SNAP CODE: **030322**

SOURCE ACTIVITY: **PROCESSES WITH CONTACT**
Alumina Production

NOSE CODE: **104.12.13**

NFR CODE: **1 A 2 b**

1 ACTIVITIES INCLUDED

This chapter covers emissions released from combustion processes within alumina production. Alumina production is an ore treatment step in the production of primary aluminium (SNAP code 040301, chapter B431).

2 CONTRIBUTION TO TOTAL EMISSIONS

The contribution of emissions related to fuel use, released from the alumina production to total emissions in countries of the CORINAIR90 inventory is minor, as indicated in table 1.

Table 1: Contribution to total emissions of the CORINAIR90 inventory (*28 countries*)

Source-activity	**SNAP-code**	**Contribution to total emissions [%]**							
		SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3
Aluminia Production	030322	0	0	-	-	-	-	-	-

0 = emissions are reported, but the exact value is below the rounding limit (0.1 per cent)
- = no emissions are reported

3 GENERAL

3.1 Description of activities

The base ore for primary aluminium production is bauxite. Alumina is produced by the Bayer process. In this process the ore is dried, ground in ball mills, and mixed with a leaching solution of sodium hydroxide at an elevated temperature and pressure, producing a sodium aluminate which is seperated from the impurities and cooled, during which the alumina precipitates. After washing to remove impurities the alumina is dried and calcined to produce a crystalline form of alumina.

3.2 Definitions

Bauxite A hydrated oxide of aluminium consisting of 30-70 percent alumina and lesser amounts of iron, silicon and titanium.

3.3 Techniques

The calcination of the aluminium-hydroxide takes place in rotary kilns at about 1,300 °C or in fluidised bed furnaces at lower temperatures. The furnaces are fired with heavy oil and gas.

3.4 Emissions

The main emissions are dust emissions occurring during the grinding of the bauxite and the calcining of the aluminium hydroxide.

Pollutants related to fuel use are sulphur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compunds (non-methane VOC and methane (CH_4)), carbon monoxide (CO), carbon dioxide (CO_2), and nitrous oxide (N_2O). Of these, according to CORINAIR90, the main relevant pollutants are SO_2 and NO_x (see also table 1).

3.5 Controls

Dust emissions can be abated by spray towers, floating bed scrubbers, quench towers, or electrostatic precipitators. The dust trapped in the calcining process is usually reused.

No information is available about control of gaseous emissions.

4 SIMPLER METHODOLOGY

The simpler methodology involves applying an appropriate emission factor to either production or energy consumption statistics.

5 DETAILED METHODOLOGY

A detailed methodology is possible if sufficient measurements are available about the situation in an individual plant.

6 RELEVANT ACTIVITY STATISTICS

Production and energy statistics for instance as produced by the United Nations or the IEA are available.

7 POINT SOURCE CRITERIA

Aluminium production plants containing an alumina production department can be considered as point sources if plant specific data are available.

8 EMISSION FACTORS, QUALITY CODES AND REFERENCES

For the situation in the Netherlands, the following can be proposed:
Controlled and uncontrolled emission factors for dust are available for both sectors of the Bayer process. These emission factors are presented in Table 2.

Table 2: Emission factors for dust from alumina production in gram/kg aluminium produced

	Bauxite grinding	Calcining
Uncontrolled	3.0	100.0
Spray towers	0.5	30.0
Floating bed scrubber	0.85	28.0
Quench tower	0.5	17.0
Electrostatic precipitator	0.06	2.0

Source: EPA Compilation of air pollutant emission factors AP-42.

The composition of the dust is determined by the composition of the dust.

The following Table 3 contains fuel related emission factors for the alumina production based on CORINAIR90 data in [g/GJ]. In the case of using production statistics the specific energy consumption (e.g. GJ/Mg product) has to be taken into account, which is process and country specific. At this stage no data for the definition of appropriate conversion factors are available.

Table 3: Emission factors for the alumina production[2)]

				Emission factors						
		Type of fuel	NAPFUE code	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O
				[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[g/GJ]	[kg/GJ]	[g/GJ]
l	oil	residual	203	419[1)]	123[1)]	7.4[1)]	1[1)]	5[1)]	79[1)]	
g	gas	natural	301	8[1)]	60[1)]	10[1)]	2[1)]	30[1)]	55[1)]	

1) CORINAIR90 data, area sources

2) It is assumed, that emission factors cited within the table are related to combustion sources in alumina production; other process emissions are not covered.

9 SPECIES PROFILES

The species profile of the dust is directly related to the bauxite composition which may differ from location to location.

10 UNCERTAINTY ESTIMATES

The uncertainty classification of the emission factors expressed per kg aluminium is estimated to be C.

11 WEAKEST ASPECTS/PRIORITY AREAS FOR IMPROVEMENT IN CURRENT METHODOLOGY

The weakest aspects discussed here are related to fuel use related emission factors.

The fuel specific emission factors provided in table 3 are related to point sources and area sources without specification. CORINAIR90 data can only be used in order to give a range of emission factors with respect to point and area sources. Further work should be invested to develop emission factors, which include technical or fuel dependent explanations concerning emission factor ranges.

12 SPATIAL DISAGGREGATION CRITERIA FOR AREA SOURCES

National emission estimates can be disaggregated on the basis of plant capacity, employment or population statistics.

13 TEMPORAL DISAGGREGATION CRITERIA

Alumina production is usually a continuous process.

14 ADDITIONAL COMMENTS

15 SUPPLEMENTARY DOCUMENTS

Environmental Protection Agency, Compilation of Air Pollutant Emission Factors. AP-42.

16 VERIFICATION PROCEDURES

Verification may be done by comparing the calculated emissions with measurements from individual plants.

17 REFERENCES

/1/ VDI (ed.): Auswurfbegrenzung - Aluminium-Monoxidgewinnung und Aluminium-schlmelzflußelektrolyse (Entwurf); 1974

18 BIBLIOGRAPHY

19 RELEASE VERSION, DATE AND SOURCE

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20 POINT OF ENQUIRY

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