



QUESTIONNAIRE FOR STEEL MILLS AND METAL SMELTING AND REFINING (SECTOR-RELATED QUESTIONS)

The completion of this questionnaire is voluntary. However, replying to the relevant questions as completely as possible will facilitate and speed up the assessment of the environmental, social and human rights impacts of the project for which the German export supplies or services offered for cover are intended. This – together with the questionnaire not related to a particular sector, the completion and submission of which should also be considered in order to speed up the assessment procedure – can replace the description of the environmental, social and human rights impacts in the memorandum.

The questionnaire provides guidance on what information may be important for this sector. It is based on the World Bank/IFC General Environmental Health and Safety (EHS) Guidelines, the EHS Guidelines for Integrated Steel Mills, the EHS Guidelines for Foundries, and the EHS Guidelines for Base Metal Smelting and Refining. Additional information on the applicable standards can be found at the [AGA Portal](#).

This is a list of possible questions. Depending on the individual case only some of them, or perhaps also additional information, may become relevant in the course of the application procedure. Because of the specific features of each project further clarification may be required.

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A. Integrated steel mills and rolling mills

A.1. Process and resources consumption

- Please give a technical description of the individual process steps (e.g. coke making, sinter plant, blast furnace, electric steel plant, converter, continuous casting, slag conditioning).
- Does a production-related connection with other (planned) facilities (electricity generation, combustion processes, etc.) exist?
- How is the project supplied with energy and raw materials?
- Where are the required raw materials sourced and how are they mined?
- Does the project involve the expansion of existing and/or the development of new iron ore, coal or other mines? If so, please also answer the respective questions in the sector-related questionnaire *Mining*.
- Please state the resources and energy consumption after the project's completion in accordance with the table below.

Resources and Energy Consumption							
Inputs per unit of Product	Mass Load Unit	Industry Benchmark					
		Sinter	Coke Oven	BF	BOF	EAF	Rolling
Electricity, direct	MJ/t product	90 - 120	20 - 170	270- 370	40 - 120	1250 - 1800	70 -140 kWh/t
Project Value							
Fuel	MJ/t product	60 - 200	3200 - 3900	1050 - 2700	20 - 55	-	1100 - 2200
Project Value						-	
Water	m³/t product	0.01 - 0.35	1 - 10	1 - 50	0.5 - 5	3	1 - 15
Project Value							
Source: WORLD BANK/IFC EHS Guidelines for INTEGRATED STEEL MILLS 2007, page 17							

- Please also complete the table below with the values expected after the project's completion.

Emission / Waste Generation							
Outputs per unit of product		Industry Benchmark					
Emissions	Unit	Sinter	Coke Oven	BF	BOF	EAF	Rolling
Particulate Matter	kg/T product	0.04 - 0.4	0.05 - 3.5	0.005	0.2	0.02	0.002 - 0.040
Project Value							
CO	kg/T product	12 - 40	0.40 - 4.5	0.8 - 1.75	1.5 - 8	0.75 - 4	0.005 - 0.85
Project Value							
NO _x	Kg/T product	0.4 - 0.65	0.45 - 0.7	0.01 - 0.6	-	0.12 - 0.25	0.08 - 0.35
Project Value					-		
VOC	Kg/T product	0.15	0.12 - 0.25	-	-	-	-
Project Value				-	-	-	-
PCDD/F	µgITEQ/T product	1 - 10	-	-	-	0.7 - 9	-
Project Value			-	-	-		-
Waste	Unit	Sinter	Coke Oven	BF	BOF	EAF	Rolling
Solid Waste	Kg/T product	0.9 - 15	-	200 - 300	85 - 110	110 - 180	70 - 150
Project Value			-				
Sludge	Kg/T product	0.3	-	3 - 5	-	-	-
Project Value			-		-	-	-
Waste Water	m ³ /T product	0.06	0.3 - 0.4	0.1 - 3	-	-	0.8 - 15
Project Value					-	-	

Source: WORLD BANK/IFC EHS Guidelines for INTEGRATED STEEL MILLS 2007, page 17

A.2. Air emissions

- Please state the expected maximum values for air emissions after the project's completion for all process steps in accordance with the table below. Occasionally, not all pollutants listed in the table are emitted or others specific to the project have to be added. Please inform us if that is the case.

Air Emission Levels for Integrated Steel Mills ^c			
Pollutant	Units	Guideline Value	Project Value
Particulate Matter	mg/Nm ³	20 - 50 ^a	
Oil Mist	mg/Nm ³	15	
NO _x	mg/Nm ³	500 750 (coke oven)	
SO ₂	mg/Nm ³	500	
VOC	mg/Nm ³	20	
PCDD/F	ng TEQ/Nm ³	0.1	
Carbon Monoxide (CO)	mg/Nm ³	100 (EAF) 300 (coke oven)	
Chromium (Cr)	mg/Nm ³	4	
Cadmium (Cd)	mg/Nm ³	0.2	
Lead (Pb)	mg/Nm ³	2	
Nickel (Ni)	mg/Nm ³	2	
Hydrogen Chloride (HCL)	mg/Nm ³	10	
Fluoride	mg/Nm ³	5	
Hydrogen Fluoride (HF)	mg/Nm ³	10	
H ₂ S	mg/Nm ³	5	
Ammonia	mg/Nm ³	30	
Benzo(a)pirene	mg/Nm ³	0.1	
Tar fume ^b	mg/Nm ³	5	
Notes: a) Lower value where toxic metals are present b) Tar fume measured as organic matter extractable by solvent from total matter collected by membrane filter c) Reference conditions for limits. For combustion gases: dry, temperature 273K (0°C), pressure 101.3 kPa (1 atmosphere), oxygen content 3% dry for liquid and gaseous fuels, 6% dry for solid fuels. For non-combustion gases: no correction for water vapor or oxygen content, temperature 273K (0°C), pressure 101.3 kPa (1 atmosphere).			
Source: WORLD BANK/IFC EHS Guidelines for INTEGRATED STEEL MILLS 2007, page 16			

- Please state which process exhaust gases are reused as fuels?
- Please also state the (expected) emission values (in particular greenhouse gas emissions (CO₂eq), dust (PM), sulfur dioxide (SO₂) and nitrogen oxides (NO_x) in mg/Nm³) for any steam and power generation. In the case of plants with a capacity of more than 50 MW_{thermic} please use the questionnaire *Conventional Energy* as guideline.
- Please describe what measures are taken to avoid/reduce air emissions (including greenhouse gas emissions) from the site. Will collected dust be recycled?
- What limit values for ambient air quality are applicable in the buyer's country (please make a table available)? Please state the relevant expected air emission levels. Please comment on changes in the ambient air quality before and after the project implementation. If there are no national limit values, please use the table below.

WHO Ambient Air Quality Guidelines^{1,2}

	Averaging Period	IFC Guideline Value [µg/m³]	Guideline Value Host country	Project Value (baseline status) [µg/m³]	Project Value (after implementation) [µg/m³]
Sulfur dioxide (SO₂)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)			
	10 minute	500 (guideline)			
Nitrogen dioxide (NO₂)	1-year	40 (guideline)			
	1-hour	200 (guideline)			
Particulate Matter (PM₁₀)	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)			
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)			
Particulate Matter (PM_{2.5})	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)			
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)			
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)			

Notes:

¹ World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.

² Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 4

- Please describe the on-site monitoring of air emissions as well as ambient air quality levels.

A.3. Fresh water and effluents

- How much (fresh) water is used on site? Is the water recirculated?

- Where and how is the water withdrawn?
- What wastewater streams are generated?
- How are effluents treated before they are discharged? Please also state whether effluents are discharged into a public sewage treatment system or into surface water bodies (river, lake, sea). If there are discharges, please provide information on the quantities of the wastewater streams (e.g. m³/h or l/s).
- If wastewater is discharged directly into a surface water body, please state the maximum values of the pollution levels in mg/l (table "Effluent Levels"). Occasionally, not all pollutants listed in the table are emitted or others specific to the project have to be added. Please inform us if that is the case.

Effluents Levels for Integrated Steel Mills Sector			
Pollutants	Units	Guideline Value	Project Value
pH	S.U.	6-9	
TSS	mg/L	35	
Oil and Grease	mg/L	10	
Temperature increase	°C	<3 ^a	
COD	mg/L	250	
Phenol	mg/L	0.5	
Cadmium	mg/L	0.01	
Chromium (total)	mg/L	0.5	
Chromium (hexavalent)	mg/L	0.1	
Copper	mg/L	0.5	
Lead	mg/L	0.2	
Tin	mg/L	2	
Mercury	mg/L	0.01	
Nickel	mg/L	0.5	
Zinc	mg/L	2	
Cyanides (free)	mg/L	0.1	
Cyanides (total)	mg/L	0.5	
Total Nitrogen	mg/L	30	
Ammonia	mg/L (as N)	5	
Total Phosphorous	mg/L	2	
Fluoride	mg/L (as F)	5	
Sulfides	mg/L	0.1	
Iron	mg/L	5	
PAH	mg/L	0.05	
Toxicity	To be determined on a case specific basis		
a) At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity			
Source: WORLD BANK/IFC EHS Guidelines for INTEGRATED STEEL MILLS 2007, page 17			

- How and where are the effluents discharged? Please explicitly comment on a temperature rise at the point of discharge, describe possible effects of the discharge on the ecology of the water bodies and provide information on the condition and size of the water body (e.g. flow values, flow rate). Please give also details on protection measures.
- Please describe the measures planned to avoid/reduce/treat wastewater.
- Please describe the on-site monitoring of the effluent values.

- What national standards are applicable in the buyer's country for the discharge of sanitary sewage? How is sewage treated before it is discharged? Please state the expected maximum values of the pollution levels in the sewage. If there are no national limit values, please use the table below.

Indicative Values for Treated Sanitary Sewage Discharges ¹			
Pollutants	Units	Guideline Value	Project Value
pH	pH	6-9	
BOD	mg/L	30	
COD	mg/L	125	
Total nitrogen	mg/L	10	
Total phosphorus	mg/L	2	
Oil and grease	mg/L	10	
TSS	mg/L	50	
Total coliform bacteria	MPN ² /100 ml	400 ¹	
Notes: ¹ Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation. ² MPN = Most Probable Number			
Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 30			

A.4. Waste

- What relevant waste products are generated on site?
- What measures are taken to avoid, treat and dispose of the waste (solid/liquid) generated and, as the case may be, where/how is it deposited?
- Please give also details on possible waste incineration processes (type and quantity of waste, incineration temperature, etc.).

A.5. Noise

- Please state the noise impact (existing background noise level and additional noise emissions of the project) on the nearest receptors (industrial estates and residential areas) in dB(A) for day and night after completion of the project in accordance with the table below.

Noise Level Guidelines ¹				
Receptor	One Hour LA _{eq} (dBA)			
	Guideline Value Daytime (07:00-22:00)	Project Value Daytime (07:00-22:00)	Guideline Value Nighttime (22:00-07:00)	Project Value Nighttime (22:00-07:00)
Residential; institutional; educational ²	55		45	
Industrial; commercial	70		70	
Notes: ¹ Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, WHO, 1999. ² For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).				
Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 53				

- Do the project's noise emissions lead to an increase of the background noise level at the nearest receptors by more than 3 dB(A)?
- How far is the nearest residential area away?
- Are noise mitigation measures necessary or planned? If so, what measures?

A.6. Occupational health and safety

- What safety measures and/or control systems are planned to prevent accidents?
- How are safety and health (in particular with regard to physical, chemical and electrical hazards, heat and hot liquids, radiation, respiratory hazards, noise, fire and explosions) guaranteed at the workplace?
- What average and maximum noise exposure is to be expected in the production? What safety measures are taken at workplaces where the noise exposure exceeds 85 dB(A)?
- Please make accident statistics for the past two years available to us.
- How are subcontractors integrated into the health and safety measures on site?

A.7. Health and safety of the population

- What measures are taken to minimize impacts and possible risks (noise, explosions, dust and/or due to increased traffic) for adjacent communities?
- Please make information on infrastructure links (access roads, railway link, etc.), which may be necessary, available to us.

B. Foundries

B.1. Process and resources consumption

- Please give a technical description of the individual process steps.
- Does a production-related connection with other (planned) facilities (electricity generation, combustion processes, etc.) exist?
- Is scrap melted? Is it mixed with oil, paint and plastics?
- What moulding material/type of moulds is used? Is the moulding material recycled and reused?
- How is the project supplied with energy, raw materials and moulding material?
- Where are the required raw materials sourced and how are they mined?
- Does the project involve the expansion of existing and/or the development of new quarries or mines? If so, please also answer the respective questions in the sector-related questionnaire *Mining*.

B.2. Air emissions

- Please state the expected maximum values for air emissions after the project's completion for all process steps in accordance with the table below. Occasionally, not all pollutants listed in the table are emitted or others specific to the project have to be added. Please inform us if that is the case.

Air Emission Levels for Foundries ⁽¹⁾			
Pollutant	Units	Guideline Value	Project Value
Particulate Matter	mg/Nm ³	20 ⁽²⁾	
		50 ⁽³⁾	
Oil Aerosol / Mist	mg/Nm ³	5	
NO _x	mg/Nm ³	400 ⁽⁴⁾	
		120 ⁽⁵⁾	
		150 ⁽⁶⁾	
SO ₂	mg/Nm ³	400 ⁽⁸⁾	
		50 ⁽⁹⁾	
		120 ⁽⁷⁾	
VOC	mg/Nm ³	20 ⁽¹⁰⁾	
		30	
		150 ⁽¹¹⁾	
PCDD/F	ng TEQ/Nm ³	0,1	
CO	mg/Nm ³	200 ⁽¹²⁾	
		150 ⁽¹³⁾	
Amines	mg/Nm ³	5 ⁽¹⁴⁾	
Chlorine	mg/Nm ³	5 ⁽¹⁵⁾	
Pb, Cd and their compounds	mg/Nm ³	1 – 2 ⁽¹⁶⁾	
Ni, Co, Cr, Sn and their compounds	mg/Nm ³	5	
Cu and their compounds	mg/Nm ³	5 – 20 ⁽¹⁷⁾	
Chloride	mg/Nm ³	5 ⁽¹⁸⁾	
Fluoride	mg/Nm ³	5 ⁽¹⁹⁾	
H ₂ S	ppm v/v	5	
<p>NOTES:</p> <div> <div> 1. References conditions for limits. For combustion gases: dry, temperature 273K (0°C), pressure 101.3 kPa (1 atmosphere), oxygen content 3% dry for liquid and gaseous fuels, 6% dry for solid fuels. For non-combustion gases: no correction for water vapor or oxygen content, temperature 273K (0°C), pressure 101.3 kPa (1 atmosphere). 2. Particulate matter emissions where toxic metals are present 3. Particulate matter emissions where toxic metals are not present 4. Ferrous metal melting. Maximum emissions level considered on BAT base and based on cokeless cupola furnaces 5. Non-ferrous metal melting (shaft furnaces) 6. From thermal sand reclamation systems/regeneration units 7. Maximum emissions level considered on BAT base and based on cold blast cupola furnaces 8. Non-ferrous metal melting (shaft furnaces) 9. Ferrous metal melting (cupola furnaces) 10. Non-ferrous metal melting (shaft furnaces) 11. Ferrous metal melting (EAFs). Cupola furnaces may have higher emission levels (up to 1,000 mg/N3) 12. Non-ferrous metal melting (shaft furnaces) 13. Cold box molding and core making shop 14. Non-ferrous metal melting (aluminum) 15. Thermal sand reclamation systems and solvent based investment foundry coating, shelling, and setting operation 16. Higher value applicable to non-ferrous metal foundries from scrap 17. Higher value applicable to copper and its alloy producing processes 18. Furnace emissions where chloride flux is used 19. Furnace emissions where fluoride flux is used </div> </div>			
Source: WORLD BANK/IFC EHS Guidelines for FOUNDRIES 2007, page 13			

- Please state which process exhaust gases are reused as fuels?
- Please also state the (expected) emission values (in particular greenhouse gas emissions (CO₂eq), dust (PM), sulfur dioxide (SO₂) and nitrogen oxides (NO_x) in mg/Nm³) for any steam and power generation. In the case of plants with a capacity of more than 50 MW_{thermic} please use the questionnaire *Conventional Energy* as guideline.
- Please describe what measures are taken to avoid/reduce air emissions (including greenhouse gas emissions) from the site. Will collected dust be recycled?
- What limit values for ambient air quality are applicable in the buyer's country (please make a table available)? Please state the relevant expected air emission levels. Please comment on changes in the ambient air quality before and after the project implementation. If there are no national limit values, please use the table below.

WHO Ambient Air Quality Guidelines ^{1,2}					
	Averaging Period	IFC Guideline Value [µg/m ³]	Guideline Value Host country	Project Value (baseline status) [µg/m ³]	Project Value (after implementation) [µg/m ³]
Sulfur dioxide (SO ₂)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)			
	10 minute	500 (guideline)			
Nitrogen dioxide (NO ₂)	1-year	40 (guideline)			
	1-hour	200 (guideline)			
Particulate Matter (PM ₁₀)	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)			
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)			
Particulate Matter (PM _{2.5})	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)			
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)			
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)			
Notes: ¹ World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile. ² Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.					
Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 4					

- Please describe the on-site monitoring of air emissions as well as ambient air quality levels.

B.3. Fresh water and effluents

- How much (fresh) water is used on site? Is the water recirculated?
- Where and how is the water withdrawn?
- What wastewater streams are generated?
- How are effluents treated before they are discharged? Please also state whether effluents are discharged into a public sewage treatment system or into surface water bodies (river, lake, sea). If there are discharges, please provide information on the quantities of the wastewater streams (e.g. m³/h or l/s).
- If wastewater is discharged directly into a surface water body, please state the maximum values of the pollution levels in mg/l (table "Effluent Levels"). Occasionally, not all pollutants listed in the table are emitted or others specific to the project have to be added. Please inform us if that is the case.

Effluents Levels for Foundries			
Pollutant	Units	Guideline Value	Project Value
pH	S.U.	6 – 9	
Total Suspended Solids (TSS)	mg/L	35	
Oil and grease	mg/L	10	
Temperature increase	°C	3 ^(a)	
COD	mg/L	125	
Phenol	mg/L	1	
Cadmium	mg/L	0,01	
Chromium (total)	mg/L	0,5	
Copper	mg/L	0,5	
Lead	mg/L	0,2	
Nickel	mg/L	0,5	
Zinc	mg/L	0,5	
Tin	mg/L	2	
Ammonia	mg/L (as N)	5	
Fluoride	mg/L (as F)	5	
Iron	mg/L	5	
Aluminium	kg/t	0.02 ^(b)	
NOTES:			
(a) At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity			
(b) Aluminum smelting and casting			
Source: WORLD BANK/IFC EHS Guidelines for FOUNDRIES 2007, page 13			

- How and where are the effluents discharged? Please explicitly comment on a temperature rise at the point of discharge, describe possible effects of the discharge on the ecology of the water bodies and provide information on the condition and size of the water body (e.g. flow values, flow rate). Please give also details on protection measures.
- Please describe the measures planned to avoid/reduce/treat wastewater.
- Please describe the on-site monitoring of the effluent values.
- What national standards are applicable in the buyer's country for the discharge of sanitary sewage? How is sewage treated before it is discharged? Please state the expected maximum values of the pollution levels in the sewage. If there are no national limit values, please use the table below.

Indicative Values for Treated Sanitary Sewage Discharges ¹			
Pollutants	Units	Guideline Value	Project Value
pH	pH	6-9	
BOD	mg/L	30	
COD	mg/L	125	
Total nitrogen	mg/L	10	
Total phosphorus	mg/L	2	
Oil and grease	mg/L	10	
TSS	mg/L	50	
Total coliform bacteria	MPN ² /100 ml	400 ¹	
Notes: ¹ Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation. ² MPN = Most Probable Number			
Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 30			

B.4. Waste

- What relevant waste products are generated on site?
- What measures are taken to avoid, treat and dispose of the waste (solid/liquid) generated and, as the case may be, where/how is it deposited?
- Please give also details on possible waste incineration processes (type and quantity of waste, incineration temperature, etc.).

B.5. Noise

- Please state the noise impact (existing background noise level and additional noise emissions of the project) on the nearest receptors (industrial estates and residential areas) in dB(A) for day and night after completion of the project in accordance with the table below.

Noise Level Guidelines ¹				
Receptor	One Hour LA _{eq} (dBA)			
	Guideline Value Daytime (07:00-22:00)	Project Value Daytime (07:00-22:00)	Guideline Value Nighttime (22:00-07:00)	Project Value Nighttime (22:00-07:00)
Residential; institutional; educational ²	55		45	
Industrial; commercial	70		70	
Notes:				
¹ Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, WHO, 1999.				
² For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999).				
Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 53				

- Do the project's noise emissions lead to an increase of the background noise level at the nearest receptors by more than 3 dB(A)?
- How far is the nearest residential area away?
- Are noise mitigation measures necessary or planned? If so, what measures?

B.6. Occupational health and safety

- What safety measures and/or control systems are planned to prevent accidents?
- How are safety and health (in particular with regard to physical, chemical and electrical hazards, heat and hot liquids, radiation, respiratory hazards, noise, fire and explosions, getting trapped) guaranteed at the workplace?
- What average and maximum noise exposure is to be expected in the production? What safety measures are taken at workplaces where the noise exposure exceeds 85 dB(A)?
- Please make accident statistics for the past two years available to us.
- How are subcontractors integrated into the health and safety measures on site?

B.7. Health and safety of the population

- What measures are taken to minimize impacts and possible risks (noise, explosions, dust and/or due to increased traffic) for adjacent communities?
- Please make information on infrastructure links (access roads, railway link, etc.), which may be necessary, available to us.

C. Smelting and refining of base metals and secondary production from scrap metal

C.1. Process and resources consumption

- Please give a technical description of the individual process steps.
- What acids and/or solvents are used in the case of hydrometallurgical process steps?
- Does a production-related connection with other (planned) facilities (electricity generation, combustion processes, etc.) exist?

- How is the project supplied with energy and raw materials?
- Where are the required raw materials sourced and how are they mined?
- Does the project involve the expansion of existing and/or the development of new quarries or mines? If so, please also answer the respective questions in the sector-related questionnaire *Mining*.
- Please state the resources and energy consumption after the project's completion in accordance with the table below.

Energy and Water Consumption		
Facility Type	Guideline Value Energy Use (GJ/t) ^a	Project Value Energy Use (GJ/t) ^a
Copper--production from concentrate	14 – 20	
Copper—electro-refining	1.1 – 1.4	
Alumina production	8 – 13.5	
Aluminum--primary production (electrolysis, including anode production)	53 – 61	
Lead—shaft furnace, primary	6.8 – 10.3 ^b	
Lead—shaft furnace, secondary	4.4 – 5.5 ^b	
Lead—rotary furnace, secondary, with CX system and Na ₂ SO ₄ production	4.0 – 4.7 ^b	
Lead—QSL	2.3 – 3.5 ^b	
Lead—Kivcet	4.9 ^b	
Lead—top blown rotary converter	4.0 – 4.4 ^b	
Zinc—electrolysis	15	
Zinc—imperial smelting furnace & New Jersey distillation	44 ^b	
Zinc—Waelz kiln	26 ^{b, c}	
Zinc—slag fuming	7.7 ^{b, d}	
Nickel—matte from sulfide ores containing 4 – 15% Ni	25 – 65	
Nickel—refining	17 – 20	
Facility Type	Guideline Value Water Use (kg/t)	Project Value Water Use (kg/t)
Alumina production	1000 – 6000	
Aluminum--primary production (electrolysis, including anode production)	200 - 12000	
Notes: a) Gigajoules (109 Joules) per metric ton b) Calculated based on quantities of coke, coal, natural gas, and electric power used and typical heat values of the petroleum fuels. c) Per ton of Waelz oxide leached d) Per ton of slag		
Source: WORLD BANK/IFC EHS Guidelines for Base Metal Smelting and Refining 2007, page 16		

C.2. Air emissions

- Please state the expected maximum values for air emissions after the project's completion for all process steps in accordance with the table below. Occasionally, not all pollutants listed in the table are emitted or others specific to the project have to be added. Please inform us if that is the case.

Air Emissions for Nickel, Copper, Lead, Zinc, and Aluminum Smelting & Refining				
Pollutant	Emission Source (by metal type / smelting process)	Units	Guideline Values	Project Value
SO ₂	Copper: Primary smelting and converting Lead and Zinc: Primary smelting, roasting and sintering Nickel: Roasting and smelting of sulphide concentrates and intermediates		>99.1% conversion efficiency (for ~ 1 – 4 percent SO ₂ off gas) >99.7 % conversion efficiency (for >5 percent SO ₂ off gas)	
	Copper: Secondary smelting and converting, primary and secondary fire refining, electric slag cleaning and melting Aluminum: Holding and de-gassing of molten metal from primary and secondary aluminum Lead and Zinc: Materials pre-treatment, secondary smelting, thermal refining, melting, slag fuming, and Waelz kiln operation	mg/N m ³	<50 – 200 ^{1,2,3}	
NO _x	Copper: Secondary smelting and converting, primary and secondary fire refining, electric slag cleaning and melting Aluminum: Holding and de-gassing of molten metal from primary and secondary aluminum, materials pre-treatment, and from melting and smelting of secondary aluminum Lead/Zinc: Melting of clean material, alloying, and zinc dust production; From materials pre-treatment, secondary smelting, thermal refining, melting, slag fuming, and Waelz kiln operation Nickel: Leaching, chemical extraction and refining, electro-winning and solvent extraction; From materials pre-treatment incineration or after-burning, roasting, smelting thermal refining, and melting.	mg/N m ³	100 – 300 ^{4,5,6}	
Acid Mists / Gases	Copper: Hydrometallurgical and electro-winning processes Lead and Zinc: Chemical refining, electro-winning, and solvent extraction Nickel: Leaching, chemical extraction and refining, electro-winning and solvent extraction	mg/N m ³	50 ^{1,7}	
VOC / solvents (as C)	Copper: Hydrometallurgical and electro-winning processes Lead and Zinc: Chemical refining, electro-winning, and solvent extraction Nickel: Leaching, chemical extraction and refining, electro-winning and solvent extraction	mg/N m ³	5 – 15 ⁹	
Dust ²²	Copper: Secondary smelting and converting, primary and secondary fire refining, electric slag cleaning and melting, secondary fume collection systems, and drying. Aluminum: Primary aluminum electrolysis, from holding and de-gassing of molten metal from primary and secondary aluminum, materials pre-treatment, and from melting and smelting of secondary aluminum Lead/Zinc: Melting of clean material, alloying, and zinc dust production; From materials pre-treatment, secondary smelting, thermal refining, melting, slag fuming, and Waelz kiln operation Nickel: Materials pre-treatment incineration or after-burning, roasting, smelting thermal refining, and melting.	mg/N m ³	1 – 5 ^{3, 10,11}	
TOC (as C)	Copper: Secondary smelting and converting, primary and secondary fire refining, electric slag cleaning and melting Aluminum: Materials pre-treatment, and from melting and smelting of secondary aluminum Lead and Zinc: Melting of clean material, alloying, and zinc dust production; From materials pre-treatment, secondary smelting, thermal refining, melting, slag fuming, and Waelz kiln operation Nickel: Materials pre-treatment incineration or after-burning, roasting, smelting thermal refining, and melting.	mg/N m ³	5 – 50 ^{12,13}	
Dioxins	Copper: Secondary smelting and converting, primary and secondary fire refining, electric slag cleaning and melting, secondary fume collection systems, and drying. Aluminum: Materials pre-treatment, and from melting and smelting of secondary aluminum Lead and Zinc: Melting of clean material, alloying, and zinc dust production	ngTE Q/m ³	0.1 – 0.5 ^{3,10,14,15,16}	

	tion; From materials pre-treatment, secondary smelting, thermal refining, melting, slag fuming, and Waelz kiln operation Nickel: Materials pre-treatment incineration or after-burning, roasting, smelting thermal refining, and melting.			
Ammonia	Nickel: Leaching, chemical extraction and refining, electro-winning and solvent extraction	mg/N m³	5 ¹⁷	
Chlorine			0.5 ^{2,18}	
CO and carbon-yls			5 ¹⁹	
Arsine	Lead and Zinc: Chemical refining, electro-winning, and solvent extraction	mg/N m³	0.5 ⁶	
Mercury	All types of metals / smelting processes	mg/N m³	0.02	
Hydrogen Chloride	Aluminum: Holding and de-gassing of molten metal from primary & secondary aluminum, materials pre-treatment, melting and smelting of secondary aluminum	mg/N m³	5 ¹	
Hydrogen Fluoride	Aluminum: Primary aluminum electrolysis, materials pre-treatment, and from melting and smelting of secondary aluminum	mg/N m³	0.5 ^{10, 20}	
Total Fluoride		mg/N m³	0.8 ^{10, 22}	
Polyfluorinated hydrocarbons		Aluminum: Primary aluminum electrolysis	0.1 (anode effects / cell / day)	
<div><div><div>1. Alkali scrubber (semi-dry / fabric filter, wet scrubber or double alkali using lime, magnesium hydroxide, sodium hydroxide). 2. Combinations of sodium or alumina/aluminum sulphate in combination with lime. 3. For copper smelting, an SO2 emission concentration of 500 mg/m3 can be achieved through use of a fabric filter with lime injection. 4. Low NOx burner 5. Oxy-fuel burner 6. Oxidizing scrubber 7. De-mister 8. Excluding Aluminum smelting. 9. Containment, condenser, carbon and bio - filter 10. Fabric filter 11. Temperature control</div><div>12. Afterburner 13. Optimized combustion 14. Afterburner followed by quenching 15. Adsorption by activated carbon 16. Oxidation catalyst 17. Acidic scrubber 18. Collection and re -use 19. Process control and sealed reactor 20. Alumina scrubber 21. Excluding Aluminum smelting 22. Emissions of metals are dependent on the composition of the dust produced by the processes. The composition varies and is influenced by the process source of dust and by the raw materials that are being processed.</div><div>Source: Based in part on EU BREF in the Non-Ferrous Metals Industries (2001) *Associated emissions to air are given as daily averages based on continuous monitoring and standard conditions of 273 K, 101.3 kPa, measured oxygen content and dry gas without dilution of the gases with air. In cases where continuous monitoring is not practicable the value should be the average over the sampling period. If thermal cleaning and pyrolysis systems (e.g. swarf drying and decoating) are used to destroy combustion products (e.g. VOCs and dioxins) oxygen content 6 percent dry.</div></div></div>				
Source: WORLD BANK/IFC EHS Guidelines for Base Metal Smelting and Refining 2007, page 14/15				

- Please state which process exhaust gases are reused as fuels?
- Please also state the (expected) emission values (in particular greenhouse gas emissions (CO₂eq), dust (PM), sulfur dioxide (SO₂) and nitrogen oxides (NO_x) in mg/Nm³) for any steam and power generation. In the case of plants with a capacity of more than 50 MW_{thermic} please use the questionnaire *Conventional Energy* as guideline.
- Please describe what measures are taken to avoid/reduce air emissions (including greenhouse gas emissions) from the site. Will collected dust be recycled?
- What limit values for ambient air quality are applicable in the buyer's country (please make a table available)? Please state the relevant expected air emission levels. Please comment on changes in the ambient air quality before and after the project implementation. If there are no national limit values, please use the table below.

WHO Ambient Air Quality Guidelines^{1,2}

	Averaging Period	IFC Guideline Value [µg/m³]	Guideline Value Host country	Project Value (baseline status) [µg/m³]	Project Value (after implementation) [µg/m³]
Sulfur dioxide (SO₂)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)			
	10 minute	500 (guideline)			
Nitrogen dioxide (NO₂)	1-year	40 (guideline)			
	1-hour	200 (guideline)			
Particulate Matter (PM₁₀)	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)			
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)			
Particulate Matter (PM_{2.5})	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)			
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)			
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)			

Notes:

¹ World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.

² Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 4

- Please describe the on-site monitoring of air emissions as well as ambient air quality levels.

C.3. Fresh water and effluents

- How much (fresh) water is used on site? Is the water recirculated?
- Where and how is the water withdrawn?
- What wastewater streams are generated?
- How are effluents treated before they are discharged? Please also state whether effluents are discharged into a public sewage treatment system or into surface water bodies (river, lake, sea). If there are discharges, please provide information on the quantities of the wastewater streams (e.g. m³/h or l/s).
- If wastewater is discharged directly into a surface water body, please state the maximum values of the pollution levels in mg/l (table "Effluent Levels"). Occasionally, not all pollutants listed in the table are emitted or others specific to the project have to be added. Please inform us if that is the case.

Effluent Levels for Nickel, Copper, Lead, Zinc, and Aluminum Smelting & Refining				
Pollutant	Smelting type	Units	Guideline Value	Project Value
pH	All	S.U.	6-9	
Total Suspended solids (TSS)	All	mg/l	20	
COD	All	mg/l	50	
Fluoride	Aluminium	mg/l	5	
Hydrocarbons	Aluminium	mg/l	5	
Aluminium	Aluminium	mg/l	0.2	
Copper (Cu)	Copper	mg/l	0.1	
Lead (Pb)	Copper, Lead & Zinc	mg/l	0.1	
Arsenic (As)	Copper, Lead & Zinc	mg/l	0.05	
Nickel (Ni)	Nickel, Copper	mg/l	0.1	
Cadmium (Cd)	Copper, Lead & Zinc	mg/l	0.05	
Zinc (Zn)	Copper, Lead & Zinc	mg/l	0.2	
Mercury (Hg)	All	mg/l	0.01	
Temperature Increase	All	°C	< 3 ^a	
Toxicity	To be determined on a case specific basis			
a) At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity.				
Source: WORLD BANK/IFC EHS Guidelines for Base Metal Smelting and Refining 2007, page 16				

- How and where are the effluents discharged? Please explicitly comment on a temperature rise at the point of discharge, describe possible effects of the discharge on the ecology of the water bodies and provide information on the condition and size of the water body (e.g. flow values, flow rate). Please give also details on protection measures.
- Please describe the measures planned to avoid/reduce/treat wastewater.
- Please describe the on-site monitoring of the effluent values.

- What national standards are applicable in the buyer's country for the discharge of sanitary sewage? How is sewage treated before it is discharged? Please state the expected maximum values of the pollution levels in the sewage. If there are no national limit values, please use the table below.

Indicative Values for Treated Sanitary Sewage Discharges ¹			
Pollutants	Units	Guideline Value	Project Value
pH	pH	6-9	
BOD	mg/L	30	
COD	mg/L	125	
Total nitrogen	mg/L	10	
Total phosphorus	mg/L	2	
Oil and grease	mg/L	10	
TSS	mg/L	50	
Total coliform bacteria	MPN ² /100 ml	400 ¹	
Notes: ¹ Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation. ² MPN = Most Probable Number			
Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 30			

C.4. Waste

- What relevant waste products are generated on site?
- What measures are taken to avoid, treat and dispose of the waste (solid/liquid) generated and, as the case may be, where/how is it deposited?
- How is any acidic and oily waste as well as salt slag treated and disposed of?
- In cases where hydrometallurgical processes are used: What metals and metal compounds does the anode sludge contain?

C.5. Noise

- Please state the noise impact (existing background noise level and additional noise emissions of the project) on the nearest receptors (industrial estates and residential areas) in dB(A) for day and night after completion of the project in accordance with the table below.

Noise Level Guidelines ¹				
Receptor	One Hour LA _{eq} (dBA)			
	Guideline Value Daytime (07:00-22:00)	Project Value Daytime (07:00-22:00)	Guideline Value Nighttime (22:00-07:00)	Project Value Nighttime (22:00-07:00)
Residential; institutional; educational ²	55		45	
Industrial; commercial	70		70	
Notes: ¹ Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, WHO, 1999. ² For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999). Source: WORLD BANK/IFC GENERAL EHS GUIDELINES 2007, page 53				

- Do the project's noise emissions lead to an increase of the background noise level at the nearest receptors by more than 3 dB(A)?
- How far is the nearest residential area away?
- Are noise mitigation measures necessary or planned? If so, what measures?

C.6. Occupational health and safety

- What safety measures and/or control systems are planned to prevent accidents?
- How are safety and health (in particular with regard to contact with chemical substances, physical hazards, radiation, noise, confined spaces, electromagnetic fields) guaranteed at the workplace?
- What average and maximum noise exposure is to be expected in the production? What safety measures are taken at workplaces where the noise exposure exceeds 85 dB(A)?
- Please make accident statistics for the past two years available to us.
- How are subcontractors integrated into the health and safety measures on site?

C.7. Health and safety of the population

- What measures are taken to minimize impacts and possible risks (noise, explosions, dust and/or due to increased traffic) for adjacent communities?
- Please make information on infrastructure links (access roads, railway link, etc.), which may be necessary, available to us.

D. Additional Information

Additional information on the **Common Approaches**, our **environmental, social and human rights due diligence** and the **applicable standards** can be found at:

<https://agaportal.de/en/main-navigation/schnellzugriff-aga-konsortium/verantwortung>

The **World Bank/IFC EHS Guidelines** can be found on the website:

http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines.