

ANNEX 1

MAPPING TABLES

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Tables

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ANNEX 1. RELATING 2019 REFINEMENT METHODS TO THE 2006 GUIDELINES

This annex provides a road map for relating sections, equations, tables, figures and boxes in the 2019 Refinement to the 2006 Guidelines

Key:

NR = No Refinement

U = Update

E = Elaboration

NG = New Guidance

A1.1 SECTIONS

TABLE A1.1 SECTIONS			
Section Title	Type of Refinement	2006 Guidelines Section Number	2019 Refinement Section Number
Sub-Chapter 3.3			
Choice of emission factors	U	3.3.2.2	3.3.2.2
Sub-Chapter 3.10			
Fluorochemical Production		3.10	3.10
HFC-23 emission from HCFC-22 production	NR	3.10.1	3.10.1
Introduction	NR	3.10.1.1	3.10.1.1
Methodological issues	E, U	3.10.1.2	3.10.1.2
Uncertainty assessment	U	3.10.1.3	3.10.1.3
Quality assurance/Quality control (QA/QC), Reporting and Documentation	NR	3.10.1.4	3.10.1.4
Emissions from production of fluorinated compounds (other than HFC-23 emissions from HCFC-22 production)		3.10.2	3.10.2
Introduction	U	3.10.2.1	3.10.2.1
Methodological Issues	U	3.10.2.2	3.10.2.2
Uncertainty Assessment	E	3.10.2.3	3.10.2.3
Quality Assurance/Quality Control (QA/QC), Reporting and Documentation	NR	3.10.2.4	3.10.2.4
Sub-Chapter 3.11			
Sub-Chapter 3.11	NG	-	3.11

TABLE A1.1 (CONT.) SECTIONS			
Section Title	Type of Refinement	2006 Guidelines Section Number	2019 Refinement Section Number
Sub-Chapter 4.2			
Introduction	NR	4.2.1	4.2.1
Methodological issues	NR, U, NG, E	4.2.2	4.2.2
Choice of method: metallurgical coke production	NR, U, NG, E	4.2.2.1	4.2.2.1
Choice of method: iron and steel production	NR, NG, E	4.2.2.2	4.2.2.2
Choice of emission factors	NR, U, NG, E	4.2.2.3	4.2.2.3
Choice of activity data	NR, E	4.2.2.4	4.2.2.4
Completeness	NR, NG, E	4.2.2.5	4.2.2.5
Developing a consistent time series	NR	4.2.2.6	4.2.2.6
Uncertainty assessment	NR, U, NG, E	4.2.3	4.2.3
Quality Assurance/Quality Control (QA/QC), Reporting and Documentation	NR	4.2.4	4.2.4
Quality Assurance/Quality Control (QA/QC)	NR	4.2.4.1	4.2.4.1
Reporting and Documentation	NR	4.2.4.2	4.2.4.2
Sub-Chapter 4.4			
Introduction	U, E, NG	4.4.1	4.4.1
Methodological Issues for primary aluminium	U, E, NR	4.4.2	4.4.2
Choice of method for CO ₂ emissions from primary aluminium production	NR	4.4.2.1	4.4.2.1
Choice of emission factors for CO ₂ emissions from primary aluminium production	NR	4.4.2.2	4.4.2.2
Choice of method for PFCs	U, E	4.4.2.3	4.4.2.3
Choice of emission factors for PFCs	U, E	4.4.2.4	4.4.2.4
Choice of activity data	U, E	4.4.2.5	4.4.2.5
Completeness	U, E	4.4.2.6	4.4.2.6
Developing a consistent time series	U, E	4.4.2.7	4.4.2.7
Uncertainty assessment	U, E	4.4.3	4.4.3
Emission factor uncertainties	U, E	4.4.3.1	4.4.3.1
Activity data uncertainties	U, E	4.4.3.2	4.4.3.2
Quality assurance/quality control (QA/QC)	U, E	4.4.4.1	4.4.4.1
Reporting and documentation	U, E	4.4.4.2	4.4.4.2
Methodological Issues for alumina refining	NG	-	4.4.5
Alumina refining processes	NG	-	4.4.5.1
Choice of method	NG	-	4.4.5.2
Choice of emission factors for alumina production	NG	-	4.4.5.3
Choice of activity data	NG	-	4.4.5.4
Completeness	NG	-	4.4.5.5
Developing a consistent time series	NG	-	4.4.5.6

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TABLE A1.1 (CONT.) SECTIONS			
Section Title	Type of Refinement	2006 Guidelines Section Number	2019 Refinement Section Number
Uncertainty assessment	NG	-	4.4.6
Emission factor uncertainties	NG	-	4.4.6.1
Activity data uncertainties	NG	-	4.4.6.2
Quality assurance/quality control (QA/QC)	NG	-	4.4.7
Reporting and documentation	NG	-	4.4.7.2
References	U		4.4.8
Sub-Chapter 4.8			
Rare earths production (and all sub-sections included)	NG	-	4.8
Chapter 6			
Introduction	U	6.1	6.1
Etching and CVD cleaning for semiconductors, liquid crystal displays, and photovoltaics	U	6.2.1.1	6.2.1.1
Tier 1	U	6.2.1.1	6.2.1.1
Tier 2a	U	6.2.1.1	6.2.1.1
Tier 2b	U	6.2.1.1	6.2.1.1
Tier 2c	NG	6.2.1.1	6.2.1.1
Tier 3a	U	6.2.1.1	6.2.1.1
Tier 3b	NG	6.2.1.1	6.2.1.1
Heat Transfer Fluids	U	6.2.1.2	6.2.1.2
Choice of emission factors	U	6.2.2	6.2.2
Choice of activity data	U	6.2.3	6.2.3
Completeness	U	6.2.4	6.2.4
Developing a consistent time series	U	6.2.5	6.2.5
Uncertainty Assessment	U	6.3	6.3
Quality Assurance/Quality Control (QA/QC), Reporting, and Documentation	U	6.4	6.4
Chapter 7			
Chemicals and relevant application areas covered	U	7.1.1	7.1.1
Choice of method	E	7.1.2.2	7.1.2.2
Choice of emission factors	U, E	7.5.2.2	7.5.2.2
Chapter 8			
Introduction to Use of SF ₆ and PFCs in Other Products	NG	8.3.1	8.3.1
Methodological Issues	NG	8.3.2	8.3.2
Textile, carpet, leather and paper fluorinated treatment emissions	NG	-	8.5

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DISCUSSION

Sub-Chapter 4.4

- Update to T1 and T2 default factors (and uncertainties) with elaboration on newly defined technology classes and methods/default factors for low voltage anode effect emissions
- Placeholder for potential update to PFC HVAE methodology (Tier 2/3 b) depending on maturity of literature/methodology at cutoff date
- Updates and elaboration to choice of activity data, uncertainty and time series consistency discussion to reflect changes
- Overvoltage method not updated – recommendation to use slope (or Tier 3 overvoltage only)
- New guidance for alumina refining from Bayer-sintering and nepheline ore processes

Chapter 6

- Chapter 6 is being comprehensively updated. Substantial changes and new guidance include:
 - A new Tier 2c method for semiconductors that accounts for the size of manufactured wafers in addition to the process type and input gas,
 - A new Tier 3b method that relies on the measurement of emission factors at the stack level rather than the process level,
 - An update to the Tier 2b method for semiconductors to account for the size of manufactured wafers and the input gas rather than the process type and input gas,
 - Updates to the methods and Tier 1 emission factor for fluorinated heat transfer fluids,
 - Updates to the emission factors for Tier 1 and Tier 2 for all electronics industry types, and
 - Corresponding updates to the Completeness; Time Series Consistency; Uncertainty; and QA/QC, Reporting and Documentation sections.
- The Tier 3a and Tier 3b paragraphs are still being developed.

Chapter 7

- Section 7.1.1 “Chemicals and relevant application areas covered” in 2006 Guidelines: The text about HFCs and Montreal Protocol was outdated. The issue was in the mandate (TOC), but the place or section for the update was not specified.
- Section 7.1.2.2 “Choice of method” in 2006 Guidelines: Text elaborated in order to briefly describe the three new tables with consumption figures for 2015. This issue was suggested placed under 7.5.2.3 in the TOC (mandate), but we argue that this is the relevant section because it an elaboration related to table 7.3 which is located in section 7.1.2.2.
- Section 7.5.2.2 “Choice of emission factors” in 2006 Guidelines: Text is elaborated to describe new information from studies of emission factors, according to TOC.

Chapter 8

- New guidance for waterproofing of electronic circuits has been added to the Emissions from Other Applications of SF₆ and PFCs section.
- New guidance for Textile, carpet, leather and paper fluorinated treatment emissions

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A1.2 EQUATIONS

TABLE A1.2 EQUATIONS			
Equation Title	Type of Refinement	2006 Guidelines Equation Number	2019 Refinement Equation Number
Sub-Chapter 3.3			
No refinements	NR	-	-
Sub-Chapter 3.10			
Tier 1 calculation of HFC-23 from HCFC-22 (produced) using default factor	NR	3.30	3.30
Tier 2 calculation of HFC-23 from HCFC-22 (produced) using factor(s) calculated from process efficiencies	NR	3.31	3.31
Calculation of HFC-23 emission factor from carbon balance efficiency	NR	3.32	3.32
Calculation of HFC-23 emission factor from fluorine balance efficiency	NR	3.33	3.33
Tier 3a calculation of HFC-23 emissions from individual process streams(direct method)	NR	3.34	3.34
Tier 3b calculation of HFC-23 emissions from individual process streams using a Site- Or Process-Specific Emission Factor	U	3.35	3.35a
Tier 3c calculation of HFC-23 emissions from individual process streams(by monitoring reactor product)	NR	3.36	3.36a
Tier 3a calculation of 'instantaneous' HFC-23 emissions in an individual process stream (direct method)	NR	3.37	3.37
Tier 3b calculation of HFC-23 emissions in an individual process stream using a Site- Or Process-Specific Emission Factor	U	3.38	3.38a
Tier 3b calculation of standard emission for Emission Factor-based method	E	3.39	3.39
Tier 3c calculation of HFC-23 emissions from an individual facility by in-process measurement	NR	3.40	3.40
Tier 1 calculation of production-related emissions	NR	3.41	3.41
Tier 2 calculation of production-related emissions using a mass balance approach	NG	-	3.41a
Tier 3 summation of production-related emissions from process Vents and equipment leaks	NG	-	3.42a
Tier 3 direct calculation of production-related emissions from process Vents	U	3.42	3.42b
Tier 3 calculation of production-related emissions from Process vents using a Site- Or Process-Specific Emission Factor	U	3.43	3.43a
Tier 3 calculation of emissions from Equipment leaks using a Screening ranges approach	NG	-	3.43b

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TABLE A1.2 (CONT.) EQUATIONS			
Equation Title	Type of Refinement	2006 Guidelines Equation Number	2019 Refinement Equation Number
Tier 3 calculation of emissions from equipment leaks using a correlation approach	NG	-	3.43c
Tier 3 calculation of a unit-specific Correlation	NG	-	3.43d
Tier 3 calculation of emissions from equipment leaks using a unit-specific correlation approach	NG	-	3.43e
Tier 3 calculation of production-related emissions from Process vents using a Site- Or Process-Specific Emission Factor	NG	-	3.43f
Sub-Chapter 3.11			
All equations are new	NG	-	3.44-3.47
Sub-Chapter 4.2			
Emissions from coke production (Tier 1a)	NG	-	4.1
CO ₂ emissions from coke production (Tier 1b)	NG	-	4.2
CO ₂ emissions from onsite coke production (Tier 2)	NG	-	4.3
CO ₂ emissions from iron and steel production (Tier 1)	NR	4.4	4.4
CO ₂ emissions from production of pig iron not processed into steel (Tier 1)	NR	4.5	4.5
CO ₂ emissions from production of direct reduced iron (Tier 1)	NR	4.6	4.6
CO ₂ emissions from sinter production (Tier 1)	NR	4.7	4.7
CO ₂ emissions from pellet production (Tier 1)	NR	4.8	4.8
CO ₂ emissions from iron & steel production (Tier 2)	NR	4.9	4.9
CO ₂ emissions from sinter production (Tier 2)	NR	4.10	4.10
CO ₂ emissions from direct reduced iron production (Tier 2)	NR	4.11	4.11
CH ₄ emissions from sinter production (Tier 1)	NR	4.12	4.12
CH ₄ emissions from blast furnace production of pig iron (Tier 1)	NR	4.13	4.13
CH ₄ emissions from direct reduced iron production (Tier 1)	NR	4.14	4.14
Sub-Chapter 4.4			
Process CO ₂ emissions from anode and/or paste consumption (tier 1 method)	NR	4.20	4.20
CO ₂ emissions from prebaked anode consumption (tier 2 and tier 3 methods)	NR	4.21	4.21
CO ₂ emissions from pitch volatiles combustion (tier 2 and tier 3 methods)	NR	4.22	4.22
CO ₂ emissions from bake furnace packing material (tier 2 and tier 3 methods)	NR	4.23	4.23

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TABLE A1.2 (CONT.) EQUATIONS			
Equation Title	Type of Refinement	2006 Guidelines Equation Number	2019 Refinement Equation Number
CO ₂ emissions from paste consumption (tier 2 and tier 3 methods)	NR	4.24	4.24
Pfc emissions (tier 1 method)	U, E	4.25	4.25
Pfc emissions by slope method (tier 2 and tier 3 methods)	U, E	4.26	4.27
Pfc emissions by overvoltage method (tier 2 and tier 3 methods)	Not included	4.27	n/a
New: LVAE PFC emissions (tier 1, 2, 3)	NG	-	4.25b and 4.26b
New: HVAE PFC emissions (tier 1, 2, 3)	NG	-	4.25a and 4.26a
Tier 1: emissions based on alumina production data	NG	-	4.27a
Tier 2 and 3: emissions based on carbonate raw material inputs to the sintering kiln	NG	-	4.27b
Emissions captured during carbonization process and contained in produced sodium carbonate	NG	-	4.27c
Emissions from un-calcined skd not recycled to the kiln	NG	-	4.27d
Weighted average content of CO ₂ in 'i' bauxites (nephelines)	NG	-	4.27e
Weighted average content of CO ₂ in 'i' bauxite (nepheline) residue	NG	-	4.27f
Emissions from carbon-bearing non-fuel materials	NG	-	4.27g
Sub-Chapter 4.8			
Process CO ₂ Emissions from Anode Consumption (Tier 1 Method)	NG	-	4.35
Process CO ₂ emissions from anode consumption (Tier 2 method)	NG	-	4.36
PFC Emissions (Tier 1 and Tier 2 Methods)	NG	-	4.37
Chapter 6			
Tier 1 Method for estimation of the set of FC emissions	U	6.1	6.1
Emissions of FCi	U	6.2	6.2a
By-product emissions	U	6.3-6.6	6.3a
Emissions reduction impact of emissions control technology	E	6.2-6.6	6.3b
Estimate of the fraction of gas i volume in processes with emission control technologies	NG	-	6.3c
Uptime of emissions control Systems	NG	-	6.3d
Emission of FCi	U	6.7	6.7a
By-product Emissions	U	6.8-6.11	6.8a
Emissions reduction impact of emissions control technology	E	6.7-6.11	6.8b

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TABLE A1.2 (CONT.) EQUATIONS			
Equation Title	Type of Refinement	2006 Guidelines Equation Number	2019 Refinement Equation Number
Uptime of emissions control systems	NG	-	6.8c
Preliminary estimate of stack process gas emissions	NG	-	6.8d
Preliminary estimate of by-product emissions from stack	NG	-	6.8e
Tier 1 method for estimation of total FC emissions from heat transfer fluids	U	6.12	6.12a
Tier 2 method for estimation of FC emissions from heat transfer fluids	U	6.13	6.13
Chapter 8			
Waterproofing of Electronic Circuits	NG	-	8.22a
Textile, carpet, leather and paper fluorinated treatment emissions	NG	-	8.25-8.40

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92 **DISCUSSION**93 **Sub-Chapter 4.8**

- 94
- Numbering of Equations in existing 2006 IPCC Guidelines and 2019 Refinement .

95 **Chapter 6**

- 96
 - Equations 6.3 through 6.6 of the 2006 GL, which each covered an individual F-GHG by-product, have been merged into a new Equation 6.3 that covers all F-GHG by-products.
- 97
- 98
 - Equations 6.8 through 6.11 of the 2006 GL, which each covered an individual F-GHG by-product, have been merged into a new Equation 6.8 that covers all F-GHG by-products.
- 99
- 100
 - The term that accounts for emission reductions in Equations 6.2 through 6.6 in the 2006 GL, $a_i \cdot d_i$, has been replaced by the term D_i , which is elaborated and defined through three new equations:
- 101
- 102
 - Equation 6.4 defines D_i , the overall reduction of gas i emissions, in terms of a_i , the fraction of gas volume used in processes with emission control technologies, d_i , the destruction and removal efficiency for gas i , and UT , the average uptime of all abatement systems.
- 103
- 104
- 105
 - Equation 6.5 defines a_i for facilities using the Tier 2a method.
- 106
 - Equation 6.6 defines UT .
- 107
 - The term that accounts for emission reductions in Equations 6.7 through 6.11 in the 2006 GL, $a_{i,p} \cdot d_{i,p}$, has been replaced by the term $D_{i,p}$, which is elaborated and defined through two new equations:
- 108
- 109
 - Equation 6.9 defines the overall reduction of gas i emissions in terms of $a_{i,p}$, the fraction of gas volume used in processes with emission control technologies in process type p , $d_{i,p}$, the destruction and removal efficiency for gas i in process type p , and UT_p , the average uptime of all abatement systems for process type p .
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 - Equation 6.10 defines UT_p .
- 114
 - Equation 6.4: the factor a_i is still being developed.

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116 **A1.3 FIGURES**

TABLE A1.3 FIGURES			
Figure Title	Type of Refinement	2006 Guidelines Figure Number	2019 Refinement Figure Number
Sub-Chapter 3.3			
No refinements	NR	-	-
Sub-Chapter 3.10			
Decision tree for HFC-23 emissions from HCFC-22 production (or other similar by-product emissions from fluorochemical production)	NR	3.16	3.16
Decision tree for emissions of fluorinated greenhouse gases from production processes, applicable to both fugitive and by-product emissions	Correction	3.17	3.17
Sub-Chapter 3.11			
All figures are new	NG	-	3.18-3.20
Sub-Chapter 4.2			
Illustration of main processes for integrated iron and steel production	NR	4.1	4.1
Illustration of coke production process (emissions reported in Category 1A of the Energy Sector)	NR	4.2	4.2
Illustration of sinter production process	NR	4.3	4.3
Illustration of pig iron production processes	NR	4.4	4.4
Illustration of steel production processes	NR	4.5	4.5
Estimation of CO ₂ emissions from metallurgical coke production	NR, NG, E	4.6	4.6
Decision tree for estimation of CO ₂ emissions from iron and steel production	NR	4.7	4.7
Decision tree for estimation of CH ₄ emissions from iron and steel production	NR	4.8	4.8
Energy or IPPU CO ₂ emissions allocation in an integrated iron and steel facility	NG, E	-	4.8a
Sub-Chapter 4.4			
Decision tree for calculation of CO ₂ emissions from primary aluminium production	NR	4.11	4.11
Decision tree for calculation of PFC emissions from primary aluminium production	U, E	4.12	4.12
Alumina production processes	NG	-	4.12a
Decision tree for estimation of CO ₂ emissions from alumina production	NG	-	4.12b

TABLE A1.3 (CONT.) FIGURES			
Figure Title	Type of Refinement	2006 Guidelines Figure Number	2019 Refinement Figure Number
Sub-Chapter 4.8			
Decision tree for calculation of CO ₂ emissions from primary rare earth (RE) metal production.	NG	-	4.17
Decision tree for calculation of PFC emissions from primary rare earth (RE) metal production.	NG	-	4.18
Chapter 6			
Decision tree for estimation of GHG emissions from electronics manufacturing	U	6.1	6.1

DISCUSSION

Sub-Chapter 3.10

- The current version of Figure 3.17 may be further refined

Sub-Chapter 4.8

- Numbering of Figures in existing 2006 IPCC Guidelines and 2019 Refinement.

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133 **A1.4 TABLES**

TABLE A1.4 TABLES			
Table Title	Type of Refinement	2006 Guidelines Table Number	2019 Refinement Table Number
Sub-Chapter 3.3			
Different plant types for the production of HNO ₃	NG	-	3.3.a
Default factors for nitric acid production	U	3.3	3.3
Sub-Chapter 3.10			
HFC-23 default emission factors	U	3.28	3.28
F GHG default emission factor	NG	-	3.29a
Sub-Chapter 3.11			
All tables are new	NG	-	3.29-3.30
Sub-Chapter 4.2			
Tier 1 default CO ₂ emission factors for coke production and iron & steel production	NR, U, NG, E	4.1	4.1
Tier 1 default CH ₄ emission factors for coke production and iron & steel production	NR, U, NG	4.2	4.2
Tier 2 material-specific carbon contents for iron & steel and coke production	NR, U, NG	4.3	4.3
Uncertainty ranges	NR, U, NG	4.4	4.4
Sub-Chapter 4.4			
Tier 1 technology specific emission factors for calculating carbon dioxide emissions from anode or paste consumption	NR	4.10	4.10
Data sources and uncertainties for parameters used in tier 2 or 3 method for CO ₂ emissions from prebake cells (cwpb and swpb) , see equation 4.21	NR	4.11	4.11
Data sources and uncertainties for parameters used in tier 2 or 3 method for CO ₂ emissions from pitch volatiles combustion (cwpb and swpb)	NR	4.12	4.12
Data sources and uncertainties for parameters used in tier 2 or 3 method for CO ₂ emissions from bake furnace packing material (cwpb and swpb)	NR	4.13	4.13
Data sources and uncertainties for parameters used in tier 2 or 3 method for CO ₂ emissions from soderberg cells	NR	4.14	4.14
Default emission factors and uncertainty ranges for the calculation of PFC emissions from aluminium production by cell technology type (tier 1 method)	U,E	4.15	4.15 (includes LVAE)
Technology specific slope and overvoltage coefficients for the calculation of PFC emissions from aluminium production (tier 2 method)	U, E	4.16	4.16 (omits OV)
Good practice reporting information for calculating CO ₂ and PFC emissions from aluminium production by tier	U	4.17	4.18

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TABLE A1.4 (CONT.) TABLES			
Table Title	Type of Refinement	2006 Guidelines Table Number	2019 Refinement Table Number
New table: Technology specific default emission factors for the calculation of LVAE PFC emissions from aluminium production (Tier 2 method)	E	-	4.16a
Default uncertainty values for bauxite/nepheline sintering process	NG	-	4.16b
Sub-Chapter 4.8			
Tier 1 technology specific emission factors for calculating CO ₂ emissions from anode consumption (refer to Equation 4.1)	NG	-	4.26
Data sources and uncertainties for parameters used in Tier 2 method for CO ₂ emissions from anode consumption (refer to Equation 4.2)	NG	-	4.27
Default emission factors and uncertainty ranges for the calculation of PFC emissions from rare earth production by technology type (Tier 1 method, refer to Equation 4.3)	NG	-	4.28
Data sources and uncertainties for parameters used in Tier 2 method for PFC emissions (refer to Equation 4.3)	NG	-	4.29
Good practice reporting information for calculating CO ₂ and PFC emissions from rare earth metal production by tier	NG	-	4.30
Chapter 6			
Information sources necessary for completing the tiered emission estimating methods for electronics manufacturing	U	6.1	6.1
Tier1 Gas-specific emission factors for FC emissions from electronics manufacturing	U	6.2	6.2
Tier 2a method – default emission factors for GHG emissions from Semiconductor manufacturing	U	6.3	6.3
[Placeholder] Tier 2a method – Default emission factors for GHG emissions from display and PV manufacturing]	U	6.4-6.5	6.3a-6.3b
[Placeholder] Tier 2a method – Default emission factors for GHG emissions from MEMS manufacturing	NG	-	6.3c
Tier 2b method – default emission factors for GHG emissions from Semiconductor manufacturing	U	6.3	6.3d
[Placeholder]. Tier 2B method – Default emission factors for GHG emissions from display and PV manufacturing	U	6.4-6.5	6.3e-6.3f

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TABLE A1.4 (CONT.) TABLES			
Table Title	Type of Refinement	2006 Guidelines Table Number	2019 Refinement Table Number
[Placeholder]. Tier 2b method. Default emission factors for GHG emissions from MEMS manufacturing	NG	-	6.3g
Tier 2c method ($\leq 200\text{mm}$) – default emission factors for GHG emissions from semiconductor manufacturing	NG	-	6.3h
Tier 2c method ($\geq 300\text{mm}$) – default emission factors for GHG emissions from semiconductor manufacturing	NG	-	6.3i
Tier 2c method. [placeholder] Default emission factors for GHG emissions from display, PV, MEMS manufacturing	NG	-	6.3J-6.3L
Destruction Removal Efficiency (DRE) of PFC Abatement Technologies	NG	-	6.6a
Tier 2a&2b default efficiency parameters for electronics industry FC emission reduction technologies	U	6.6	6.6b
Chapter 7			
Main application areas for HFCs and PFCs as ODS substitutes	E	7.1	7.1
Distribution of HFC use by application area for 2015	E	-	7.3a
HFC consumption for RAC in article 5 countries. Per cent of total by substance and sub-application area for 2015	E	-	7.3b
HFC consumption for RAC in article 5 countries. Per cent of total by manufacturing and servicing for 2015	E	-	7.3c
Estimates for charge, lifetime and emission factors for refrigeration and air-conditioning systems	E	7.9	7.9
German study: Emission factors for refrigeration and air conditioning systems	E	-	7.9a
Emission factors for mobile air-conditioning	E	-	7.9b
End-of-life emission factors for mobile air-conditioning	E	-	7.9c
Chapter 8			
Emission Factor for High-GWP Gases from Waterproofing of Electronic Circuits	NG	-	8.11
Emission Factor for Low-GWP Gases from Waterproofing of Electronic Circuits	NG	-	8.12
Information sources necessary for completing the tiered emissions estimating methods for plasma treatment of textile, leather, and paper	NG	-	8.13
Information sources necessary for completing the tiered emissions estimating methods for wet treatment of textile, carpet, leather, and paper	NG	-	8.14

TABLE A1.4 (CONT.) TABLES			
Table Title	Type of Refinement	2006 Guidelines Table Number	2019 Refinement Table Number
List of most important input chemicals used in plasma treatment of textiles	NG	-	8.15
[Placeholder]. Tier 1 emission factors for FC emissions from textile, leather, and paper plasma treatment processes	NG	-	8.16
[Placeholder]. Tier 2a emission factors for FC emissions from textile, leather, and paper plasma treatment processes	NG	-	8.17
[Placeholder]. Tier 2b emission factors for FC emissions from textile, leather, and paper plasma treatment processes	NG	-	8.18
List of most important input chemicals used in wet treatment process, and their vapour pressure	NG	-	8.19
[Placeholder]. Tier 1 emission factors for FC emissions from wet treatment processes for textile, carpet, leather, and paper	NG	-	8.20
[Placeholder]. Tier 2a emission factors for FC emissions from wet treatment processes for textile, carpet, leather, and paper	NG	-	8.21
[Placeholder]. Tier 2b emission factors for FC emissions from wet treatment processes for textile, carpet, leather, and paper	NG	-	8.22
[Placeholder]. Default efficiency parameters for emission reduction technologies	NG	-	8.23
[Placeholder]. Default estimates of relative errors (%) for emission factors, 95% confidence intervals]	NG	-	8.24

DISCUSSION

Sub-Chapter 4.8

- Numbering of Tables in existing 2006 IPCC Guidelines and 2019 Refinement.

Chapter 6

- Tables 6.3-6.5 in the 2006 GL, which include both the Tier 2a and the Tier 2b EFs for semiconductors, LCD, and PV, respectively, have been (or will be) elaborated into Tables 6.3-6.5, which include (or will include) the Tier 2a EFs for semiconductors, display, and PV manufacturing, respectively; and Tables 6.7-6.9, which include (or will include) the Tier 2b EFs for semiconductors, display, and PV manufacturing, respectively, by wafer size.
- New tables 6.6 and 6.10 in the Refinement will present the Tier 2a and Tier 2b EFs for MEMS manufacturing.
- New tables 6.11-6.15 in the Refinement present (or will present) the Tier 2c EFs for semiconductors, display, PV, and MEMS manufacturing, respectively.

Chapter 7

- Table 7.1: Footnote 2 is elaborated, specifying that methodology for estimating emissions for plasma etching is not included in chapter 7. This issue was not in the mandate/TOC.
- Three new tables with consumption figures to address the issue of adding data on the distribution of ODS-substitutes by application, e.g. broadening the set of countries to include developing as well as developed countries. This issue was suggested placed under 7.5.2.3 in the TOC (mandate), but we argue that 7.1.2.2 is the relevant section because it an elaboration related to table 7.3 which is located in section 7.1.2.2.

First-order Draft

- New table 7.3a: Provides information similar to table 7.3 in 2006 Guidelines, but for 2015.
- New table 7.3b: Provides information for 2015 on use of HFCs in RAC by substance and sub-application area.
- New table 7.3c: Provides information for 2015 on the share of HFCs used for manufacturing and servicing in RAC.
- Table 7.9: A specification is made for the charge of buses in sub-application mobile air conditioning, as this is above the ranges given in the IPCC 2006 Guidelines. Also, foot note 5 regarding other studies for mobile air conditioning is erased because of the introduction of a new table on this issue.
- Three new tables with emission factors to address the issue of updating emission factors by further segregating equipment types, regions, and time periods where possible. The tables are placed in section 7.5.2.2 according to mandate (TOC):
 - New table 7.9a “German study”: Provides emission factors for commercial and industrial refrigeration, based on a study in Germany in 2011.
 - New table 7.9b “Mobile air conditioning”: Provides emission factors for mobile air conditioning from various studies.
 - New table 7.9c “End-of-life factors”: Provides end-of-life emission factors for mobile air conditioning from various studies.

A1.5 BOXES

TABLE A1.5
BOXES

Box Title	Type of Refinement	2006 Guidelines Box Number	2019 Refinement Box Number
Sub-Chapter 3.10			
Plant measurement frequency	NR	3.14	3.14
Sub-Chapter 3.11			
All boxes are new	NG	-	3.15-3.18
Sub-Chapter 4.4			
Fully automated anode effect intervention strategies for pfc emissions	NG	-	4.2
Anode effect description	U, E	4.2	4.3
Sub-Chapter 4.8			
Anode Effect Description (for rare earth metal production by fluoride electrolysis)	NG	n/a	4.4
Chapter 6			
Example for semiconductor manufacture		6.1	removed
Chapter 7			
Cook book for inventory compilers first building a RAC inventory. A step by step guidance on the tier 2 EF approach	E	-	Box 7.2a
Overview of the basic elements of the ODS-substitutes emission inventory	E	-	Box 7.2b
How to build the bank of ODS-substitutes	E	-	Box 7.2c
Common data sources for the ODS-substitutes inventory	E	-	Box 7.3a
Example of the application of a Tier 2a calculation for mobile air conditioning	U	Box 7.4	Box 7.4

DISCUSSION

Sub-Chapter 4.8

- Numbering of Boxes in existing 2006 IPCC Guidelines and 2019 Refinement.

Chapter 7

- Three new boxes to address the issue of increased user-friendliness and suggestion of box with “recipe”-style guidance on how to launch the ODS-substitutes inventory. Location according to suggestion in TOC (mandate):
 - New box 7.2a: Intended to simplify the process of starting an inventory on ODS-substitutes, focusing on the larger areas of use and the tier 2 EF approach.
 - New box 7.2b: Aims at giving an overview of the annual estimation process.
 - New box 7.2c: Provides information on two ways to establish the bank of ODSs for all relevant years.
- One new box to address the issue of increased user-friendliness, suggestion of examples regarding the collection of activity data, and the suggestion to further emphasizing the data and literature associated with the Montreal protocol. Location according to suggestion in TOC (mandate):

First-order Draft

- 199 ○ New box 7.3a: List of data sources commonly used for collecting data on HFCS, with a short
200 description of each.
- 201 • Box 7.4 in 2006 GL contains misleading information in terms of the emission factors used for MAC.
202 They are outside the default ranges presented in Table 7.9 in 2006 GL due to assumptions on frequent
203 A/C service with high leakage rate. We suggest to reduce the figure to be inside the default ranges
204 provided in 2006 GL Table 7.9 to consistent with the methodologies described.
- 205
- 206