

Category		Title
NFR:	<b>2.A.5.a</b>	<b>Quarrying and mining of minerals other than coal</b>
SNAP:	<b>040616 040623</b>	<b>Extraction of mineral ores Quarrying</b>
ISIC:	<b>1410</b>	<b>Quarrying of stone, sand and clay</b>
Version	<b>Guidebook 2013</b>	

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## 1 Overview

Emissions from non-coal quarrying and mining are not significant, since the contribution to the total national emissions is thought to be less than 1 % of the national emissions of any pollutant. Although significant at a local level, at a national level emissions are comparatively small and only relevant for the relatively coarse fractions of particulate matter.

The present version of the Guidebook does provide default emission factors for this source category, based on referenced or non-referenced literature values or, if no literature is available, expert judgement.

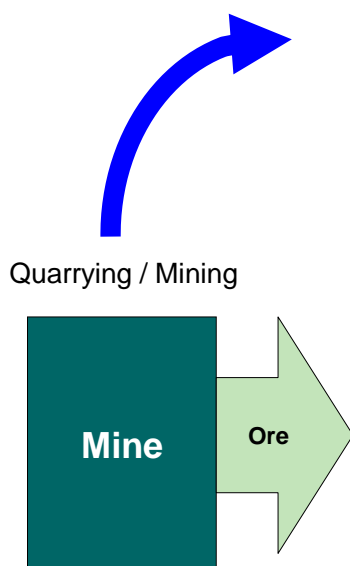
The present chapter provides a very simple process description and a Tier 1 worst case approach as well as a Tier 2 approach to estimate emissions from this source category.

## 2 Description of sources

### 2.1 Process description

This chapter discusses the quarrying and mining of minerals other than coal, for instance the mining of bauxite, copper ore, iron ore, manganese ore or zinc ore. This is illustrated in the simplified process scheme below.

This chapter does not include emissions from the combustion of fuels in the plant or transport machinery.



**Figure 2.1** Simplified process scheme for source category 2.A.5.a Quarrying and mining of minerals other than coal

## 2.2 Techniques

Standard techniques are assumed for this source including blasting transportation and crushing of materials.

## 2.3 Emissions and controls

Quarrying and mining of minerals results in emissions of particulates. Controls will include wetting and covering of processes, depending on the materials.

# 3 Methods

## 3.1 Choice of method

This chapter present a Tier 1 ‘worst case’ default approach and a Tier 2 approach based on low to medium and medium high to high emission level. More detailed information about the emissions from quarrying and mining may be found in AP-42 (US EPA, 2011).

## 3.2 Tier 1 default approach

### 3.2.1 Algorithm

The Tier 1 approach uses the general equation:

$$E_{\text{pollutant}} = AR_{\text{production}} \times EF_{\text{pollutant}} \quad (1)$$

Where:

$E_{\text{pollutant}}$	=	the emission of the specified pollutant
$AR_{\text{production}}$	=	the activity rate for the quarrying/mining
$EF_{\text{pollutant}}$	=	the emission factor for this pollutant

The Tier 1 emission factors assume an averaged or typical technology and abatement implementation in the country and integrate all sub-processes.

### 3.2.2 Default emission factors

Default emission factors for particulate emission from the quarrying and mining of minerals are given in Table 3.1. The emission factors are average factors taken from the Coordinated European Particulate Matter Emission Inventory Program (CEPMEIP) (Visschedijk et al., 2004). For Tier 1 the highest emission level has been chosen i.e. a worst case scenario.

**Table 3.1 Tier 1 emission factors for source category 2.A.5.a Quarrying and mining of minerals other than coal.**

Tier 1 default emission factors					
	Code	Name			
NFR source category	2.A.5.a	Quarrying and mining of minerals other than coal			
Fuel	NA				
Not applicable	NO <sub>x</sub> , CO, NMVOC, SO <sub>x</sub> , NH <sub>3</sub> , BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, HCH, PCBs, PCDD/F, Benzo(a)pyrene, Benzo(a)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB				
Not estimated					
Pollutant	Value	Unit	95 % confidence interval		Reference
			Lower	Upper	
TSP	102	g/Mg mineral	50	200	Visschedijk et al. (2004)
PM <sub>10</sub>	50	g/Mg mineral	25	100	Visschedijk et al. (2004)
PM <sub>2.5</sub>	5.0	g/Mg mineral	2.5	10	Visschedijk et al. (2004)

### 3.2.3 Activity data

Information on production statistics (for various source categories) is typically available from national statistics or United Nations statistical yearbooks.

## 3.3 Tier 2 technology-specific approach

### 3.3.1 Algorithm

The Tier 2 approach uses the general equation:

$$E_{\text{pollutant}} = AR_{\text{production}} \times EF_{\text{pollutant}} \quad (1)$$

Where:

$E_{\text{pollutant}}$	=	the emission of the specified pollutant
$AR_{\text{production}}$	=	the activity rate for the quarrying/mining
$EF_{\text{pollutant}}$	=	the emission factor for this pollutant

The Tier 2 emission factors assume either a low to medium emission level, or a medium-high to high emission level assuming a typical technology and abatement implementation in a country and integrate all sub-processes.

### 3.3.2 Technology specific emission factors

Emission factors for particulate emission from the quarrying and mining of minerals are given in Table 3.2 and

Table 3.3. The emission factors are average factors obtained from the Coordinated European Particulate Matter Emission Inventory Program (CEPMEIP) (Visschedijk et al., 2004). The emission factors represent low to medium emission level and medium high to high emission level.

A common rule for distinguishing between low and high emission levels cannot be given. Visschedijk et al. (2004) defines low emission level as plants having well maintained abatement/BAT and high emission level as plants with poor maintained equipment/abatement and old plants. However, national or local measurements may give a hint as to which emission level to choose. Individual quarries or mining facilities may also have an environmental impact assessment (EIA) that can provide informative information.

**Table 3.2 Tier 2 emission factors for source category 2.A.5.a Quarrying and mining of minerals other than coal; low to medium emission level.**

Tier 2 default emission factors					
	Code	Name			
NFR source category	2.A.5.a	Quarrying and mining of minerals other than coal			
Fuel	NA				
SNAP (if applicable)					
Technologies/Practices	Low to medium emission level				
Region or regional conditions					
Abatement technologies					
Not applicable	NO <sub>x</sub> , CO, NMVOC, SO <sub>x</sub> , NH <sub>3</sub> , BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, HCH, PCBs, PCDD/F, Benzo(a)pyrene, Benzo(a)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB				
Not estimated					
Pollutant	Value	Unit	95 % confidence interval		Reference
			Lower	Upper	
TSP	51	g/Mg mineral	25	100	Visschedijk et al. (2004)
PM <sub>10</sub>	25	g/Mg mineral	13	50	Visschedijk et al. (2004)
PM <sub>2.5</sub>	3.8	g/Mg mineral	1.9	7.6	Visschedijk et al. (2004)

**Table 3.3 Tier 2 emission factors for source category 2.A.5.a Quarrying and mining of minerals other than coal; medium to high emission level.**

Tier 2 default emission factors					
	Code	Name			
NFR source category	2.A.5.a	Quarrying and mining of minerals other than coal			
Fuel	NA				
SNAP (if applicable)					
Technologies/Practices	Medium high to high emission level				
Region or regional conditions					
Abatement technologies					
Not applicable	NO <sub>x</sub> , CO, NMVOC, SO <sub>x</sub> , NH <sub>3</sub> , BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, HCH, PCBs, PCDD/F, Benzo(a)pyrene, Benzo(a)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB				
Not estimated					
Pollutant	Value	Unit	95 % confidence interval		Reference
			Lower	Upper	
TSP	102	g/Mg mineral	50	200	Visschedijk et al. (2004)
PM <sub>10</sub>	50	g/Mg mineral	25	100	Visschedijk et al. (2004)
PM <sub>2.5</sub>	5.0	g/Mg mineral	2.5	10	Visschedijk et al. (2004)

### 3.4 Tier 3 emission modelling and use of facility data

Not available for this source.

## 4 Data quality

No specific issues for this source category.

## 5 Glossary

AR <sub>production</sub>	the activity rate for the quarrying/mining
E <sub>pollutant</sub>	the emission of the specified pollutant
EF <sub>pollutant</sub>	the emission factor for this pollutant

## 6 References

US EPA 2011. AP-42, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition (with revisions till January 2011). Available at: <http://www.epa.gov/ttn/chief/ap42/>.

Visschedijk, A.J.H., Pacyna, J., Pulles, T., Zandveld, P. and Denier van der Gon, H., 2004. 'Coordinated European Particulate Matter Emission Inventory Program (CEPMEIP)'. In: Dilara, P. *et al.* (eds.), *Proceedings of the PM emission inventories scientific workshop, Lago Maggiore, Italy, 18 October 2004*. EUR 21302 EN, JRC, pp. 163–174.

## 7 Point of enquiry

Enquiries concerning this chapter should be directed to the relevant leader(s) of the Task Force on Emission Inventories and Projection's expert panel on combustion and industry. Please refer to the TFEIP website ([www.tfeip-secretariat.org/](http://www.tfeip-secretariat.org/)) for the contact details of the current expert panel leaders.