where these are used in support of the activity and within the facility;

- drilling and blasting using explosives and other equipment;
- the storage and loading of the iron ore product into a medium of transportation such as trucks or rail trains;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

16.4. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- on-site electricity generation; and
- processes that do not occur within the facility.

17. Bauxite

17.1. Production variable definition

1. Tonnes of bauxite product that:
   (a) is suitable as a feedstock for refining to produce alumina; and
   (b) is produced as part of carrying on the bauxite mining activity at the facility; and
   (c) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of mining bauxite through:
   (a) the physical extraction of aluminium ores such as such as gibbsite ($Al(OH)_3$), boehmite (γ-Aloo(OH)) and diaspore (α-AlO(OH)); and
   (b) the processing of the extracted ores by crushing and separation into a bauxite product.
3. The activity in subsection (2) is the ***bauxite mining activity***.
4. [The default emissions intensity is XX t CO_2-e per tonne of bauxite product.]

17.2. Scope of the activity

The production variable includes all development processes required to allow extraction of the bauxite, including development of new mining areas through the life of the facility. This includes land clearing and removal and storage of topsoil for later use.

Bauxites are presently mined by open-cut strip mining of shallow deposits.

Open-cut mining of bauxite

Open-cut mining involves the removal and storage of overburden material that allows access to the bauxite. The overburden is removed using truck and shovel techniques, with drill and blast only required when a substantial caprock layer is present. The bauxite is then extracted via excavator loading into trucks.

The primary source of scope 1 emissions is the combustion of liquid fuel – usually diesel – used in excavators, bulldozers, haul trucks, drilling rigs and stationary diesel engines used for water management, electricity generation, and sometimes in-pit or primary ROM crushing.

Emissions from blasting include the oxidation of hydrocarbons mixed with other materials, usually ammonium nitrate, to generate the explosive reaction.

During the life of the mine, material may require multiple movements as the mine plan evolves. All movement of waste material within the facility is covered by the production variable.

The hauling of ore for treatment may involve temporary storage intended to provide buffering for the separation process, or for longer-term storage of lower grade ores for later blending or treatment.

Processing of bauxite

Some bauxite mines require limited or no additional processing. Crushing, washing and screening to separate waste material and bauxite for sale

The processing of bauxite is primarily electrically driven machinery. Scope 1 emissions are limited to ore handling processes.

Measurement of saleable bauxite

The output of the activity is defined as tonnes of saleable bauxite suitable as a feedstock for processing into alumina. The measurement of this output is expected to be based on records of the quantity of saleable bauxite produced, measured using calibrated instruments or other industry standards as applicable. Evidence of the measurement may include third party transport bill of lading records or internal company production records. The measurement of the output for the issue of a baseline is by tonne of saleable bauxite suitable as a feedstock for processing into alumina: at the facility; or transported away from the facility, where the bauxite was mined.

Mine rehabilitation

Rehabilitation for individual mines may occur at a facility while other mines are operated, or at the end of life of the facility. The rehabilitation that occurs during the continued operation of the mine are included in the production variable. End of mine life rehabilitation is not included in the production variable.

17.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of on-site machinery, equipment and processes for the extraction and treatment of the ore described in the activity definition, including, for example:
    - machinery used to:
        - prepare and remove topsoil and overburden to allow mining of ore;
        - install equipment required to move materials;
    - machinery used to move materials within the facility, including mobile equipment;
    - control rooms, laboratories, maintenance workshops;
    - machinery used to create non-electrical energy for use in the activity;
    - on-site processing of waste materials from the activity;
- the treatment of mined bauxite to size and separate bauxite from waste materials, including:
    - crushing;
    - washing and screening to separate waste material;
    - mineral recovery processes intended to return bauxite to the crushing and screening process;

- the supply of utilities such as, but not limited to, compressed air, cooling and water where these are used in support of the activity and within the facility;
- the storage and loading of the bauxite product into a medium of transportation such as trucks or rail trains;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

17.4. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- on-site electricity generation; and
- processes that do not occur within the facility.

18. Heavy metal concentrate

18.1. Production variable definition

1. Tonnes of heavy metal concentrate, on a wet basis, that:
   (a) is suitable as a feedstock for a mineral separation process; and
   (b) is produced as part of carrying on the mineral sands mining activity at the facility; and
   (c) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of mining mineral sands through:
   (a) the physical extraction of mineral sands such as such as such as ilmenite, zircon, rutile, leucoxene and monazite; and
   (b) the processing of the extracted mineral sands by crushing and separation into a heavy metal concentrate.
3. The activity in subsection (2) is the ***mineral sands mining activity***.
4. [The default emissions intensity is XX t CO_2-e per tonne of heavy metal concentrate.]

18.2. Scope of the activity

The term 'mineral sands' refers to ores containing heavy minerals including ilmenite, rutile, leucoxene, and zircon. Ilmenite, leucoxene, and rutile are titanium bearing minerals used mainly as feedstock for the production of titanium dioxide pigments. Zircon is a zirconium bearing mineral used for the manufacture of ceramics and refractories and in a range of industrial and chemical applications. Monazite is a rare earth bearing mineral found within heavy mineral sand deposits in Australia. Monazite is rich in thorium and is not widely exploited in Australia due mainly to the very limited market for monazite.

Mining of mineral sands ores is carried out either by dry mining methods or wet dredging techniques. Dry mining methods utilise heavy machinery such as scrapers to collect and transport ore located above the water table into a hopper for subsequent processing. Dry mining methods generate significant scope 1 emissions from fuel use.

Dredge mining, or wet mining, is best suited to ore reserves below the water table. Dredging involves cutting the ore under the surface of a pond and using a bucket well and suction to pump the ore in slurry form to a concentrator for separation and processing. Wet mining is primarily electricity based.

The ore is then transported (in slurry form) to a concentrator plant for separation and processing.

The production variable includes all development processes required to allow extraction of the mineral sands, including development of new mining areas through the life of the facility. This includes land clearing and removal and storage of topsoil for later use.

Mining of mineral sands

The primary source of scope 1 emissions is the combustion of liquid fuel – usually diesel – used in excavators, bulldozers, haul trucks, drilling rigs and stationary diesel engines used for

dredging and water management, electricity generation, and sometimes in-pit or primary ROM crushing.

During the life of the mine, material may require multiple movements as the mine plan evolves. All movement of waste material within the facility is covered by the production variable.

The hauling of mineral sands for treatment may involve temporary storage intended to provide buffering for the concentrating process.

Processing of mineral sands

Water is added to the mineral sands to wash the slurry through a series of spiral separators that use gravity to separate the heavy mineral sands from lighter quartz sand, rock and clay. The slurry is primary separation process step is the production of a heavy mineral concentrate (HMC) using a wet gravity separation technique. The ore is washed through a series of spiral separators that utilise sizing and gravity differentiation to separate the heavy minerals from the accompanying clay, quartz sand and rock. The concentrate obtained from this process contains a mix of valuable heavy minerals as well as other non-valuable heavy mineral components and waste. The separation process produces mineral concentrate.

The heavy metal concentrate undergoes secondary processing to separate the individual minerals. Secondary processing to separate minerals is primarily an electrically driven process. This secondary processing is not included within this production variable.

Measurement of saleable heavy metal concentrate

The output of the activity is defined as tonnes of saleable heavy metal concentrate product suitable as a feedstock for mineral separation processes measured on a wet basis. The measurement of this output is expected to be based on records of the quantity of saleable heavy metal concentrate measured on a wet basis using calibrated instruments or other industry standards as applicable. Evidence of the measurement may include third party transport bill of lading records or internal company production records. The measurement of the production variable is by tonne of saleable heavy metal concentrate suitable as a feedstock for mineral separation processes: at the facility; or transported away from the facility.

Mine rehabilitation

Rehabilitation for individual mines may occur at a facility while other mines are operated, or at the end of life of the facility. The rehabilitation that occurs during the continued operation of the mine are included in the production variable. End of mine life rehabilitation is not included in the production variable.

18.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of on-site machinery, equipment and processes for the extraction by dry mining methods and treatment of the mineral sands described in the activity definition, including, for example:
    - machinery used to:

    - prepare and remove topsoil and overburden to allow mining of mineral sands;
    - install equipment required to move materials;
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - on-site processing of waste materials from the activity;
- the treatment of mined mineral sands to separate mineral sands from waste materials to form a heavy metal concentrate, including:
  - washing and screening to separate waste material;
  - mineral recovery processes intended to return mineral sands to the separation process;
- the supply of utilities such as, but not limited to, compressed air, cooling and water where these are used in support of the activity and within the facility;
- the storage and loading of the heavy metal concentrate product into a medium of transportation such as trucks or rail trains;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

18.4. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- on-site electricity generation;
- secondary processing of heavy metal concentrate to separate the individual minerals; and
- processes that do not occur within the facility.

19. Run of mine metal ore

19.1. Production variable definition

1. Tonnes of run-of-mine metal ore that:
   (a) contains 1 or more metals; and
   (b) is produced as part of carrying on the metal ore mining and processing activity at the facility; and
   (c) is of saleable quality; and
   (d) has not been counted, in whole or part, for another production variable at the facility; and
   (e) is not eligible to be the bauxite, manganese ore or iron ore prescribed production variable.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of mining and processing metal ore through:
   (a) the physical extraction of mineral ores containing metals; and
   (b) the processing of the extracted ores to produce a metal product or feedstock material.
3. The activity in subsection (2) is the ***metal ore mining and processing activity***.
4. [The default emissions intensity is XX t CO_2-e per tonne of run-of-mine metal ore.]

19.2. Scope of the activity

The production variable is run-of-mine metal ore, however the activity includes not just the processes required to extract the ore, but also those for on-site processing of the ore, such as into metal concentrates and bars. Processing can include:

- metal ores produced via a pyrometallurgical process from sulphate ores. Metal concentrate is produced at most metal sulphate mines and subsequently used as a feedstock for smelters to produce metals (smelting is excluded from the activity);
- alternative processing techniques, such as heap leaching and solvent extraction or electrowinning can be used for low grade metal ores, resulting in direct metal production.

If the processed outputs meet the definitions of other production variables, then the ROM metal ore production variable is not applicable, such as iron ore or bauxite.

The production variable includes all development processes required to allow extraction of the metal bearing ore, including development of new mining areas through the life of the facility. This includes land clearing and removal and storage of topsoil for later use.

Metal ores are mined from both open-cut and underground mines, based on the physical characteristics of the mine and the most economically efficient mining method. Both open-cut and underground mining may be used for any particular ore body, and separate ore bodies mined at a single facility. Both mining methods are covered by this production variable.

Open-cut mining of metal ore

Open-cut mining involves the removal and storage of overburden material to allow access to the metal bearing ore. The overburden and ore are mined using drill and blasting techniques to break up the materials to allow extraction, usually via excavator loading into trucks.

The primary source of scope 1 emissions is the combustion of liquid fuel – usually diesel – used in excavators, bulldozers, haul trucks, drilling rigs and stationary diesel engines used for water management, electricity generation, and sometimes in-pit or primary ROM crushing.

Emissions from blasting include the oxidation of hydrocarbons mixed with other materials, usually ammonium nitrate, to generate the explosive reaction.

During the life of the mine, waste material may require multiple movements as the mine plan evolves. All movement of waste material within the facility is covered by the production variable.

The hauling of ore for treatment may involve temporary storage intended to provide buffering for the milling process, or for longer-term storage of lower grade ores for later blending or treatment, often at the end of the mine life.

Underground mining of metal ore

Underground mining, like open-cut mining, requires significant activity to prepare for the extraction of ore for treatment. Shallow underground mines may include the development of an access ramp allowing vehicles to access the underground mining areas for haulage of ore and possibly waste to the surface. Deeper mines would generally be developed with one or more vertical shafts to lift ore and possibly waste material to the surface. Underground mines would also include vertical shafts for ventilation, and sometimes cooling water supply and other services such as electricity and communications.

Different mining techniques can be employed underground depending on the characteristics of the ore body. All involve drilling, blasting and movement of any waste required to access the ore. Waste material is, when possible, left underground as backfill of previous voids. Ore, and waste when required, is brought to the surface for treatment (ore) or storage (ore and waste).

The primary source of scope 1 emissions from underground mining is from the combustion of liquid fuel – usually diesel – used in underground vehicles, haul trucks, and drilling rigs when access ramps are available, stationary engines used for water management, electricity generation and sometimes underground primary ROM crushing. Emissions from blasting will occur.

Processing of metal ore via grinding, separation and flotation

Grinding of hard rock ore may require multiple stages to reduce the particle size of mineral ore to a required size to allow formation of metal grains in a slurry prior to beneficiation by flotation. Grinding is generally electrically driven.

The flotation process involves the addition of chemical flocculant such as xanthates to increase the hydrophobic properties of the metallic mineral grains to separate the metal from the water slurry. Compressed air injection or other mixing processes are used to form air bubbles that capture the hydrophobic mineral grains and rise to the surface, forming a froth. The froth is mechanically removed, producing a concentrate of the metal mineral. The waste materials

are sent to a tailings dam for storage. The flotation and separation process are generally electrically driven.

The collected metal mineral slurry from the flotation process are sent to a hydrocyclone to thicken the slurry by reducing the water content. Hydraulic presses may then be used to further dry the metal concentrate.

Processing of metal ore via leaching

Various leaching options are available for metal extraction including chemical and biological leaching. The majority of emissions expected to be covered by this production variable will result from the mining rather than processing processes.

Measurement of ROM metal ore

The output of the activity is defined as tonnes of ROM metal ore, that is, ROM metal ore produced by mining operations that is suitable for (or has been through) primary crushing. The measurement of this output is expected to be based on company records of the quantity of ROM ore mined or other industry measurement standards as applicable. The measurement of the output for the issue of a baseline is by tonne of ROM that is produced, which is suitable for: processing into concentrate, metal bar or other feedstock at the facility; or transportation away from the facility.

Mine rehabilitation

Rehabilitation for an individual mine or part of a mine may occur at a facility while other parts of the mine continue in operation, or at the end of life of the facility. The rehabilitation that occurs during the continued operation of the mine are included in the production variable. End of mine life rehabilitation is not included in the production variable.

19.3. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of on-site machinery, equipment and processes for the extraction and treatment of the ore described in the activity definition, including, for example:
    - machinery used to:
        - prepare and remove topsoil and overburden to allow mining of ore;
        - develop underground access roadways;
        - dewatering mine areas;
        - install equipment required to move materials.
    - machinery used to move materials within the facility, including mobile equipment;
    - control rooms, laboratories, maintenance workshops;
    - machinery used to create non-electrical energy for use in the activity;
    - machinery used to generate electricity that is not reported as electricity production in an NGER report;
    - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;

  - on-site processing of waste materials from the activity;
- the treatment of mined ore to separate metal bearing ore from waste materials and concentrating one or more metals that are subsequently contained in a solution form predominantly containing metal, including:
  - crushing and grinding to produce a fine mineral slurry;
  - flotation, leaching and adsorption process that separates the metal bearing ore from the waste material;
  - thickening of metal containing slurry to reduce water content;
  - electrochemical processes to separate metal species from a flocculant used in an adsorption process;
  - drying and preparation for transport of metal concentrate;
  - drying of pregnant eluate and preparation for a furnace;
  - smelting the metals and setting in metal bars;
  - mineral recovery processes intended to return metal ore to the flotation circuit.
- Alternative treatment processes that produce metal in a solution including:
  - heap leaching & insitu leaching involving chemical or acid reagents;
  - pressurised vessel leaching involving chemical or acid reagents;
  - bio-leaching using microbes to extract the metal from the ore;
- waste heat recovery within the activity;
- drilling and blasting using explosives and other equipment;
- the supply of utilities such as, but not limited to, compressed air, cooling and water where these are used in support of the activity and within the facility;
- the regeneration of any solvents used within the activity;
- the storage and loading of the metal concentrate into a medium of transportation such as trucks or rail trains;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

19.4. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- on-site electricity generation; and
- processes that do not occur within the facility.

Oil and gas

20. Extracted oil and gas hydrocarbon

20.1. Production variable definition

1. Total gigajoules of the following products which meet the requirements of subsection (2):
   (a) unprocessed natural gas;
   (b) unstabilised crude oil and condensate.
2. The requirements for products to be included in subsection (1) are that the products:
   (a) consist of
      (i) naturally occurring hydrocarbons; or
      (ii) a naturally occurring mixture of hydrocarbons and non-hydrocarbons; and
   (b) are extracted from a naturally occurring petroleum reservoir or other unconventional natural source as part of carrying on the oil and gas extraction activity at the facility; and
   (c) at the time of measurement for the production variable, have undergone minimal or partial processing which is either:
      (i) sufficient only to allow efficient transportation of the product to processing facilities; or
      (ii) less than required to be considered processed natural gas or saleable crude oil or condensate; and
   (d) are not consumed in carrying on the oil and gas extraction activity.
3. The metric in subsection (1) is applicable to a facility that conducts the activity of oil and gas extraction through the production of a hydrocarbon stream from a natural petroleum reservoir or an unconventional natural source, such as a coal seam, and either:
   (a) transports the produced stream of products covered by subsection (1) to the upstream boundary of a separate facility that conducts one of more of the following activities;
      (i) natural gas processing;
      (ii) LNG production;
      (iii) crude oil or condensate stabilisation; or
   (b) transfers the products covered by subsection (1) to downstream processes within the same facility to produce multiple products.
4. The activity in subsection (3) is the ***oil and gas extraction activity***.
5. [The default emissions intensity is XX t CO_2-e per gigajoule of products covered by subsection (1).]

20.2. Scope of the activity

The extraction of unprocessed natural gas and unstabilised crude oil and/or condensate is the production of a fluid stream from a naturally occurring petroleum reservoir or an unconventional natural gas source, that may contain gas, crude oil, condensate, natural gas liquids and non-hydrocarbon components, in a gaseous, liquid and/or mixed liquid and gaseous state, and may include transportation of the fluid stream to a facility or facilities for processing.

The produced stream may undergo a treatment stage where crude oil, condensate, natural gas liquids and/or water are separated from the gas stream and be compressed to allow transportation for processing. Before compression, minimal processing of the gas stream may occur to allow efficient transportation of the gas. Partial processing of the gas, such as partial acid gas removal or separation of natural gas liquids, may also occur. However, the gas produced as an output from this partial processing does not meet the standard defined in the processed natural gas production variable, and hence remains unprocessed natural gas. The compressed unprocessed natural gas is transported by pipeline to a separate downstream facility for processing, or may be transferred for processing within the same facility which produces multiple outputs.

The liquid components, if any, may undergo a treatment stage where bulk gases and water are removed. Following such processing, the liquids are transported either with the gas or separately to the same or a different facility for processing. Partial processing of the crude oil/condensate, such as some additional gas removal, may occur. However, the crude oil/condensate produced as an output from this partial processing does not meet the standard defined in the crude oil and condensate production variable (for example, it is not stabilised and is not of a saleable quality), and hence remains unprocessed crude oil/condensate.

This activity does not include gas re-injection into a natural reservoir and subsequent gas withdrawal.

The activity does not include oil and gas extracted from a crude oil or condensate production well at a facility that only produces crude oil and condensate.

The inputs of the activity are a naturally occurring hydrocarbon stream produced from a wellhead, which may contain gas and/or liquid and may be a mixture of hydrocarbons and non-hydrocarbons.

The outputs of the activity are GJ of unprocessed natural gas and unstabilised crude oil/condensate. The measurement of this output is expected to be conducted so that it does not include any GJ of unprocessed natural gas or unstabilised crude oil/condensate that are consumed within the activity. The measurement of the production variable is as GJ of unprocessed natural gas and unstabilised crude oil/condensate that are transported, as a gas and/or liquid, away from the activity.

The activity does not include the downstream processing of the natural gas or the crude oil/condensate and other associated liquids.

20.3. Inclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be included:

- The use of machinery, equipment and processes for the activity as described in the activity definition, including, for example:
  - machinery used to move materials within and as part of the activity, including machinery required to lift the crude oil from the petroleum reservoir if required;
  - control rooms, laboratories, and maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - on-site processing of waste materials, such as wastewater, from the activity;
- partial treatment of the produced well fluid that can be subsequently transported to a downstream facility for processing, using processes including, for example:
  - bulk water removal (such as emissions associated with the separation of water from the natural gas and flaring of entrained hydrocarbons in this water);
  - separation of hydrocarbon gas from hydrocarbon liquids;
  - injection of additives such as corrosion inhibitor to allow efficient transportation of the gas or liquid;
  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the short-term buffer storage of hydrocarbon liquids produced in the extraction activity, where the volume of that buffer storage is designed specifically to allow efficient loading into transportation systems, such as tankers or pipeline systems, at a frequency and rate determined by the facility's off-take requirements;
- field compression of the unprocessed natural gas and/or pumping of unstabilised crude oil and condensate associated with the gathering of the fluids upstream of any treatment carried out as part of the activity;
- compression of the unprocessed natural gas and/or pumping of unstabilised crude oil and condensate to transfer the fluids to the downstream activity boundary;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- waste heat recovery within the activity and production of steam consumed within the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

20.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the hydrocarbon fluid stream as part of the extraction activity, as reservoir CO_2 is reported under its own production variable;
- processes which do not occur within the facility; and
- on-site electricity generation.

20.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

21. Stabilised crude oil or condensate (stabilisation only)

21.1. Production variable definition

1. Total gigajoules of the crude oil and condensate that:
   (a) are a mixture of hydrocarbons that are liquid at atmospheric pressure (101.325 kilopascals) and ambient temperature; and
   (b) can be safely stored and transported at atmospheric pressure and ambient temperature; and
   (c) are produced as part of carrying on the crude oil or condensate stabilisation activity at the facility; and
   (d) are not consumed in carrying on the crude oil or condensate stabilisation activity; and
   (e) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of crude oil or condensate stabilisation through the physical transformation of either or both of unstabilised crude oil and condensate, which may be a mixture of liquids and gases, into stabilised crude oil and condensate that:
   (a) is in a liquid state; and
   (b) has a vapour pressure of less than 101.325 kilopascals; and
   (c) is safe to store and transport at atmospheric pressure and ambient temperature.
3. The activity in subsection (2) is the ***crude oil or condensate stabilisation activity***.
4. [The default emissions intensity is XX t CO_2-e per gigajoule of crude oil and condensate.]

21.2. Scope of the activity

This production variable applies to facilities that produce stabilised crude oil or condensate, typically as one of multiple hydrocarbon products. It does not apply to facilities that extract the well fluid and subsequently produce stabilised crude oil or condensate as the only saleable hydrocarbon product. These facilities should use the crude oil and condensate (production and processing) production variable.

The production of stabilised crude oil or condensate is the separation of crude oil or condensate from a mixture that may contain crude oil, condensate, natural gas and non-hydrocarbon components, in a liquid and/or mixed liquid and gaseous state on entering the activity, into crude oil or condensate that is stable in a liquid state at atmospheric pressure and ambient temperature, and that is in a liquid state on leaving the activity.

The activity involves the stabilisation of unstabilised crude oil and/or condensate, which is taken from a crude oil or natural gas extraction activity or from an alternative source such as an unstabilised crude oil or condensate pipeline. It may include a feed treatment stage where bulk water is removed. Following such processing, the predominantly liquid mixture is stabilised by removing some of the dissolved light hydrocarbon and non-hydrocarbon components to reduce the vapour pressure, for example by passing it through several stages of separation at increasingly lower pressures, or via a stabilisation (distillation) column.

Hydrocarbons contained in the unstabilised crude oil and/or condensate stream may be processed into other products, such as processed natural gas, ethane and LPG. However, the processing steps unique to these other products are not part of the activity.

It is intended that alternative forms of production that do not require the feed treatment stage would be considered to fit within the activity definition, so long as at least stabilisation of crude oil and/or condensate takes place at the facility.

The outputs of the activity are GJ of crude oil or condensate. The measurement of this output is to be conducted so that it does not include any GJ of crude oil or condensate that are consumed during the activity. The measurement of the production variable is as GJ of crude oil or condensate of saleable quality that are transported, as a liquid, away from the facility where the crude oil or condensate was stabilised.

The activity does not include the upstream extraction or production of unstabilised crude oil and condensate to feed the activity. Further, the activity does not include the downstream processing of the stabilised crude oil including refining into petroleum products such as petrol, jet fuel, diesel, lubrication oil, bitumen or other refinery products. The activity also does not include transportation of the stabilised crude oil to downstream users or processors.

21.3. Inclusions

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical transformation described in the activity definition, including, for example:
  - machinery used to move materials within and as part of the activity;
  - control rooms, laboratories, and maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described; unless the by-product is being reported as a separate production variable, in which case, refer to section 21.5;
  - on-site processing of waste materials, such as wastewater, from the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;
- the treatment of the feed stream that is subsequently transformed into stabilised crude oil or condensate, using processes including, for example:
  - bulk water removal (such as emissions associated with the separation of water from the natural gas and flaring of entrained hydrocarbons in this water);
  - stabilisation, being the process of removing some of the dissolved light hydrocarbon and non-hydrocarbon components from crude oil and/or condensate to reduce its vapour pressure, for example by passing it through several stages of separators at increasingly lower pressures; or via a stabilisation (distillation) column;
  - dehydration;

  - desalting;
  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the short-term buffer storage of stabilised crude oil or condensate where the volume of that buffer storage is designed specifically to allow efficient loading into transportation systems, such as tankers, at a frequency and rate determined by the facility's off-take requirements;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- the loading of the stabilised crude oil or condensate (by pumping) into a medium of transportation such as tankers, pipeline systems or to a piece of equipment which will consume the stabilised crude oil or condensate, if the pumps are included within the facility for the purpose of NGER; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

21.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the crude oil mixture as part of the processing activity, as reservoir CO_2 is reported under its own production variable;
- the processing or transfer of other products such as processed natural gas, ethane or LPG;
- processes which do not occur within the facility; and
- on-site electricity generation.

21.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

The method for determining the amount of emissions to be apportioned to each reported production variable may be one of the following options:

1. Apportion emissions from the activity to each production variable using a whole-of-activity mass balance method that assigns emissions at each step to the associated material stream, tracked through the activity to its transportation out of the activity

location. For example, for a crude oil and condensate (processing) activity that also produces processed natural gas:

- apportion emissions from the processing steps between the two production variables, using a mass balance method;
- apportion the emissions from facility activities such as generation of utilities, venting and flaring, treatment of waste streams, between the two production variables, using a mass balance method;
- apportion the emissions from remaining, general facility activities such as the control rooms, laboratories, and maintenance workshops between the two production variables, in the ratio of the amount of that production variable produced, for example on an energy basis, unless there is another justifiable basis.

2. Apportion all emissions unique to the crude oil and condensate processing activity to the crude oil and condensate (processing) production variable. Similarly, apportion all emissions unique to other production variables produced at the same facility to the relevant production variable. Apportion all emissions involved in processing steps prior to the separation of crude oil and condensate amongst the various production variables on an energy basis, unless there is another justifiable basis. That is:
   - apportion all emissions from the pre-processing, such as bulk water and gas separation, amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis;
   - apportion all emissions from the crude oil and/or condensate stabilisation unit operation, such as the series of separators or stabilisation column, to the crude oil and condensate (processing) production variable;
   - apportion all emissions from the further processing of the crude oil and condensate, such as desalting (if that process is carried out) and pumping to storage, to the crude oil and condensate (processing) production variable;
   - apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with the crude oil and condensate stabilisation process and the further processing of the crude oil and condensate to the crude oil and condensate (processing) production variable;
   - apportion all emissions from the processing of each of the other production variables, (for example dehydration, dew point control and compression if another production variable was processed natural gas), to the relevant production variable;
   - apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with each of the other production variables, to the relevant production variable;
   - apportion the emissions from remaining, general facility activities such as general utilities, the control rooms, laboratories, and maintenance amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis.

22. Stabilised crude oil or condensate (extraction and stabilisation)

22.1. Definition

1. Total gigajoules of the crude oil and condensate that:
   (a) are a mixture of hydrocarbons that are liquid at atmospheric pressure (101.325 kilopascals) and ambient temperature; and
   (b) can be safely stored and transported at atmospheric pressure and ambient temperature; and
   (c) are produced as part of carrying on the crude oil or condensate extraction and stabilisation activity at the facility; and
   (d) are not consumed in carrying on the crude oil or condensate extraction and stabilisation activity; and
   (e) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that:
   (a) conducts both of the following activities:
      (i) the extraction and production of a hydrocarbon stream from a natural petroleum reservoir or an unconventional natural source, such as a coal seam;
      (ii) the crude oil or condensate stabilisation activity; and
   (b) has either or both of stabilised crude oil and condensate as its only saleable hydrocarbon products.
3. The activity in subsection (2) is the ***crude oil or condensate extraction and stabilisation activity***.
4. However, the metric in subsection (1) is not applicable to a facility using another production variable in Part 16 of Schedule 2 (other than the reservoir CO_2 production variable).
5. [The default emissions intensity is XX t CO_2-e per gigajoule of crude oil and condensate.]

22.2. Scope of the activity

This production variable applies to facilities that both extract the well fluid and subsequently produce stabilised crude oil or condensate as the only saleable hydrocarbon product.

The extraction of crude oil or condensate is the production of a fluid stream that is predominantly liquid from a naturally occurring petroleum reservoir or an unconventional crude oil source, which may also contain water and/or non-hydrocarbon components, and transportation of the fluid stream to the processing facility (which is part of the same facility) for processing.

The processing of the fluid stream into stabilised crude oil or condensate is the separation of crude oil or condensate from the fluid stream, which was a mixture that may contain crude oil, condensate, natural gas and non-hydrocarbon components, in a liquid and/or mixed liquid and gaseous state on entering the process, into crude oil or condensate that is stable in a liquid

state at atmospheric pressure and ambient temperature, and that is in a liquid state on leaving the activity.

The activity involves the extraction of crude oil and/or condensate from a naturally occurring petroleum (conventional) reservoir, or an unconventional crude oil source, such as a shale oil deposit. The produced fluid may also include natural gas, water, CO_2 and other non-hydrocarbon gases.

The activity may include a feed treatment stage where bulk gases and water are removed from the well stream. Following such processing, the predominantly liquid mixture is stabilised by removing some of the dissolved light hydrocarbon and non-hydrocarbon components to reduce the vapour pressure, for example by passing it through several stages of separation at increasingly lower pressures, or via a stabilisation (distillation) column.

Gases contained in the unstabilised crude oil or condensate stream are disposed of, for example by use as fuel, flaring, or compression for injection into a petroleum reservoir, and hence have not been reported as a separate production variable. The water contained in the unstabilised crude oil or condensate stream is treated as required, for example by desalination; and disposed of, for example by discharge to the environment, reinjection or evaporation.

It is intended that alternative forms of extraction and stabilisation that do not require the removal of water would be considered to fit within the activity definition, so long as at least stabilisation of crude oil or condensate takes place at the facility.

This activity does not include crude oil refining. The activity is also not satisfied where the crude oil or condensate being produced by the facility has a vapour pressure higher than atmospheric pressure at ambient temperature. The activity is also not satisfied by a facility that does stabilisation but not extraction, as the output from such a facility is **Crude Oil and Condensate (Processing)**.

The inputs of the activity are the fluid stream produced from a crude oil or condensate wellhead. This may include crude oil and condensate, produced and / or injected water, and produced or injected hydrocarbon and / or non-hydrocarbon gases.

The outputs of the activity are GJ of crude oil or condensate. The measurement of this output is to be conducted so that it does not include any GJ of crude oil or condensate that are consumed within the facility. The measurement of the production variable is as GJ of crude oil or condensate that are transported, as a liquid, away from the facility where the crude oil or condensate was stabilised.

The activity does not include the downstream processing of the stabilised crude oil or condensate including refining into petroleum products such as petrol, jet fuel, diesel, lubrication oil, bitumen or other refinery products. The activity also does not include transportation of the stabilised crude oil or condensate to downstream users or processors, after the point of transfer into the crude oil/condensate tanker or pipeline system.

22.3. Inclusions

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the extraction and physical transformation described in the activity definition, including, for example:
  - machinery used to move materials within and as part of the activity, including machinery required to lift the crude oil from the petroleum reservoir if required;
  - control rooms, laboratories, and maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity, such as compression of gas to be reinjected into the reservoir, or are necessary for the activity to proceed as described;
  - on-site processing of waste materials, such as gases and wastewater;
- waste heat recovery within the activity and production of steam consumed within the activity;
- field pumping of the well fluid associated with the gathering of the fluid upstream of processing;
- the treatment of the well fluid that is subsequently transformed into stabilised crude oil or condensate, using processes including, for example:
  - bulk gas and water removal (such as emissions associated with the separation of water from the crude oil or condensate and flaring of entrained hydrocarbons in this water);
  - stabilisation, being the process of removing some of the dissolved light hydrocarbon and non-hydrocarbon components from crude oil or condensate to reduce its vapour pressure, for example by passing it through several stages of separators at increasingly lower pressures; or via a stabilisation (distillation) column;
  - dehydration;
  - desalting;
  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the short-term buffer storage of stabilised crude oil or condensate where the volume of that buffer storage is designed specifically to allow efficient loading into transportation systems, such as tankers, at a frequency and rate determined by the facility's off-take requirements;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;
- the loading of the stabilised crude oil or condensate (eg by pumping) into a medium of transportation such as tankers or pipeline systems, or to a piece of equipment which will

consume the stabilised crude oil or condensate, if such loading equipment is included within the facility for the purpose of NGER; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

22.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the crude oil mixture as part of the extraction and processing activity, as reservoir CO_2 is reported under its own production variable;
- processes which do not occur within the facility; and
- on-site electricity generation.

22.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable.

The crude oil and condensate (integrated) production variable does not allow for the use of other production variables, except for reservoir CO_2 and electricity. If other hydrocarbon products identified as production variables are produced by the activity, the separate production variables of **crude oil and condensate (processing)**, along with the other applicable production variables, such as unprocessed or processed natural gas, must be used.

23. Processed natural gas (processing only)

23.1. Production variable definition

1. Gigajoules of processed natural gas that:
   (a) are produced as part of carrying on the natural gas processing activity at the facility; and
   (b) are not consumed in carry on the natural gas processing activity; and
   (c) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of processing natural gas through the physical transformation of unprocessed natural gas, which may be a mixture of gases and liquids, into processed natural gas (the ***natural gas processing activity)***.
3. [The default emissions intensity is XX t CO_2-e per gigajoule of processed natural gas.]

Definition of processed natural gas

Where 'processed natural gas' means a substance that:

- is in a gaseous state at standard temperature and pressure; and
- consists of:
  (a) naturally occurring hydrocarbons; or
  (b) a naturally occurring mixture of hydrocarbons and non-hydrocarbons; and
- is mainly methane; and
- has been:
  (a) injected into a natural gas transmission pipeline; or
  (b) supplied to a downstream user after processing the substance to an agreed specification, such that the gas has at least the following qualities:
    (i) water content of 150 mg/Sm^3 or less;
    (ii) inert gases (including carbon dioxide) of 12 molar per cent or less;
    (iii) hydrocarbon cricondentherm of 10 °C or lower;
    (iv) sulphur content (including any sulphur from odourant) of 60 mg/Sm^3 or less.

23.2. Scope of the activity

This production variable applies to facilities that produce processed natural gas, typically as one of multiple hydrocarbon products. It does not apply to facilities that extract the unprocessed natural gas and subsequently produce processed natural gas as the only saleable hydrocarbon product. These facilities should use the ***processed natural gas (production and processing)*** production variable.

The processing of natural gas is the treatment of an unprocessed natural gas stream, which may contain some hydrocarbon and/or non-hydrocarbon liquids, to produce a gaseous stream for injection into a natural gas transmission pipeline, or for supply to another downstream user with a specification meeting the requirements of the processed natural gas definition.

The activity involves the receipt of unprocessed natural gas from a facility conducting the activity of natural gas extraction, and processing it to a quality suitable for injection into a natural gas transmission pipeline or for supply to a downstream user with a specification meeting the requirements of the processed natural gas definition. The processing may involve separation from hydrocarbon and/or non-hydrocarbon liquids, dehydration, acid gas removal, mercury removal, and any other processes required to bring the gas to pipeline quality or the user specification meeting the requirements of the processed natural gas definition. Compression of the gas to allow injection into the pipeline is also included in the activity, if the equipment used for compression is included within the facility for the purpose of reporting under the NGER scheme.

The inputs of the activity are a stream of unprocessed natural gas that may contain gas, crude oil, condensate, natural gas liquids and non-hydrocarbon components, in a gaseous, liquid and/or mixed liquid and gaseous state.

The outputs of the activity are GJ of processed natural gas injected into the natural gas transmission pipeline or supplied to a downstream user with a specification meeting the requirements of the processed natural gas definition. The measurement of this output is expected to be conducted so that it does not include any GJ of processed natural gas that are consumed within the activity.

The activity does not include the upstream extraction or production of unprocessed natural gas to feed the activity. Further, the activity also does not include transportation of the processed natural gas, from the point where it is injected into a natural gas transmission pipeline, to downstream users or processors.

23.3. Inclusions

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical transformation described in the activity definition, including, for example:
    - machinery used to move materials within and as part of the activity;
    - control rooms, laboratories, and maintenance workshops;
    - machinery used to create non-electrical energy for use in the activity;
    - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described; unless the by-product is being reported as a separate production variable, in which case, refer to section 23.5 below;
    - on-site processing of waste materials, such as wastewater, from the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;
- treatment of the unprocessed natural gas stream that is subsequently transformed into processed natural gas, using processes including, for example:
    - bulk water removal (such as emissions associated with the separation of water from the natural gas and flaring of entrained hydrocarbons in this water);
    - separation of hydrocarbon gas from hydrocarbon liquids;

  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
  - mercury removal;
  - dehydration, for example by glycol absorption or molecular sieves;
  - removal of ethane and heavier hydrocarbons;
  - odourisation of the processed natural gas;
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- compression of the gas process stream (as part of or subsequent to the processing activity), including where the processed gas is then injected into a gas transmission pipeline and the compression contributes to the gas reaching the required pressure for transmission, if such equipment is included within the facility for the purpose of NGER; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

23.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the natural gas mixture as part of the processing activity, as reservoir CO_2 is reported under its own production variable;
- the processing or transfer of other production variables such as ethane and/or LPG, or crude oil and condensate (processed) (if hydrocarbon liquids separated from the natural gas stream are incorporated into a crude oil or condensate stream);
- processes which do not occur within the facility; and
- on-site electricity generation.

23.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

The method for determining the amount of emissions to be apportioned to each reported production variable may be one of the following options:

1. Apportion emissions from the activity to each production variable using a whole-of-activity mass balance method that assigns emissions at each step to the associated

material stream, tracked through the activity to its transportation out of the activity location. For example, for a processed natural gas activity that also produces ethane:

- apportion emissions from the processing steps between the two production variables, using a mass balance method
- apportion the emissions from facility activities such as generation of utilities, venting and flaring, treatment of waste streams, between the two production variables, using a mass balance method
- apportion the emissions from remaining, general facility activities such as the control rooms, laboratories, and maintenance workshops between the two production variables, in the ratio of the amount of that production variable produced, for example on an energy basis, unless there is another justifiable basis.

2. Apportion all emissions unique to the processed natural gas activity to the processed natural gas production variable. Similarly, apportion all emissions unique to other production variables produced at the same facility to the relevant production variable. Apportion all emissions involved in processing steps prior to the separation of natural gas amongst the various production variables on an energy basis, unless there is another justifiable basis. For example, for a processed natural gas activity that also produces ethane:
   - apportion all emissions from the pre-processing, such as bulk water separation, amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis
   - apportion all emissions from processed natural gas production and further gas processing unit operations to the processed natural gas production variable
   - apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with the production of processed natural gas to the processed natural gas production variable
   - apportion all emissions from the ethane production unit operations, such as the fractionation step that produced the ethane, to the ethane production variable
   - apportion all emissions from the further processing of the ethane, such as further CO_2 removal and compression to storage or the facility discharge pipeline, to the ethane production variable
   - apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with each of the other production variables, to the relevant production variable
   - apportion the emissions from remaining, general facility activities such as general utilities, the control rooms, laboratories, and maintenance amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis.

24. Processed natural gas (production and processing)

24.1. Production variable definition

1. Gigajoules of processed natural gas that:
   (a) are produced as part of carrying on the natural gas production and processing activity at the facility; and
   (b) are not consumed in carry on the natural gas production and processing activity; and
   (c) are of saleable quality.
2. The metric is subsection (1) is applicable to a facility that:
   (a) conducts both of the following activities:
      (iii) the extraction and production of a hydrocarbon stream that is predominantly gas from a natural petroleum reservoir or an unconventional natural source, such as a coal seam;
      (iv) the natural gas processing activity; and
   (b) has processed natural gas as its only saleable hydrocarbon product.
3. The activity in subsection (2) is the ***natural gas production and processing activity***.
4. However, the metric in subsection (1) is not applicable to a facility using another production variable in Part 16 of Schedule 2 (other than the reservoir CO_2 production variable).
5. [The default emissions intensity is XX t CO_2-e per gigajoule of processed natural gas.]

Definition of processed natural gas

Where 'processed natural gas' means a substance that:

- is in a gaseous state at standard temperature and pressure; and
- consists of:
   (a) naturally occurring hydrocarbons; or
   (b) a naturally occurring mixture of hydrocarbons and non-hydrocarbons; and
- is mainly methane; and
- has been:
   (a) injected into a natural gas transmission pipeline; or
   (b) supplied to a downstream user after processing the substance to an agreed specification, such that the gas has at least the following qualities:
      (i) water content of 150 mg/Sm^3 or less;
      (ii) inert gases (including carbon dioxide) of 12 molar per cent or less;
      (iii) hydrocarbon cricondentherm of 10 °C or lower;
      (iv) sulphur content (including any sulphur from odourant) of 60 mg/Sm^3 or less.

24.2. Scope of the activity

This production variable applies to facilities that both extract unprocessed natural gas and subsequently produce processed natural gas as the only saleable hydrocarbon product.

The extraction of natural gas is the production of a fluid stream that is predominantly gaseous from a naturally occurring petroleum reservoir or an unconventional natural gas source, which may also contain water and/or non-hydrocarbon components, in a gaseous and/or mixed liquid and gaseous state, and transportation of the fluid stream for processing within the same integrated facility.

The processing of natural gas is the treatment of the extracted natural gas stream to produce a gaseous stream for injection into a natural gas transmission pipeline or for supply to another downstream user with a specification meeting the requirements of the processed natural gas definition.

The activity involves the extraction of natural gas from a naturally occurring petroleum (conventional) reservoir or an unconventional natural source such as a coal seam. The produced fluid may also include water, CO2 and other non-hydrocarbon gases. The produced stream may undergo a treatment stage where water is separated from the gas stream. The gas stream may then be compressed to allow transportation to a downstream location for processing, which is part of the same integrated facility.

The processing involves transforming the natural gas into a quality suitable for injection into a natural gas transmission pipeline, or for supply to another downstream user with a specification meeting the requirements of the processed natural gas definition. The processing may involve separation from water, dehydration, and any other processes required to bring the gas to pipeline quality or the user specification meeting the requirements of the processed natural gas definition. Compression of the gas to allow injection into the pipeline is included in the activity, if the equipment used for compression was included within the facility for the purpose of National Greenhouse and Energy Reporting (NGER).

The inputs of the activity are a naturally occurring fluid stream produced from a gas wellhead, which is predominantly methane, may be a mixture of gaseous hydrocarbons and non-hydrocarbons, and may contain water.

The outputs of the activity are GJ of processed natural gas injected into a natural gas transmission pipeline or supplied to another downstream user with a specification meeting the requirements of the processed natural gas definition. The measurement of this output is expected to be conducted so that it does not include any GJ of processed natural gas that are consumed within the facility. The measurement of the production variable is as GJ of processed natural gas that are transported, as a gas, away from the facility where the natural gas was processed.

The activity does not include transportation of the processed natural gas, from the point where it is injected into a natural gas supply pipeline, to downstream users or processors.

24.3. Inclusions

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the extraction and physical transformation described in the activity definition, including, for example:
  - machinery used to move materials within and as part of the activity;
  - control rooms, laboratories, and maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - processing within the facility of waste materials, such as wastewater, from the activity;
- field compression of the unprocessed natural gas associated with the gathering of the gas upstream of processing;
- compression of the gas process stream (as part of or subsequent to the processing activity), including where the processed gas is then injected into a gas transmission pipeline and the compression contributes to the gas reaching the required pressure for transmission, if such equipment is included within the facility for the purpose of NGER;
- waste heat recovery within the activity and production of steam consumed within the activity;
- treatment of the unprocessed natural gas stream that is subsequently transformed into processed natural gas, using processes including, for example:
  - bulk water removal (such as emissions associated with the separation of water from the natural gas and flaring of entrained hydrocarbons in this water);
  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
  - dehydration, for example by glycol absorption or molecular sieves;
  - mercury removal;
  - odourisation of the processed natural gas;
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

24.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the natural gas mixture as part of the extraction and/or processing activities, as reservoir CO_2 is reported under its own production variable;
- processes which do not occur within the facility; and
- on-site electricity generation.

24.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable.

The processed natural gas (integrated) production variable does not allow for the use of multiple production variables from the same activity, except for reservoir CO_2 and electricity. If other hydrocarbon products identified as production variables are produced in the activity, the separate production variables of unprocessed natural gas and processed natural gas must be used, along with the other production variable(s).

25. Liquefied natural gas (from unprocessed natural gas)

25.1. Production variable definition

1. Gigajoules of liquefied natural gas that:
   (a) have a methane (CH_4) content by mass of 70% or more; and
   (b) are produced as part of carrying on the unprocessed natural gas liquefaction activity at the facility; and
   (c) are transported away from the facility; and
   (d) are in a liquid state on leaving the facility; and
   (e) are of saleable quality; and
   (f) has not been counted as part of the liquefied natural gas production variable in section 35 of Schedule 2 (liquefied natural gas from processed natural gas).
2. The metric in subsection (1) is applicable to a facility that conducts the activity of liquefying unprocessed natural gas through the physical transformation of unprocessed natural gas into liquefied natural gas that:
   (a) has a methane content by mass of 70% of more; and
   (b) is in a liquid state on leaving the facility.
3. The activity is subsection (2) is the ***unprocessed natural gas liquefaction activity***.
4. [The default emissions intensity is XX t CO_2-e per gigajoule of liquefied natural gas.]

25.2. Scope of the activity

The production of LNG from unprocessed natural gas is the physical transformation of unprocessed natural gas, which is in a gaseous state on entering the activity, to LNG which has a methane content by mass of 70 per cent or more and that is in a liquid state on leaving the activity.

The activity involves the processing and subsequent liquefaction of unprocessed natural gas (that is, natural gas that does not meet the definition of processed natural gas) that was taken from a facility conducting natural gas extraction from a petroleum reservoir or other naturally occurring source. The activity may include a feed treatment stage where CO_2, hydrogen sulphide, mercury, water or other contaminants, and ethane and heavier hydrocarbons are removed from the unprocessed natural gas feed. Following such processing, if any, the predominantly methane mixture is then liquefied through compression and temperature reduction in a liquefaction train to -161 °C. Hydrocarbons contained in the natural gas stream that is in part taken to be liquefied into LNG may be processed into other products such as crude oil or condensate, processed natural gas and LPG. The processing steps unique to these other products are not part of the activity.

This activity does not include the undertaking of natural gas extraction, or through LNG regasification. The activity is also not satisfied where the product is in a gaseous state on leaving the facility or has a concentration of methane (CH_4) that is less than 70 per cent with respect to mass.

The inputs of the activity include unprocessed natural gas in a gaseous state, which is predominantly methane, from a facility conducting the activity of natural gas extraction. The stream may contain hydrocarbon and/or non-hydrocarbon liquids as well as the naturally occurring gaseous phase.

The outputs of the activity are GJ of LNG where the concentration of methane is equal to or greater than 70 per cent with respect to mass. The measurement of this output is expected to be conducted so that it does not include any GJ of LNG that boil off in conveying the LNG to a transportation vessel or storage facility. The measurement of the output is GJ of LNG transported as a liquid away from the facility where the natural gas was liquefied.

The activity does not include the upstream extraction of the natural gas or transportation of the unprocessed natural gas to the boundary of the facility conducting the activity of LNG production from unprocessed natural gas. Further, the activity does not include the downstream processing of the LNG including transportation, distribution or regasification, or the processing of any by-products from the production of LNG including condensate, processed natural gas and LPG.

25.3. Inclusions

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within and as part of the activity;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described; unless the by-product is being reported as a separate production variable, in which case, refer to section 25.5 below;
  - on-site processing of waste materials from the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;
- the treatment of the unprocessed natural gas feed, that is subsequently transformed into LNG, including:
  - bulk water removal (such as emissions associated with the separation of water from the natural gas and flaring of entrained hydrocarbons in this water);
  - separation of hydrocarbon gas from hydrocarbon liquid;
  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
  - removal of mercury and any other impurities;
  - dehydration, for example by glycol absorption or molecular sieves;

  - removal of ethane and heavier hydrocarbons;
  - liquefaction of the natural gas to produce LNG;
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the short-term buffer storage of LNG where the volume of that buffer storage is designed specifically to allow efficient loading into the transportation system, such as ocean going tankers, at a frequency and rate determined by the facility's off-take requirements;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- the loading of the LNG into a medium of transportation such as ocean going tankers or pipeline system (by pumping), if the pumps are included within the facility for the purpose of NGER; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

25.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the feed stream as part of the processing activity, as reservoir CO_2 is reported under its own production variable;
- the processing or transfer of other production variables such as processed natural gas, ethane and/or LPG, or crude oil/condensate (processing) (if hydrocarbon liquids separated from the natural gas stream are incorporated into a crude oil or condensate stream);
- processes which do not occur within the facility; and
- on-site electricity generation.

25.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

The method for determining the amount of emissions to be apportioned to each reported production variable may be one of the following options:

1. Apportion emissions from the activity to each production variable using a whole-of-activity mass balance method that assigns emissions at each step to the associated material stream, tracked through the activity to its transportation out of the activity location. For example, for an LNG production activity that also produces processed natural gas:

- apportion emissions from the processing steps between the two production variables, using a mass balance method
- apportion the emissions from facility activities such as generation of utilities, venting and flaring, treatment of waste streams, between the two production variables, using a mass balance method
- apportion the emissions from remaining, general facility activities such as the control rooms, laboratories, and maintenance workshops between the two production variables, in the ratio of the amount of that production variable produced, for example on an energy basis, unless there is another justifiable basis.

2. Apportion all emissions unique to the LNG production activity to the LNG from unprocessed natural gas production variable. Similarly, apportion all emissions unique to other production variables produced at the same facility to the relevant production variable. Apportion all emissions involved in processing steps prior to the separation of the LNG stream from the natural gas stream amongst the various production variables on an energy basis, unless there is another justifiable basis. For example, for an LNG production facility that also produces processed natural gas:
   - apportion all emissions from the pre-processing, such as bulk water separation, amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis
   - apportion all emissions from the natural gas processing to the quality required for liquefaction to the LNG production variable
   - apportion all emissions from the LNG liquefaction unit operation to the LNG production variable
   - apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with the production of LNG to the LNG production variable
   - apportion all emissions from the further processing of the natural gas to a standard that meets the definition of the processed natural gas production variable, such as odourisation and compression, to the processed natural gas production variable
   - apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with the production of processed natural gas to the processed natural gas production variable
   - apportion the emissions from remaining, general facility activities such as general utilities, the control rooms, laboratories, and maintenance amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis.

26. Liquefied natural gas (from processed natural gas)

26.1. Production variable definition

1. Gigajoules of liquefied natural gas that:
   (a) have a methane content by mass of 70% or more; and
   (b) are produced as part of carrying on the processed natural gas liquefaction activity at the facility; and
   (c) are transported away from the facility; and
   (d) are in a liquid state on leaving the facility; and
   (e) are of saleable quality; and
   (f) has not been counted as part of the liquefied natural gas production variable in section 34 of Schedule 2 (liquefied natural gas from unprocessed natural gas).
2. The metric in subsection (1) is applicable to a facility that conducts the activity of liquefying processed natural gas through the physical transformation of processed natural gas into liquefied natural gas that:
   (a) has a methane content by mass of 70% or more; and
   (b) is in a liquid state on leaving the facility.
3. The activity is subsection (2) is the ***processed natural gas liquefaction activity***.
4. [The default emissions intensity is XX t CO_2-e per gigajoule of liquefied natural gas.]

26.2. Scope of the activity

The production of LNG from processed natural gas is the physical transformation of processed natural gas, which is in a gaseous state on entering the activity, to LNG that has a methane content by mass of 70 per cent or more and that is in a liquid state on leaving the activity.

The activity involves the processing and subsequent liquefaction of processed natural gas that is taken from a natural gas pipeline. It may include a feed treatment stage where ethane, CO_2, mercaptans, mercury, water or other contaminants are removed from the natural gas feed stream. Following such processing, if any, the predominantly methane mixture is then liquefied through compression and temperature reduction in a liquefaction train to -161 °C.

This activity does not include the undertaking of natural gas extraction and processing, or through LNG regasification. The activity is also not satisfied where the natural gas being processed is in a gaseous state on leaving the activity or has a concentration of methane (CH_4) that is less than 70 per cent with respect to mass.

The inputs of the activity include processed natural gas in a gaseous state, which has been injected into a natural gas transmission pipeline or supplied to another downstream user with a specification meeting the requirements of the processed natural gas definition.

The outputs of the activity are GJ of LNG where the concentration of methane is equal to or greater than 70 per cent with respect to mass. The measurement of this output is expected to be conducted so that it does not include any GJ of LNG that boil off in conveying the LNG to a

transportation vessel or storage facility. The measurement of the output is GJ of LNG transported as a liquid away from the facility where the natural gas was liquefied.

The activity does not include the upstream extraction or processing of the natural gas for injection into the natural gas pipeline that feeds the LNG production activity. Further, the activity does not include the downstream processing of the LNG including transportation, distribution or regasification.

26.3. Inclusions

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within and as part of the activity;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described;
  - on-site processing of waste materials from the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;
- the treatment of the processed natural gas feed, if any, that is subsequently transformed into LNG, including:
  - removal of sulphur compounds;
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
  - further dehydration, for example by molecular sieves;
  - removal of mercury and any other impurities;
  - removal of ethane and heavier hydrocarbons;
  - liquefaction of the natural gas to produce LNG;
- any flaring, leaks or venting of greenhouse gases associated with the activity, except for reservoir CO_2;
- the short-term buffer storage of LNG where the volume of that buffer storage is designed specifically to allow efficient loading into the transportation system, such as ocean going tankers, at a frequency and rate determined by the facility's off-take requirements;
- the supply of utilities such as, but not limited to, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;

- the loading of the LNG into a medium of transportation such as ocean going tankers or a pipeline system (by pumping), if the pumps are included within the facility for the purpose of NGER; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

26.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the feed stream as part of the processing activity, as reservoir CO_2 is reported under its own production variable;
- processes which do not occur within the facility; and
- on-site electricity generation.

26.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

27. Ethane

27.1. Production variable definition

1. Gigajoules of the ethane that:
   (a) has an ethane content by mass of 95% or more; and
   (b) is in a gaseous state; and
   (c) is produced as part of carrying on the ethane production activity at the facility; and
   (d) is not consumed in carrying on the ethane production activity; and
   (e) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of ethane production through the separation of ethane from a mixture of hydrocarbons to produce ethane that:
   (a) has an ethane content by mass of 95% or more; and
   (b) is in a gaseous state.
3. The activity in subsection (2) is the ***ethane production activity***.
4. [The default emissions intensity is XX t CO_2-e per gigajoule of ethane.]

27.2. Scope of the activity

The production of ethane gas is the separation and purification of ethane from a stream containing a mixture of hydrocarbons and non-hydrocarbons, into an ethane product that is gaseous on leaving the activity.

The activity involves the production of ethane from a processing plant. Examples of these types of facilities include natural gas processing facilities or natural gas liquids recovery facilities.

Ethane is produced in an activity that also produces processed natural gas and/or LPG. The activity may also produce other products, so emissions must be apportioned in a justifiable manner amongst the relevant production variables, as per the guidelines in section 27.4.

The process involves the pre-treatment of the mixed hydrocarbon stream, for example by dehydration (water removal) and removal of bulk CO_2 and other impurities; partial liquefaction of the mixed hydrocarbon inlet stream by cooling it to cryogenic temperatures; then fractionation (distillation) to separate the gaseous methane from ethane and heavier hydrocarbons; then further fractionation to remove ethane from the propane and heavier hydrocarbons.

Following separation of the ethane from the mixed hydrocarbon stream, the ethane may be purified, for example by further removal of CO_2. The ethane is then compressed for transfer into storage or a pipeline system.

As described above, hydrocarbons contained in the hydrocarbon inlet stream may also be processed into other products, such as processed natural gas and LPG. The processing steps unique to these other products are not part of the activity.

It is intended that alternative forms of production that do not require the feed treatment stage would be considered to fit within the activity definition, so long as at least the separation from other hydrocarbons and non-hydrocarbons, purification if required, and transfer of ethane takes place at the facility.

This activity does not include the undertaking of natural gas processing, LPG production or crude oil refining. The activity is also not satisfied through the undertaking of ethane production that does not produce ethane that is equal to or greater than 95 percent with respect to mass, and is transported away from the facility. The further refining of ethane into other chemicals is not considered part of this activity.

The inputs of the activity include a hydrocarbon stream that may also contain some non-hydrocarbons. This stream may be processed or unprocessed natural gas, coal seam gas, or other mixtures of hydrocarbons and non-hydrocarbons, sourced from activities such as natural gas processing and LNG production facilities or from an alternative source such as crude oil stabilisation.

The outputs of the activity are GJ of ethane in a gaseous state. The measurement of this output is to be conducted so that it does not include any GJ of ethane that are consumed within the facility. The measurement of the production variable is as GJ of ethane that are transported, in a gaseous state, away from the facility where the ethane was produced.

The activity does not include the upstream extraction or production of the mixed hydrocarbon stream that feeds the activity. Further, the activity does not include transportation of the gaseous ethane to downstream users or processors.

27.3. Inclusions

The ethane production activity is carried out at processing plants that undertake a range of activities and report a range of production variables. Emissions from machinery or activities that are not solely related to the ethane production activity must be apportioned amongst the relevant production variables from the facility, as per the guidelines in section 27.5. Where inclusions are listed below, they are emissions that could be included, provided the rules of apportionment are followed.

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical transformation described in the activity definition, including, for example:
    - machinery used to move materials within and as part of the activity;
    - machinery used to create non-electrical energy for use in the activity;
    - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described; unless the by-product is being reported as a separate production variable, in which case, refer to section 27.5;
    - on-site processing of waste materials from the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;

- the regeneration of any catalysts or solvents used, if the regeneration is undertaken within the activity;
- the treatment of the hydrocarbon stream to produce ethane, using processes including, for example:
  - pretreatment of the mixed hydrocarbon stream by removing impurities such as water, sulphur compounds and mercury (if required);
  - removal of CO_2 (the separated CO_2 is not included and must be reported separately, but the emissions associated with the process of separating the CO_2 are included);
  - cooling of the mixed hydrocarbon stream to cryogenic temperature so it is partially liquefied, for example using refrigeration and/or turbo-expansion;
  - separation of the gaseous methane from the feed stream using fractionation (distillation);
  - heating the remaining mixed hydrocarbon stream, then removing the ethane by fractionation;
  - removal of any impurities from the ethane stream;
- any flaring, leaks or venting of greenhouse gases associated with the activity, except reservoir CO_2;
- the short-term buffer storage of ethane where the volume of that buffer storage is designed specifically to allow efficient loading into transportation systems, at a frequency and rate determined by the facility's off-take requirements;
- the supply of utilities such as, but not limited to, refrigeration, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the transfer of the ethane (by compression) into a medium of transportation such as a pipeline system or to a piece of equipment outside the facility which will consume the ethane, if such transfer equipment is included within the facility for the purpose of NGER; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

27.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated as part of the processing activity, as reservoir CO_2 is reported under its own production variable;
- the processing or transfer of other production variables such as processed natural gas, and/or LPG, as the emissions from other production variables from the activity must be apportioned as per the guidance provided below;
- processes which do not occur within the facility; and
- on-site electricity generation.

27.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

The method for determining the amount of emissions to be apportioned to each production variable may be one of the following options:

1. Apportion emissions from the activity to each production variable using a whole-of-activity mass balance method that assigns emissions at each step to the associated material stream, tracked through the activity to its transportation out of the activity location. For example, for a natural gas processing plant that produces ethane as one of two or more production variables:
    - apportion emissions from the processing steps amongst all the production variables, using a mass balance method;
    - apportion the emissions from facility activities such as generation of utilities, venting and flaring, treatment of waste streams, amongst all the production variables, using a mass balance method;
    - apportion the emissions from remaining, general facility activities such as the control rooms, laboratories, and maintenance workshops amongst all the production variables, in the ratio of the amount of that production variable produced, for example on an energy basis, unless there is another justifiable basis.
2. Apportion all emissions unique to the production of ethane to the ethane production variable. Similarly, apportion all emissions unique to other production variables produced at the same facility to the relevant production variable. Apportion all emissions involved in processing steps prior to the separation of ethane amongst the various production variables on an energy basis, unless there is another justifiable basis. For example, for a natural gas processing plant that produces ethane as one of two or more production variables:
    - apportion all emissions from the pre-processing, such as bulk water separation and bulk CO_2 removal, amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis;
    - apportion all emissions from processed natural gas production and further processed natural gas processing unit operations to the processed natural gas production variable;
    - apportion all emissions from activities such as generation of utilities, venting, flaring, and treatment of waste streams, associated with the production of processed natural gas to the processed natural gas production variable;
    - apportion all emissions from the ethane production unit operations, such as the fractionation step that produced the ethane, to the ethane production variable;
    - apportion all emissions from the further processing of the ethane, such as further CO_2 removal and compression to storage or the facility discharge pipeline, to the ethane production variable;

- apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with the production of ethane, to the ethane production variable;
- apportion all the emissions from the production and further processing of other production variables, such as LPG, to the respective production variable, being LPG for this example;
- apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with each of the other production variables, to the relevant production variable;
- apportion the emissions from remaining, general facility activities such as general utilities, the control rooms, laboratories, and maintenance amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis.

28. Liquefied petroleum gas

28.1. Production variable definition

1. Gigajoules of the liquefied petroleum gas that:
   (a) is in a liquid state;
   (b) is produced as part of carrying on the liquefied petroleum gas production activity at the facility; and
   (c) is not consumed in carrying on the liquefied petroleum gas production activity; and
   (d) is of saleable quality.
2. The metric in subsection (1) is applicable to a facility that:
   (a) conducts the activity of liquefied petroleum gas production through the separation of propane and butane fractions from a mixture of hydrocarbons to produce liquefied petroleum gas that is in a liquid state (the ***liquefied petroleum gas production activity***); and
   (b) includes another activity covered by this Part.
3. [The default emissions intensity is XX t CO_2-e per gigajoule of liquefied petroleum gas.]

Definition of liquefied petroleum gas

'Liquefied petroleum gas' means a substance that is:

- liquid propane; or
- liquid butane; or
- a liquid mixture of propane and butane; or
- a liquid mixture of propane and other hydrocarbons that consists mainly of propane; or
- a liquid mixture of butane and other hydrocarbons that consists mainly of butane; or
- a liquid mixture of propane, butane and other hydrocarbons that consists mainly of propane and butane.

28.2. Scope of the activity

The production of liquid LPG is the separation and purification of propane and butane fractions from a stream containing a mixture of hydrocarbons, and that may also contain non-hydrocarbons, into an LPG product that is in a liquid state on leaving the activity.

The activity involves the production of LPG from a facility that produced a number of products. Examples of these types of facilities include natural gas processing facilities, natural gas liquefaction facilities or natural gas liquids recovery facilities.

LPG is produced in an activity that may also produce processed natural gas, liquefied natural gas (LNG), ethane and condensate. Emissions from this activity must be apportioned in a justifiable manner amongst the relevant production variables, as per the guidelines in section 28.5.

The process involves the pre-treatment of the mixed hydrocarbon stream, for example by dehydration (water removal) and removal of bulk CO_2 and other impurities; partial liquefaction

of the mixed hydrocarbon inlet stream by cooling it to cryogenic temperatures; a series of fractionation (distillation) steps to separate first the gaseous methane from ethane and heavier hydrocarbons; then the ethane from the propane and heavier hydrocarbons; then the propane from the butane and heavier hydrocarbons, and lastly the butane from the pentane and heavier hydrocarbons. The propane and butane fractions may be removed in the same fractionation (distillation) column.

Following separation of the propane and butane fractions from the mixed hydrocarbon stream, the resulting LPG streams may be kept separated or recombined. The propane and butane fractions are then compressed until liquefaction occurs, and the resulting LPG stream(s) is transferred to storage or a pipeline system.

As described above, hydrocarbons contained in the hydrocarbon inlet stream may also be processed into other products such as processed natural gas, ethane or crude oil/ condensate. The processing steps unique to these other products are not part of the activity.

It is intended that alternative forms of production that do not require the feed treatment stage would be considered to fit within the activity definition, so long as at least the separation from other hydrocarbons and non-hydrocarbons, purification if required, and liquefaction of the propane and butane fractions takes place at the facility.

This activity does not include the undertaking of natural gas processing, ethane production, crude oil/condensate stabilisation or crude oil refining. The activity is also not satisfied through the undertaking of LPG production that does not produce LPG that is of saleable quality and is transported away from the facility. The further refining of pure propane, butane or LPG into other chemicals is not considered part of this activity.

The inputs of the activity include a hydrocarbon stream that may also contain some non-hydrocarbons. This stream may be processed or unprocessed natural gas, or other mixtures of hydrocarbons and non-hydrocarbons, sourced from activities such as natural gas processing, natural gas liquids removal and LNG production facilities or from an alternative source such as crude oil/condensate stabilisation.

The outputs of the activity are GJ of LPG in a liquid state. The measurement of this output is to be conducted so that it does not include any GJ of LPG consumed within the activity.

The activity does not include the upstream extraction or production of the mixed hydrocarbon stream that feeds the activity. Further, the activity does not include transportation of the LPG to downstream users or processors.

28.3. Inclusions

The LPG production activity is carried out at processing plants that undertake a range of activities and report a number of production variables. Emissions from machinery or activities that are not solely related to the LPG production activity must be apportioned amongst the relevant production variables from the facility, as per the guidelines in section 28.5. Where inclusions are listed below, they are emissions that could be included, provided the rules of apportionment are followed.

For the purposes of developing the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes for the physical transformation described in the activity definition, including, for example:
    - machinery used to move materials within and as part of the activity;

  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described; unless the by-product is being reported as a separate production variable, in which case, refer to section 28.5;
  - onsite processing of waste materials from the activity;
- waste heat recovery within the activity and production of steam consumed within the activity;
- the treatment of the hydrocarbon stream to produce LPG using processes including, for example:
  - pretreatment of the mixed hydrocarbon stream by removing impurities such as water, sulphur compounds and mercury (if required);
  - cooling of the mixed hydrocarbon stream to cryogenic temperature so it is partially liquefied, for example using refrigeration and/or turbo-expansion;
  - separation of the gaseous methane from the feed stream using fractionation (distillation);
  - heating the remaining mixed hydrocarbon stream, then removing the ethane by fractionation (distillation) if required;
  - heating the mixed hydrocarbon stream remaining after the removal of methane and ethane, then removing the propane fraction by fractionation (distillation);
  - heating the remaining mixed hydrocarbon stream, then removing the butane fraction by fractionation (distillation), noting that the propane and butane fractions may be removed via the same fractionation column if separate propane and butane fractions are not required;
  - removal of impurities from the LPG stream(s);
  - the liquefaction of the propane and butane fractions, or the combined LPG stream by cooling;
  - odourisation of the LPG product(s);
- any flaring, leaks or venting of greenhouse gases associated with the activity, except for reservoir CO_2;
- the short-term buffer storage of LPG where the volume of that buffer storage is designed specifically to allow efficient loading into transportation systems, at a frequency and rate determined by the facility's off-take requirements;
- the supply of utilities such as, but not limited to, refrigeration, compressed air, nitrogen, steam and water where these are used in support of the activity and within the activity boundaries;
- the regeneration of any catalysts or solvents, if the regeneration is undertaken within the activity;
- the transfer of the LPG (by pumping) into a medium of transportation such as a pipeline system or road tankers, or to a piece of equipment outside the facility that will consume the LPG, if the pumps are included within the facility for the purpose of NGER; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

28.4. Exclusions

For the purposes of calculating the default emissions intensity value and the estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility should be excluded:

- reservoir CO_2 that is separated from the fluid as part of the processing activity, as reservoir CO_2 is reported under its own production variable;
- the processing or transfer of other production variables such as processed natural gas, ethane or crude oil/condensate, as the emissions from other production variables from the activity must be apportioned as per the guidance provided below;
- processes which do not occur within the facility; and
- on-site electricity generation.

28.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable. Where a facility produces multiple products, emissions must be apportioned in a justifiable manner, making sure no emissions are counted more than once and the total emissions counted cannot be more than the total emissions from the facility.

The method for determining the amount of emissions to be apportioned to each reported production variable may be one of the following options:

1. Apportion emissions from the activity to each production variable using a whole-of-activity mass balance method that assigns emissions at each step to the associated material stream, tracked through the activity to its transportation out of the activity location. For example, for a processed natural gas activity that produces LPG as one of two or more production variables:
    - apportion emissions from the processing steps amongst all the production variables, using a mass balance method;
    - apportion the emissions from facility activities such as generation of utilities, venting and flaring, treatment of waste streams, amongst all the production variables, using a mass balance method;
    - apportion the emissions from remaining, general facility activities such as the control rooms, laboratories, and maintenance workshops amongst all the production variables, in the ratio of the amount of that production variable produced, for example on an energy basis, unless there is another justifiable basis.
2. Apportion all emissions unique to the production of LPG to the LPG production variable. Similarly, apportion all emissions unique to other production variables produced at the same facility to the relevant production variable. Apportion all emissions involved in processing steps prior to the separation of LPG amongst the various production variables on an energy basis, unless there is another justifiable basis. For example, for a natural gas processing plant that produces LPG as one of two or more production variables:
    - apportion all emissions from the pre-processing, such as bulk water separation and bulk CO_2 removal, amongst the various production variables in the ratio of the

amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis;

- apportion all emissions from processed natural gas production and further processed natural gas processing unit operations to the processed natural gas production variable;
- apportion all emissions from activities such as generation of utilities, venting, flaring, and treatment of waste streams, associated with the production of processed natural gas to the processed natural gas production variable;
- apportion all emissions from the LPG production unit operations, such as the fractionation steps that produced the propane and butane, to the LPG production variable;
- apportion all emissions from the further processing of the LPG, such as pumping to storage or the facility discharge pipeline, to the LPG production variable;
- apportion all emissions from activities such as generation of utilities, venting and flaring, treatment of waste streams, associated with the production of LPG, to the LPG production variable;
- apportion the emissions from remaining, general facility activities such as general utilities, the control rooms, laboratories, and maintenance amongst the various production variables in the ratio of the amount of each production variable produced, for example on an energy basis, unless there is another justifiable basis.

29. Reservoir carbon dioxide

29.1. Production variable definition

1. Tonnes of carbon dioxide (CO_2)that:
   (a) occurred naturally as carbon dioxide in a petroleum reservoir or a natural unconventional source; and
   (b) were extracted as a component of a natural gas or crude oil mixture from that reservoir or source; and
   (c) were separated in an acid gas removal unit from the natural gas, crude oil mixture or products produced from the extracted substances as part of one of the following activities:
      (i) the oil and gas extraction activity;
      (ii) the crude oil or condensate extraction and stabilisation activity;
      (iii) the natural gas processing activity;
      (iv) the natural gas production and processing activity;
      (v) the processed natural gas liquefaction activity;
      (vi) the unprocessed natural gas liquefaction activity;
   (d) when separated, consist of a mixture which is primarily carbon dioxide; and
   (e) have not previously been included as a tonne of carbon dioxide under this section; and
   (f) were not imported as a carbon dioxide stream from another facility.
2. The metric in subsection (1) is applicable to a facility that separates carbon dioxide from natural gas, crude oil mixtures or products produced from those substances as part of one of the following activities:
   (a) the oil and gas extraction activity;
   (b) the crude oil or condensate extraction and stabilisation activity;
   (c) the natural gas processing activity;
   (d) the natural gas production and processing activity;
   (e) the processed natural gas liquefaction activity;
   (f) the unprocessed natural gas liquefaction activity;
3. The default emissions intensity is given by the following equation:

$$EI,CO_2 = 1 - \text{storage rate}$$

where:

EI,CO₂ is the default emissions intensity, in t CO_2-e per tonne of carbon dioxide.

storage rate is the ***fraction*** of the separated carbon dioxide that is sent to storage using a carbon capture and storage, enhanced oil recovery or other petroleum reservoir management purpose determined by the Regulator for the facility and included in the baseline determination applicable to the facility.

29.2. Scope of the activity

The production of CO_2 as a by-product of oil and gas extraction and production activities is the process of separating naturally occurring reservoir CO_2 present in a natural gas and/or crude oil mixture, or their products, from the mixture or product stream. The reservoir CO_2 may be separated to produce a stream that was predominantly CO_2, or it may be present as a component in other streams vented and/or flared and released to atmosphere.

The activity may occur as part of any oil and gas extraction and production activity that resulted in the production of one or more hydrocarbon production variables. It is likely that most CO_2 removal occurs during natural gas processing and LNG production, however some CO_2 removal may occur during natural gas extraction, crude oil extraction and stabilisation, and/or ethane production.

For the removal of reservoir CO_2 from natural gas, the processing may involve chemical absorption, a membrane process or any other process that created a CO_2 rich stream from the natural gas. Other processes such as gas-liquid separation may result in the venting or flaring of a gaseous mixture containing CO_2 as a component.

The output of the activity is tonnes of naturally occurring reservoir CO_2 separated from the product stream. The production variable therefore is reservoir CO_2 that is released to atmosphere, is stored using a carbon capture and storage (CCS) mechanism or is stored by being utilised in an enhanced oil recovery or other petroleum reservoir management process, *less* CO_2 that has previously been separated and reinjected (for example, for enhanced oil recovery) and has resurfaced.

The default emissions intensity for reservoir CO_2 is (1 – "storage rate") tonnes CO_2 per tonne of carbon dioxide separated. The "storage rate" is the fraction of separated CO_2 that is sent to storage using a carbon capture and storage (CCS) process or enhanced oil recovery or other petroleum reservoir management purposes, rather than being released to atmosphere.

29.3. Inclusions

Emissions that are included in the reservoir CO_2 production variable calculation include:

- tonnes of naturally occurring reservoir CO_2 separated in an acid gas removal unit.

Emissions that are included in the 'storage rate' calculation include:

- the fraction of the separated CO_2 that is sent to storage using a carbon capture and storage (CCS) process or enhanced oil recovery or other petroleum reservoir management purposes, rather than being released to atmosphere (meaning only the reservoir CO_2 itself—see exclusions below).

29.4. Exclusions

Emissions that are not included in the production variable and associated 'storage rate' calculation include:

- machinery, equipment and processes involved in the separation of CO_2 from the feed stream or product—these are to be assigned to the facility's hydrocarbon production variables;
- further treatment, if any, of the separated CO_2 stream—these are to be assigned to the facility's hydrocarbon production variables;

- machinery, equipment and processes involved in the storage of CO_2 using a CCS mechanism, or utilisation of the CO_2 in enhanced oil recovery or other petroleum reservoir management processes—these are to be assigned to the facility's hydrocarbon production variables;
- the regeneration of any catalysts or solvents used to separate the CO_2, even if the regeneration is undertaken within the activity, as these are to be assigned to the relevant hydrocarbon production variables;
- other incidental, ancillary or supporting processes;
- processes which do not occur within the facility; and
- on-site electricity generation.

29.5. Multiple production variables from the same facility

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable.

The reservoir CO_2 production variable may be used in conjunction with any other oil and gas production variable, where the activity has included the separation of reservoir CO_2 from the feed stream or product, to provide an allowance for the emission of reservoir CO_2. The apportionment of emissions between the CO_2 production variable and the hydrocarbon production variable(s) is to be as described in the inclusions and exclusions above.

Steel manufacturing

There are nine prescribed production variables for primary steel manufacturing. Five production variables for integrated iron and steel manufacturing—from the preparation of raw materials to casting of carbon steel—are being grouped together in the activity of ***integrated iron and steel manufacturing***. This grouping is made in recognition of the integrated nature of the processes, which will avoid duplication of processes in the inclusions and exclusions list. The remaining four production variables are being defined as four activities that each represent the relevant production variable.

General definitions

integrated iron and steel manufacturing is the chemical and physical transformation of iron ore into crude carbon steel products and hot-rolled carbon steel products involving all of the following processes:

(a) the carbonisation of coal (principally coking coal) into coke oven coke;

(b) the chemical and physical transformation of either or both of limestone or dolomite, into lime (including burnt lime and burnt dolomite);

(c) the chemical and physical transformation of iron ore into iron ore sinter or iron ore pellets;

(d) the chemical and physical transformation of iron ore feed, including iron ore sinter or iron ore pellets, into molten iron which includes the reduction of oxides of iron using carbon as the predominant reducing agent;

(e) the chemical and physical transformation of molten iron and cold ferrous feed, such as pig iron, flat iron and ferrous scrap, into 1 or more of the following:

(i) continuously cast carbon steel products;

(ii) ingots of carbon steel.

manufacture of carbon steel from cold ferrous feed is the physical and chemical transformation of cold ferrous feed (such as ferrous scrap, pig iron and flat iron) by heating and melting into liquid steel and the subsequent casting of the liquid steel to produce 1 or more of the following:

(a) continuously cast carbon steel products;

(b) ingots of carbon steel.

carbon steel means material which*:*

(a) contains by mass more iron (Fe) than any other single element; and

(b) has a carbon (C) concentration less than 2%.

coke oven coke means the solid product obtained from the carbonisation of coal (principally coking coal) at a high temperature and includes coke breeze and foundry coke.

The following inclusions and exclusions list *applies* to the ***integrated iron and steel manufacturing*** activity, specifically:

- coke oven coke (integrated iron and steel manufacturing)

- lime (integrated iron and steel manufacturing)
- iron ore sinter (integrated iron and steel manufacturing)
- iron ore pellets (integrated iron and steel manufacturing)
- continuously cast carbon steel products and ingots of carbon steel (integrated iron and steel manufacturing).

Inclusions for integrated iron and steel manufacturing

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes at the facility are included:

- the use of machinery, equipment and processes used for the physical and/or chemical transformation described in the activity definition, including, for example:
    - machinery used to move materials within the facility, including mobile equipment;
    - control rooms, laboratories, maintenance workshops;
    - machinery used to create non-electrical energy for use in the activity;
    - the processing of by-products where it involves the recovery of materials for re-use within the activity or is necessary for the activity to proceed as described[2]; and
    - onsite processing of waste materials and by-products from the activity;
- waste heat recovery within the facility;
- steam produced on-site that is not used to produce electricity;
- the production of cryogenic gases e.g. oxygen, nitrogen and argon that are consumed in the activity;
- the conduct of secondary metallurgical treatment;
- the production of intermediate products manufactured for export from the facility;
- casting via the continuous casting process or ingot casting process into intermediate steel products;
- the processing of cold ferrous feed where that process is conducted on site;
- the treatment or combustion of indigenous waste gases, e.g. coke oven gas, blast furnace gas and basic oxygen steelmaking off-gas;
- steel scrap receival (including quality checks and storage);
- warehousing or storage of activity outputs, raw materials and consumables used by the activity where this is at the same location as the activity;
- water and waste treatment (including gases) necessary for the activity to be conducted;
- transportation of inputs (including intermediate products) used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;

[2] Examples include BTX, blast furnace slag, gypsum and ammonium sulphate.

- transportation of the outputs (including intermediate products) from the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary activities, such as raw material preparation (including blending, sizing), straightening and cold-forming, facility managed port operations, packaging, head office, administrative and marketing operations where they are undertaken at the site of the facility; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables in accordance with:

- the methods used to calculate the emissions of continuously cast carbon steel in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
- the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019.

Exclusions for integrated iron and steel manufacturing

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are not taken to relate to the activity and must be excluded from the calculation of an estimated emissions intensity value relevant to this activity:

- the primary extraction and concentration of raw materials prior to the conduct of the activity;
- any stand-alone finishing processes, including, but not limited to, cold-rolling, annealing, pickling or coating of steel products;
- processes which do not occur within the facility;
- on-site electricity generation.

30. Coke oven coke (integrated iron and steel manufacturing)

30.1. Production variable definition

1. Tonnes of coke oven coke on a dry weight basis that:
   (a) are produced as part of carrying on the integrated iron and steel manufacturing activity at the facility; and
   (b) meet the necessary requirements for use in the integrated iron and steel manufacturing activity.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of ***integrated iron and steel manufacturing***.
3. The default emissions intensity is 0.467 t CO_2-e per tonne of coke oven coke.

30.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are included within the production variable:

- the component of emissions from the activity of integrated iron and steel manufacturing that is attributable to the production of coke oven coke by:
  - the methods used to calculate the emissions of coke oven coke in accordance with the requirements in the National Greenhouse and Energy Reporting (Measurement) Determination 2008; and
  - the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

30.3. Exclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are not taken to relate to the production variable and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes excluded from the activity of integrated iron and steel manufacturing;
- processes which do not occur within the facility;
- on-site electricity generation; and
- coal mining.

31. Lime (integrated iron and steel manufacturing)

31.1. Production variable definition

1. Tonnes of lime on a dry weight basis that:
   (a) are produced as part of carrying on the integrated iron and steel manufacturing activity at the facility; and
   (b) meet the necessary requirements for use in the integrated iron and steel manufacturing activity.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of ***integrated iron and steel manufacturing***.
3. The default emissions intensity is 0.780 t CO_2-e per tonne of lime.

31.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are included within the production variable:

- the component of emissions from the activity of ***integrated iron and steel manufacturing*** that is attributable to the production of lime (including burnt lime and burnt dolomite) by:
  - the methods used to calculate the emissions of lime in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
  - the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

31.3. Exclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are not taken to relate to the production variable and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes excluded from the activity of integrated iron and steel manufacturing;
- processes which do not occur within the facility;
- on-site electricity generation; and
- the extraction of raw materials.

32. Iron ore sinter (integrated iron and steel manufacturing)

32.1. Production variable definition

1. Tonnes of iron ore sinter on a dry weight basis that:
   (a) are produced as part of carrying on the integrated iron and steel manufacturing activity at the facility; and
   (b) meet the necessary requirements for use in the integrated iron and steel manufacturing activity.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of ***integrated iron and steel manufacturing***.
3. The default emissions intensity is 0.233 t CO_2-e per tonne of iron ore sinter.

32.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are included within the production variable:

- the component of emissions from the activity of integrated iron and steel manufacturing that is attributable to the production of iron ore sinter by:
  - the methods used to calculate the emissions of iron ore sinter in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
  - the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

32.3. Exclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are not taken to relate to the production variable and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes excluded from the activity of integrated iron and steel manufacturing***;***
- processes which do not occur within the facility;
- on-site electricity generation; and
- iron ore mining.

33. Iron ore pellets (integrated iron and steel manufacturing)

33.1. Production variable definition

1. Tonnes of iron ore pellets on a dry weight basis that:
   (a) are produced as part of carrying on the integrated iron and steel manufacturing activity at the facility; and
   (b) meet the necessary requirements for use in the integrated iron and steel manufacturing activity.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of ***integrated iron and steel manufacturing***.
3. The default emissions intensity is 0.0586 t CO_2-e per tonne of iron ore pellets.

33.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are included within the production variable:

- the component of emissions from the activity of integrated iron and steel manufacturing that is attributable to the production of iron ore pellets by:
  - the methods used to calculate the emissions of iron ore pellets in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
  - the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

33.3. Exclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are not taken to relate to the production variable and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes excluded from the activity of integrated iron and steel manufacturing;
- processes which do not occur within the facility;
- on-site electricity generation; and
- iron ore mining.

34. Iron ore pellets (not from integrated iron and steel manufacturing)

34.1. Production variable definition

1. Tonnes of iron ore pellets on a dry weight basis that:
   (a) are produced as part of carrying on the iron ore pellet production activity at the facility; and
   (b) have a concentration of iron (Fe) equal to or greater than 63%; and
   (c) have a concentration of alumina (aluminium oxide (Al_2O_3)) equal to or less than 2%; and
   (d) have a concentration of silicon dioxide (silica (SiO_2)) equal to or less than 7%; and
   (e) have an average diameter of between 9 and 16 millimetres; and
   (f) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of producing iron ore pellets through the physical and chemical transformation of iron ore into saleable iron ore pellets that are for the production of steel and that have:
   (a) a concentration of iron (Fe) equal to or greater than 63%; and
   (b) a concentration of alumina (aluminium oxide (Al_2O_3)) equal to or less than 2%; and
   (c) a concentration of silicon dioxide (silica (SiO_2)) equal to or less than 7%; and
   (d) an average diameter of between 9 and 16 millimetres.
3. However, the metric is subsection (1) is not applicable to a facility that includes the integrated iron and steel manufacturing activity.
4. The activity in subsection (2) is the ***iron ore pellets production activity***.
5. The default emissions intensity is 0.0517 t CO_2-e per tonne of iron ore pellets.
6. In this section:

   iron ore means any form of iron ore product that has not been semi-processed into iron ore balls or exposed to a hardening process by the application of heat or pressure and includes:
   (a) magnetite ore that has been concentrated; and
   (b) hematite ore that has been crushed to varying extents.

34.2. Inclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes within the facility are included:

- the direct emissions from machinery, equipment, facilities and processes used for the physical and/or chemical transformation described in the activity definition, including, for example:

  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the activity or are necessary for the activity to proceed as described; and
  - onsite processing of by-products and waste materials from the activity;
- emissions associated with the production of hot air for use in furnace operations;
- waste heat recovery within the facility;
- steam produced on-site that is not used to produce electricity;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations where they are undertaken at the site of the facility; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the iron ore pellets production activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

34.3. Exclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are not taken to relate to the activity and must be excluded from the calculation of an estimated (site-specific) emissions intensity value from the activity:

- the production of iron ore concentrate;
- processes which do not occur within the facility;
- on-site electricity generation.

35. Continuously cast carbon steel products and ingots of carbon steel (integrated iron and steel manufacturing)

35.1. Production variable definition

1. Tonnes of continuously cast carbon steel products and ingots of carbon steel that:
   (a) are produced as part of carrying on the integrated iron and steel manufacturing activity at the facility; and
   (b) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of ***integrated iron and steel manufacturing***.
3. The default emissions intensity is 1.50 t CO_2-e per tonne of continuously cast carbon steel products and ingots of carbon steel.

35.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are included within the production variable:

- the component of emissions from the activity of integrated iron and steel manufacturing that is attributable to the production of continuously cast carbon steel products by:
  - the methods used to calculate the emissions of continuously cast carbon steel in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
  - the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019.
- the preparation of cold ferrous feed prior to any heating and melting into liquid steel;
- the conduct of secondary metallurgical treatment; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

35.3. Exclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes are not taken to relate to the production variable and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- processes excluded from the activity of integrated iron and steel manufacturing;
- processes which do not occur within the facility;
- on-site electricity generation.

36. Continuously cast carbon steel products and ingots of carbon steel (manufacture of carbon steel products from cold ferrous feed)

36.1. Production variable definition

1. Tonnes of continuously cast carbon steel products and ingots of carbon steel that:
   (a) are produced as part of carrying on the manufacture of carbon steel products from cold ferrous feed activity at the facility; and
   (b) are not produced as part of carrying on the integrated iron and steel manufacturing activity at the facility; and
   (c) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of the ***manufacture of carbon steel products from cold ferrous feed***.
3. The default emissions intensity is 0.0981 t CO_2-e per tonne of continuously cast carbon steel products and ingots of carbon steel.

36.2. Inclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are included within the activity boundary:

- the use of machinery, equipment and processes used for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where it involves the recovery of materials for re-use within the activity or is necessary for the activity to proceed as described; and
  - onsite processing of waste materials or by-products from the activity;
- waste heat recovery within the facility;
- steam produced on-site that is not used to produce electricity;
- warehousing or storage of activity outputs, raw materials and consumables used by the activity where this is at the same location as the activity;
- the preparation of cold ferrous feed prior to any heating and melting into liquid steel;
- the conduct of secondary metallurgical treatment;
- the production of cryogenic gases, e.g. oxygen, nitrogen and argon that are consumed in the activity;
- casting via processes such as continuous casting or ingot casting into intermediate steel products;

- water and waste treatment (including gases etc.) necessary for the activity to be conducted;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility as the activity;
- transportation of the outputs from the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as raw material preparation (including blending, sizing), facility managed port operations, straightening and cold-forming, packaging, head office, administrative and marketing operations where they are undertaken at the site of the facility; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions from ancillary services or processes (which do not relate to a specific output) to one production variable only, or apportion those emissions among production variables on a justifiable basis.

36.3. Exclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are not taken to relate to the activity and must be excluded from the calculation of an estimated (site-specific) emissions intensity value from the activity:

- the primary extraction and concentration of raw materials prior to the conduct of the activity;
- any stand-alone finishing processes, including, but not limited to, cold-rolling, annealing, pickling or coating of steel products;
- processes which do not occur within the facility;
- on-site electricity generation.

37. Hot-rolled long products

37.1. Hot-rolled long products

1. Tonnes of hot-rolled carbon steel long products that:
   (a) are produced as part of carrying on the hot-rolled carbon steel long products activity at the facility; and
   (b) are in coils or straight lengths; and
   (c) are generally produced in rod, bar and structural (section) mills; and
   (d) generally have a cross sectional shape such as I, T, Y, U, V, H, C, L, square, rectangular, round, flat, hexagonal, angle, channel, structural beam profile or rail profile; and
   (e) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of the hot-rolling continuously cast carbon steel products (originally produced from an integrated iron and steel manufacturing activity or manufacture of carbon steel from cold ferrous feed activity) into carbon steel long products that:
   (a) are in coils or straight lengths; and
   (b) are generally produced in rod, bar and structural (section) mills; and
   (c) generally have a cross sectional shape such as I, T, Y, U, V, H, C, L, square, rectangular, round, flat, hexagonal, angle, channel, structural beam profile or rail profile.
3. The activity in subsection (2) is the ***hot-rolled carbon steel long products activity***.
4. The default emissions intensity is 0.0743 t CO_2-e per tonne of long products.

37.2. Inclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are included within the activity boundary:

- the direct emissions from machinery, equipment and processes used for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the on-site recovery and processing of steel scrap from rolling operations back into facility operations;
  - onsite processing of waste materials and by-products from the activity;
- waste heat recovery within the facility;
- steam produced on-site that is not used to produce electricity;

- warehousing or storage of activity outputs, raw materials and consumables used by the activity where this is at the same location as the activity;
- water and waste treatment (including gases) necessary for the activity to be conducted;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations where they are undertaken at the site of the facility; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

Where emissions need to be apportioned among the activity of integrated iron and steel manufacturing and the activity of hot-rolled long products, the responsible emitter should use:

- the methods used to calculate the emissions of continuously cast carbon steel in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
- the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019.

A facility can assign emissions from ancillary services or processes (which do not relate to a specific output) to one production variable only, or apportion those emissions among production variables as described above.

37.3. Exclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are not taken to relate to the activity and must be excluded from the calculation of an estimated (site-specific) emissions intensity value from the activity:

- any stand-alone finishing processes, including, but not limited to, cold-rolling, annealing, pickling or coating of steel products;
- processes which do not occur within the facility;
- on-site electricity generation.

38. Hot-rolled flat products

38.1. Production variable definition

1. Tonnes of hot-rolled carbon steel flat products that:
   (a) are produced as part of carrying on the hot-rolled carbon steel flat products activity at the facility; and
   (b) are flat in profile, such as plate and hot rolled coil; and
   (c) are generally produced in hot strip mills and plate mills; and
   (d) are generally greater than 600 mm in width; and
   (e) are generally less than 150 mm in thickness; and
   (f) are of saleable quality.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of the hot-rolling continuously cast carbon steel products (originally produced from an integrated iron and steel manufacturing activity or manufacture of carbon steel from cold ferrous feed activity) into carbon steel flat products that:
   (a) are flat in profile, such as plate and hot rolled coil; and
   (b) are generally produced in hot strip mills and plate mills; and
   (c) are generally greater than 600 mm in width; and
   (d) are generally less than 150 mm in thickness.
3. The activity in subsection (2) is the ***hot-rolled carbon steel flat products activity***.
4. The default emissions intensity is 0.000358 t CO_2-e per tonne of flat products.

38.2. Inclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are included within the activity boundary:

- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where it involves the recovery of materials for re-use within the activity or is necessary for the activity to proceed as described[3]; and
  - the on-site recovery and processing of steel scrap from rolling operations back into facility operations; and

[3] Examples include BTX, blast furnace slag, gypsum and ammonium sulphate.

  - onsite processing of waste materials and by-products from the activity;
- waste heat recovery within the facility;
- steam produced on-site that is not used to produce electricity;
- casting via the continuous casting process or ingot casting process into intermediate steel products;
- warehousing or storage of activity outputs, raw materials and consumables used by the activity where this is at the same location as the activity;
- water and waste treatment (including gases) necessary for the activity to be conducted;
- transportation of inputs used in the activity to storage at the facility, where the transport activity wholly occurs within the facility;
- transportation of the output of the activity from storage at the facility, where the transport activity wholly occurs within the facility;
- complementary processes, such as packaging, head office, administrative and marketing operations, where they are undertaken at the site of the facility; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

It is intended that all scope 1 NGER-reported emissions from a facility can be assigned to a production variable, but where a facility produces multiple products, emissions cannot be counted more than once.

Where emissions need to be apportioned among the activity of integrated iron and steel manufacturing and the activity of hot-rolled flat products, the responsible emitter should use:

- the methods used to calculate the emissions of continuously cast carbon steel in accordance with the requirements in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
- the apportioning method used by the responsible emitter in their data submission to the Department for the purposes of calculating the default emissions intensity in 2019.

A facility can assign emissions from ancillary services or processes (which do not relate to a specific output) to one production variable only, or apportion those emissions among production variables as described above.

38.3. Exclusions

For the purposes of the development of the default emissions intensity values relevant to this activity and the preparation of estimated (site-specific) emission intensity values for production variables relevant to this activity, scope 1 emissions from the following processes are not taken to relate to the activity and must be excluded from the calculation of an estimated (site-specific) emissions intensity value from the activity:

- any stand-alone finishing processes, including, but not limited to, cold-rolling, annealing, pickling or coating of steel products;
- processes which do not occur within the facility;
- on-site electricity generation.

Rail transport

Rail transport is the use of rolling stock that combusts fuels on-board for propulsion and transports passengers or freight on a rail system.

Note: Fuel may be combusted by a drive train or used to generate electricity which runs the drive train.

There are four prescribed production variables for rail transport. All fall under the *activity* of *rail transport*.

General definitions

ANZSIC industry classification and code means an industry classification and code for that classification published in the Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006.

bulk freight includes goods that consist of large quantities of homogenous product that is generally non-containerised and conveyed in wagons, such as iron ore, coal and grain.

dedicated line includes:

(a) a line which only services the rail transport needs of a single business enterprise or corporate group; and

(c) a vertically integrated rail system:

(i) where the rail infrastructure manager and the user of the rail system is under common control or part of a common corporate group; and

(ii) that wholly or predominantly serves the rail transport needs of a single business enterprise or corporate group.

freight includes a saleable good.

net-tonne-kilometre means the unit of measure representing the movement over a distance of one kilometre of one tonne of freight. The weight of the rolling stock (such as tractive vehicle and rail car) is excluded.

passenger-kilometre means the unit of measure representing the movement over a distance of one kilometre of one passenger.

Note: facilities that are not in the rail freight transport or rail passenger transport sectors are excluded from the use of rail transport production variables.

39. Net-tonne-kilometres of bulk freight on a dedicated line

39.1. Production variable definition

1. Net-tonne-kilometres of bulk freight that:
   (a) result from carrying on the rail transport activity at the facility; and
   (b) is transported by rail:
      (i) only using a dedicated line; or
      (ii) using a dedicated line for over 70% of the journey.
2. The metric in subsection (1) is applicable to a facility that:
   (a) conducts the activity of ***rail transport***; and
   (b) transports bulk freight by rail wholly or partly on one or more dedicated lines; and
   (c) is in the rail freight transport ANZSIC industry classification and code 471.
3. The default emissions intensity is 0.00000527 t CO_2-e per net-tonne-kilometre of bulk freight.
4. The net-tonne kilometres must be measured consistently with relevant industry practice.

39.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on-board a rolling stock to drive the propulsion system for the purpose of transferring passengers and freight on a rail system;
- combustion of fuels on-board the rolling stock for the generation of electricity to drive the propulsion system for the purpose of transferring passengers and goods on a rail system. For example, a diesel engine connected to an electrical generator, creating electricity that powers electric traction motors;
- electricity generated by the propulsion system of a rolling stock that is consumed within the rolling stock;
- direct emissions from, and electricity use of, machinery and equipment used for supporting rail freight or passenger transport. For example, vehicles and equipment used in rail system maintenance activities;
- water and waste treatment (including fugitive emissions) necessary to support rail system maintenance activities. For example, water and waste treatment for maintenance camps along the rail system;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the net-tonne-kilometres of bulk freight on a dedicated line activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

39.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the rolling stock not sent to the propulsion system or traction motors of the rolling stock;
- manufacturing process emissions;
- processes which do not occur within the facility.

40. Net-tonne-kilometres of bulk freight on a non-dedicated line

40.1. Production variable definition

1. Net-tonne-kilometres of bulk freight that:
   (a) result from carrying on the rail transport activity at the facility; and
   (b) is transported by rail; and
   (c) either:
      (i) does not use a dedicated line; or
      (ii) uses a dedicated line for 70% or less of the journey.
2. The metric in subsection (1) is applicable to a facility that:
   (a) conducts the activity of ***rail transport***; and
   (b) transports bulk freight by rail wholly or partly on one or more non-dedicated lines; and
   (c) is in the rail freight transport ANZSIC industry classification and code 471.
3. The default emissions intensity is 0.0000163 t CO_2-e per net-tonne-kilometre of bulk freight.
4. The net-tonne kilometres must be measured consistently with relevant industry practice.

40.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on-board a rolling stock to drive the propulsion system for the purpose of transferring passengers and goods on a rail system;
- combustion of fuels on-board the rolling stock for the generation of electricity to drive the propulsion system for the purpose of transferring passengers and goods on a rail system. For example, a diesel engine connected to an electrical generator, creating electricity that powers electric traction motors;
- electricity generated by the propulsion system of a rolling stock that is consumed within the rolling stock;
- direct emissions from, and electricity use of, machinery and equipment used for supporting rail freight or passenger transport. For example, vehicles and equipment used in rail system maintenance activities;
- water and waste treatment (including fugitive emissions) necessary to support rail system maintenance activities. For example, water and waste treatment for maintenance camps along the rail system;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

Where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

40.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the rolling stock not sent to the propulsion system or traction motors of the rolling stock;
- manufacturing process emissions;
- processes which do not occur within the facility.

41. Net-tonne-kilometres of non-bulk freight

41.1. Production variable definition

1. Net-tonne-kilometres of freight that:
   (a) result from carrying on the rail transport activity at the facility; and
   (b) is transported by rail; and
   (c) is not bulk freight.
2. The metric in subsection (1) is applicable to a facility that:
   (a) conducts the activity of ***rail transport***; and
   (b) transports freight that is not bulk freight; and
   (c) is in the rail freight transport ANZSIC industry classification and code 471.
3. The default emissions intensity is 0.0000204 t CO_2-e per net-tonne-kilometre of freight.
4. The net-tonne kilometres must be measured consistently with relevant industry practice.

41.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on-board a rolling stock to drive the propulsion system for the purpose of transferring passengers and goods on a rail system;
- combustion of fuels on-board the rolling stock for the generation of electricity to drive the propulsion system for the purpose of transferring passengers and goods on a rail system. For example, a diesel engine connected to an electrical generator, creating electricity that powers electric traction motors;
- electricity generated by the propulsion system of a rolling stock that is consumed within the rolling stock;
- direct emissions from, and electricity use of, machinery and equipment used for supporting rail freight or passenger transport. For example, vehicles and equipment used in rail system maintenance activities;
- water and waste treatment (including fugitive emissions) necessary to support rail system maintenance activities. For example, water and waste treatment for maintenance camps along the rail system;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

Where a facility produces multiple products, emissions cannot be counted more than once.

When calculating estimated (site-specific) emissions intensity values, a facility can assign emissions which do not relate to a specific output either to one production variable only, or apportion those emissions among production variables on a justifiable basis.

41.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the rolling stock not sent to the propulsion system or traction motors of the rolling stock;
- manufacturing process emissions;
- processes which do not occur within the facility.

42. Passenger-kilometres of rail passenger transport

42.1. Production variable definition

1. Passenger-kilometres that result from carrying on the rail transport activity at the facility.
2. The metric in subsection (1) is applicable to a facility that:
   (a) conducts the activity of ***rail transport***; and
   (b) transports passengers; and
   (c) is in the rail passenger transport ANZSIC industry classification and code 472.
3. The default emissions intensity is 0.0000710 t CO_2-e per passenger-kilometre.
4. The net-tonne kilometres must be measured consistently with relevant industry practice.

42.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on-board a rolling stock to drive the propulsion system for the purpose of transferring passengers and goods on a rail system;
- combustion of fuels on-board the rolling stock for the generation of electricity to drive the propulsion system for the purpose of transferring passengers and goods on a rail system. For example, a diesel engine connected to an electrical generator, creating electricity that powers electric traction motors;
- electricity generated by the propulsion system of a rolling stock that is consumed within the rolling stock;
- direct emissions from, and electricity use of, machinery and equipment used for supporting rail freight or passenger transport. For example, vehicles and equipment used in rail system maintenance activities;
- water and waste treatment (including fugitive emissions) necessary to support rail system maintenance activities. For example, water and waste treatment for maintenance camps along the rail system;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur within the boundary of the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the passenger-kilometres of rail passenger transport activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

42.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the rolling stock not sent to the propulsion system or traction motors of the rolling stock;
- manufacturing process emissions;
- processes which do not occur within the facility.

Air transport

43. Revenue-tonne-kilometres of air transport

43.1. Production variable definition

1. Revenue-tonne-kilometres of air transport that:
   (a) result from carrying on the air transport activity at the facility; and
   (b) relates to the covered emissions of the facility.
2. The metric in subsection (1) is applicable to a facility that:
   (a) transports passengers and freight by air (the ***air transport activity***); and
   (b) is in the air and space transport ANZSIC industry classification and code 490.
3. The default emissions intensity is 0.00112 t CO_2-e per revenue-tonne-kilometre.

In this section:

freight-tonne-kilometre means the unit of measure representing the movement of a tonne of freight over the distance of one kilometre calculated by multiplying the total tonnes of freight on a flight by the distance flown.

passenger-tonne-kilometre means the unit of measure representing the movement of a revenue-generating passenger over the distance of one kilometre calculated by assuming each passenger and baggage on a flight total 90 kilograms and multiplying by the distance flown.

revenue-tonne-kilometre means the sum of passenger-tonne-kilometres and freight-tonne-kilometres.

43.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on the aircraft to drive the propulsion system for the purpose of transferring passengers and freight;
- combustion of fuels on the aircraft for the generation of electricity to drive the propulsion system for the purpose of transferring passengers and freight;
- electricity generated by the propulsion system of the aircraft that is consumed on the aircraft;
- direct emissions from, and electricity use of, vehicles, machinery and equipment used for supporting air transport. For example, ground vehicles used in transporting passengers on the air or land side of an airport;
- fugitive emissions from air conditioning and refrigeration;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur at the facility that is undertaking the activity; and

- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the air transport activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

43.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the aircraft not sent to the propulsion system of the aircraft;
- manufacturing process emissions;
- processes which do not occur within the facility.

Passenger road transport

44. Vehicle-kilometres of passenger road transport

44.1. Production variable definition

1. Vehicle-kilometres of passenger road transport that result from carrying on the road passenger transport activity at the facility.

2. The metric in subsection (1) is applicable to a facility that:

   (a) transports passengers by road in registered vehicles (the ***road passenger transport activity***); and

   (b) is in the passenger road transport ANZSIC industry classification and code 462.

3. The default emissions intensity is 0.00164 t CO_2-e per vehicle-kilometre.

In this section:

> ***vehicle-kilometre*** means the unit of measure representing the movement of a vehicle over the distance of one kilometre.

44.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on the road registered vehicle to drive the propulsion system for the purpose of transferring passengers;
- combustion of fuels on the road registered vehicle for the generation of electricity to drive the propulsion system for the purpose of transferring passengers;
- electricity generated by the propulsion system of the road registered vehicle that is consumed within the road registered vehicle;
- direct emissions from, and electricity use of, vehicles, machinery and equipment used for supporting the road passenger transport activity;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur within the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the vehicle-kilometres of passenger road transport activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

44.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the road registered vehicle not sent to the propulsion system of the road registered vehicle;
- manufacturing process emissions;
- processes which do not occur within the facility.

Mixed passenger and freight water transport

45. Deadweight-tonne-kilometres of mixed passenger and freight water transport

45.1. Production variable definition

1. Deadweight-tonne-kilometres of water transport that:
   (a) result from carrying on the mixed passenger and freight water transport activity at the facility; and
   (b) relates to the covered emissions of the facility.
2. The metric in subsection (1) is applicable to a facility that:
   (a) transports passengers and freight by water (the ***mixed passenger and freight water transport activity***); and
   (b) is in the water freight transport or water passenger transport ANZSIC industry classification and codes 481 or 482.
3. The default emissions intensity is 0.000103 t CO_2-e per operational deadweight-tonne-kilometre.
4. The relevant kilometres must be measured:
   (a) using the actual distance travelled and recorded on a ship for a voyage; or
   (b) by using an internationally accepted standard distance between the two ports on a voyage.

In this section:

operational deadweight tonne is a tonnes of the cargo, passengers, fuel, dry provisions, supplies and other things carried on board a ship for a voyage, but not including the ship itself.

deadweight-tonne-kilometre means the unit of measure representing the movement of an operational deadweight tonne over the distance of one kilometre.

45.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- combustion of fuels on the ship to drive the propulsion system for the purpose of transferring passengers and freight;
- combustion of fuels on the ship for the generation of electricity to drive the propulsion system for the purpose of transferring passengers and freight;
- electricity generated by the propulsion system of the ship that is consumed on the ship;
- direct emissions from, and electricity use of, vehicles, machinery and equipment used for supporting water passenger and freight transport;

- fugitive emissions from air conditioning and refrigeration;
- complementary activities, such as packaging, head office, administrative and marketing operations, which occur within the facility that is undertaking the activity; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the operational deadweight-tonne-kilometres of mixed passenger and freight water transport activity includes all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

45.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on the ship not sent to the propulsion system of the ship;
- manufacturing process emissions;
- processes which do not occur within the facility.

Wastewater

46. Wastewater handling (domestic and commercial)

46.1. Production variable definitions

1. Tonnes of the following:
   (a) COD removed, calculated in accordance with subsection (4); and
   (b) nitrogen removed, calculated in accordance with subsection (5).
2. The metric in subsection (1) is applicable to a facility whose primary activity is the handing of either or both of domestic or commercial wastewater and reports emissions under Division 5.3 of the NGER (Measurement) Determination.
3. The default emissions intensity is:
   (a) 0.459 t CO_2e per tonne of COD removed; and
   (b) 5.03 t CO_2e per tonne of Nitrogen removed.
4. For paragraph (1)(a), COD removed is given by the following equation:

$$\text{COD removed} = \text{COD}_{\text{measured entering}} - (\text{COD}_{\text{in effluent leaving site}} + \text{COD}_{\text{in sludge leaving site}})$$

where:

COD$_{\textit{measured entering}}$ is the COD entering the site measured consistently with the requirements in Division 5.3 of the NGER (Measurement) Determination.

COD$_{\textit{in effluent leaving site}}$ is the COD leaving the site measured consistently with the requirements in Division 5.3 of the NGER (Measurement) Determination.

COD$_{\textit{in sludge leaving site}}$ is COD in sludge leaving the site measured consistently with the requirements in Division 5.3 of the NGER (Measurement) Determination.

5. For paragraph (1)(b), nitrogen removed is given by the following equation:

$$\text{nitrogen removed} = \text{N}_{\text{measured entering}} - (\text{N}_{\text{in effluent leaving site}} + \text{N}_{\text{in sludge leaving site}})$$

where:

N$_{\textit{measured entering}}$ is the nitrogen entering the site measured consistently with the requirements in Division 5.3 of the NGER (Measurement) Determination.

N$_{\textit{in effluent leaving site}}$ is the nitrogen leaving the site measured consistently with the requirements in Division 5.3 of the NGER (Measurement) Determination.

N$_{\textit{in sludge leaving site}}$ is the nitrogen in sludge leaving the site measured consistently with the requirements in Division 5.3 of the NGER (Measurement) Determination.

In this section:

COD or ***chemical oxygen demand*** means the total material available for chemical oxidation (both biodegradable and non-biodegradable) measured in tonnes.

46.2. COD Removed Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions of all gases, other than nitrous oxide, from the following processes at the facility are included:

- the treatment of wastewater received by the facility as well as from other associated on-site processes, including:
  - flaring;
  - stationary equipment such as diesel back-up or natural gas boilers not used to generate electricity;
  - sulphur hexafluoride gases used in equipment at the facility;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the facility or are necessary for the activity to proceed as described;
  - processing of waste materials from the activity;
  - furnaces; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the COD removed activity includes all scope 1 NGER-reported emissions, other than emissions of nitrous oxide and scope 1 emissions from on-site electricity generation, from the facilities relevant for setting the default intensity value.

46.3. COD Removed Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- further treatment of the outflow by receiving entities;
- pre-treatment of industrial and commercial wastewater that occurs off-site;
- processes that do not occur within the facility, such as the distribution and transportation of treated wastewater, sludge biosolids, and other outputs from the facility to receiving destinations;
- on-site electricity generation; and
- processes that are included in the definition of another production variable.

46.4. Nitrogen Removed Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions of nitrous oxide from the following processes at the facility are included:

- the treatment of wastewater received by the facility as well as from other associated on-site processes;
- the use of machinery, equipment and processes for the physical and/or chemical transformation described in the activity definition, including, for example:
  - machinery used to move materials within the facility, including mobile equipment;
  - control rooms, laboratories, maintenance workshops;
  - machinery used to create non-electrical energy for use in the activity;
  - the processing of by-products where they involve the recovery of materials for re-use within the facility or are necessary for the activity to proceed as described;
  - processing of by-products and waste materials from the activity;
  - furnaces;
  - flaring; and
- other incidental, ancillary or supporting processes which are not included in another default or estimated emissions intensity value.

The default emissions intensity value for the nitrogen removed activity includes all scope 1 NGER-reported emissions of nitrous oxide from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

46.5. Nitrogen Removed Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- further treatment of the outflow by receiving entities;
- pre-treatment of industrial and commercial wastewater that occurs off-site;
- processes that do not occur within the facility, such as the distribution and transportation of treated wastewater, sludge biosolids, and other outputs from the facility to receiving destinations;
- on-site electricity generation.

Electricity

47. Electricity generation

47.1. Production variable definition

1. Megawatt hours of electricity that:
   (a) are produced as part of carrying on the electricity generation activity at the facility; and
   (b) if electricity generation is the only production variable applicable to the facility—are exported from the facility; and
   (c) if the electricity generation occurs on a vehicle:
      (i) are not used by the vehicle's propulsion system; or
      (ii) are not both generated by a vehicle's propulsion system and used by or on the vehicle for purposes unrelated to propulsion.
2. The metric in subsection (1) is applicable to a facility that conducts the activity of electricity generation (the ***electricity generation activity***).
3. The default emissions intensity is 0.538 t CO_2-e:
   (a) if paragraph (1)(b) does not apply—per megawatt hour of electricity generated; and
   (b) if paragraph (1)(b) applies—per megawatt hour of electricity exported from the facility.
4. The megawatt hours of electricity under subsections (1) and (3) must:
   (a) be metered; and
   (b) if some or all of the electricity is exported to a designated electricity network—be measured consistently with the requirements applicable to the designated electricity network; and
   (c) if paragraph (b) applies and the electricity is exported to a designated electricity network—be measured in accordance with the requirements for the export of electricity into the designated electricity network.

47.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- electricity produced on-site and sent to a designated electricity network (as defined in section 4 of the Safeguard Rule); and
- electricity produced on-site that is used on-site or sent to another location that is not a designated electricity network (as defined in section 4 of the Safeguard Rule);
  - note: this includes electricity generated on a vehicle, but not by its propulsion system (e.g. by a generator on a ship), that is either used on-site or sent to another location.

To avoid confusion: emissions from electricity generation that is not used in, or generated by, a vehicle's drive train or propulsion system have been included in the calculation of the emissions intensity value for the prescribed electricity generation production variable. Facilities are therefore able to receive baseline allocation for such generation through the use of the prescribed electricity generation production variable.

47.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- electricity generated on a vehicle that is used by the vehicle's (including ship's) propulsion system;
- electricity generated by a vehicle's (including ship's) propulsion system that is used by the vehicle for non-propulsion purposes (such as lighting, navigation, refrigeration).
    - Note that emissions from electricity generated by a vehicle's (including ship's) propulsion system that is exported outside the facility was included in the calculation of the default emissions intensity value for the electricity generation production variable, which means that generation of that type (such a regenerative breaking from trains) is eligible to use the electricity generation production variable in a baseline application;
- steam produced on-site that is not used to produce electricity;
- processes that do not occur within the facility.

SCHEDULE 3 PRODUCTION VARIABLES

48. Petroleum refining

48.1. Production variable definition

1. Kilolitres of the following substances that are used in carrying on the activity of petroleum refining at the facility in accordance with subsection (2):
   (a) stabilised crude petroleum oil at 15 °C and 1 atmosphere; and
   (b) condensate at 15 °C and 1 atmosphere; and
   (c) tallow at 15 °C and 1 atmosphere; and
   (d) vegetable oil at 15 °C and 1 atmosphere; and
   (e) eligible petroleum feedstocks at 15 °C and 1 atmosphere.
2. A substance mentioned in paragraphs (1)(a) to (e) is used in carrying on the activity of petroleum refining if the substance is, or is to be, refined:
   (a) by 1 or both of the processes mentioned in paragraphs (3)(a) and (b); and
   (b) into either of the following:
      (i) 1 or more petroleum products mentioned in paragraphs (3)(c) and (d);
      (ii) other by products which result from carrying on the petroleum refining activity.
3. The metric in subsection (1) is applicable to a facility that conducts the activity of petroleum refining through the chemical and physical transformation of stabilised crude petroleum oil, which may be supplemented with 1 or more of condensate, tallow, vegetable oil, eligible petroleum feedstocks or other petroleum feedstocks, to produce a range of refined petroleum products through the following processes:
   (a) the distillation of stabilised crude petroleum oil, condensate, tallow, vegetable oil and other petroleum feedstocks;
   (b) the adjustment of the molecular weight and structure of hydrocarbons (such as that which occurs through catalytic or hydro cracking, steam or catalytic reforming, polymerisation, isomerisation or alkylation);
   (c) the blending of products from distillation and adjustment of molecular weight and structure to produce Australian and international standard diesel, jet fuel and unleaded petrol;
   (d) the production of 2 or more of the following refinery products saleable in Australian or international markets:
      (i) hydrogen;
      (ii) ethane;
      (iii) propane;
      (iv) refinery grade propylene;
      (v) polymer grade propylene;
      (vi) liquefied petroleum gas;
      (vii) butane;
      (viii) naphtha;

(ix) aviation gasoline;
(x) before oxygenate blend;
(xi) kerosene;
(xii) heating oil;
(xiii) solvents;
(xiv) lubricant base stocks;
(xv) leaded petrol;
(xvi) waxes;
(xvii) bitumen.

4. However, the metric is subsection (1) is not applicable to a facility unless:
   (a) each of the processes mentioned in paragraphs (1)(a) to (d) are conducted within the year at the facility; and
   (b) the combined volume of diesel, jet fuel, unleaded petrol, lubricant base stocks and bitumen at 15°C and 1 atmosphere produced from stabilised crude petroleum oil, condensate, tallow, vegetable oil and eligible petroleum feedstocks is equal to or greater than 75% of the total kilolitres of stabilised crude petroleum oil, condensate, tallow, vegetable oil and eligible petroleum feedstocks used in the year at the facility.
5. The activity in subsection (3) is the ***petroleum refining activity***.
6. The default emissions intensity is 0.136 t CO_2-e per kilolitre of the substances mentioned in paragraphs (1)(a) to (e).

In this section:

condensate has the same meaning as in the *Excise Act 1901*.

eligible petroleum feedstocks means any 1 or more of the following that were not produced through the conduct of the petroleum refining activity carried on at another facility in Australia:

(a) catalytic cracker feedstocks that are processed in the catalytic cracker in carrying on the petroleum refining activity and have a density of 0.84 to 0.98 kg/L at 15°C and 1 atmosphere;

(b) hydro cracker unit feedstocks that are processed in the hydro cracking unit in carrying on the petroleum refining activity and have a density of 0.84 to 0.98 kg/L at 15 °C and 1 atmosphere;

(c) reformer unit feedstocks that are used to produce reformate in carrying on the petroleum refining activity and have a density of 0.6 to 0.80 kg/L at 15 °C and 1 atmosphere;

(d) alkylation unit feedstocks that are used to produce alkylate in carrying on the petroleum refining activity and have a density of 0.55 to 0.62 kg/L at 15 °C and 1 atmosphere;

(e) bitumen feedstocks that are used to produce bitumen in carrying on the petroleum refining activity and have a density greater than or equal to 0.95 kg/L at 15 °C and 1 atmosphere;

(f) lubricant base stock feedstocks that are used to produce lubricant base stocks in carrying on the petroleum refining activity and have a density of 0.84 to 0.98 kg/L at 15 °C and 1 atmosphere.

stabilised crude petroleum oil has the meaning given in the Australian Taxation Office Interpretative Decision, ATO ID 2008/154, published on 18 November 2008.

unleaded petrol means all grades of unleaded petrol meeting Australian or international standards, including standard unleaded petrol, premium unleaded petrol and other proprietary forms of unleaded petrol.

48.2. Inclusions

For the purposes of the development of the default emissions intensity value and the preparation of an estimated (site-specific) emission intensity value for this production variable, scope 1 emissions from the following processes at the facility are included:

- the activity of petroleum refining as defined in Schedule 3 of the Safeguard Rule; and
- all scope 1 NGER-reported emissions from the facilities relevant for setting the default intensity value, except scope 1 emissions from on-site electricity generation.

48.3. Exclusions

Scope 1 emissions from the following processes were not included in the default emissions intensity calculation for this production variable, and must be excluded from the calculation of an estimated (site-specific) emissions intensity value for the production variable:

- upstream stabilisation of crude petroleum oil;
- processes which do not occur within the facility;
- on-site electricity generation.