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**Matters related to the implementation of the
Convention: measures to reduce or eliminate
releases from unintentional production**

Report on the polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran releases reported according to Article 5 and Annex C

As is mentioned in the note by the Secretariat on guidelines and guidance on best available techniques and best environmental practices (UNEP/POPS/COP.11/8), the annex to the present note sets out a report on the polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran releases reported according to Article 5 and Annex C prepared by the experts on the Toolkit and on best available techniques and best environmental practices. The present note, including its annex, has not been formally edited.

* UNEP/POPS/COP.11/1.

Annex

Report on the polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran releases reported according to Article 5 and Annex C

Report by the experts on the Toolkit and on best available techniques and best environmental practices

Ver. 27 February 2023

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This report has been prepared by the Group of experts on the Toolkit and on best available techniques and best environmental practices. The Group of experts was tasked with the preparation of an assessment of dioxin/furan release inventories pursuant to Article 5 and Annex C to the Stockholm Convention through decision SC-9/17, by which the Conference of the Parties adopted the revised framework for effectiveness evaluation, and decision SC-10/4, on interim programme of work and budget of the Stockholm Convention for 2022, in which it took note of the information on the modalities for the continuation of the intersessional work and processes of the Stockholm Convention emanating from the decisions of the ninth and previous meetings of the Conference of the Parties.

This report has been prepared in collaboration with the Basel and Stockholm Conventions Regional Centre China (BCRC/SCRC China), School of Environment of Tsinghua University, Beijing, China. Data collection, processing and analysis for the production of the report, along with the drafting work, have been conducted by Ms. Heidelore Fiedler, Örebro University, Sweden, and Ms. Weiyu Lin, Tsinghua University, China, whose contributions are highly acknowledged.

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Abbreviations and Acronyms

a	Year (annum)
B2001	Years before 2001 (year of adoption of text of the Stockholm Convention)
CFR	Common reporting format (UNECE LRTAP)
CLRTAP	Convention on Long-Range Transboundary Air Pollution
EE	Eastern Europe
g	Gram
GOV	Governmental or other public reports
GRULAC	Group of Latin American and Caribbean countries
ISO	International Organization for Standardization
NIP	National implementation plan (according to Article 6)
NR	National reports according to Article 15
Proj	Project reports
SCI	Scientific publications
SG	Source group (as defined in the Toolkit 2013)
TEQ	Toxic equivalents
UKN	Unknown sources
WEOG	Western Europe and Other Group

1. Context and Introduction

1. In accordance with Article 5 and Annex C to the Stockholm Convention on Persistent Organic Pollutants (POPs), Parties to the Convention are required to maintain source inventories and release estimates of unintentional POPs in their national strategies (action plans) to eliminate sources of Annex C substances or to reduce their releases. According to Article 5 (v), these strategies shall be revisited every five years. Parties are also required to report release inventories in their national reports according to Article 15, every four years (national reports can be accessed at <http://chm.pops.int/Countries/Reporting/NationalReports/tabid/3668/Default.aspx> (UNEP, No Year-b).
2. Parties are also required to prepare and submit national implementation plans (NIPs) according to Article 7 of the Convention¹.
3. The recommended approach to develop, maintain and update release inventories of unintentional POPs is explained in the UNEP Toolkit: T3 (for the 2003 version (UNEP, 2003)) or T13 (version 2013, latest (UNEP, 2013)). Reporting according to the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP), POPs Protocol, is indicated as Common Reporting Format (CFR) (under the CLRTAP guidelines, sources are categorized according to the CFR).
4. It should be noted that PCDD/PCDF releases are often accompanied by releases of other unintentional POPs, which can be minimized or eliminated by the same measures that are used to address PCDD/PCDF releases. When a comprehensive and consistent inventory of PCDD/PCDF is elaborated, it allows the identification of priority sources, assignment of counter-measures, and development of action plans to minimize releases of all unintentional POPs.
5. The Toolkit recommends that inventory activities be focused on PCDD/PCDF, as these substances are indicative of the presence of other unintentional POPs. They are considered to constitute a sufficient basis for identifying and prioritizing sources of all such substances as well as for devising applicable control measures for all Annex C POPs and for evaluating their efficacy (UNEP, 2013).
6. In this report, the following information has been assessed:
 - (a) Count of number of Parties and other locations for which release inventory information was submitted;
 - (b) Count of entries (individual numbers in the inventories for any of the release vectors in combination with a source group (SG)) that have been provided in the submissions.
7. The sources of information include the following groups:
 - (a) National reporting according to Article 15 (as second, third or fourth national report (NR2, NR3, NR4));
 - (b) National implementation plans (NIP; until 2014); or
 - (c) Others, such as:
 - (i) Scientific publications (SCI);
 - (ii) Project reports (Proj);
 - (iii) Governmental or other public reports (GOV).
8. The reference years are shown as 4-digit numbers preceded by Y for year. Reports that refer to years before 2001 are shown as 'B2001' (before 2001); not clearly defined years are assigned "Year not defined".
9. Further, the years have been grouped into periods, which include the years that are to be covered by the NR reporting period. These were assigned as shown in **Table 1**. Please note that the information from the fifth national reports (NR5) covering the period from 2019 to 2022 was not reflected in the present report due to time constraints and will be considered in future assessments.

Table 1. Grouping of years into periods.

Period	Years
Before the adoption of the Stockholm Convention	B2001
Before the entry into force of the Stockholm Convention	Y2001, Y2002, Y2003
NR1	Year not defined, Y2004, Y2005, Y2006
NR2	Y2007, Y2008, Y2009, Y2010
NR3	Y2011, Y2012, Y2013, Y2014
NR4	Y2015, Y2016, Y2017, Y2018

¹ The NIPs can be accessed at <http://chm.pops.int/Implementation/NationalImplementationPlans/NIPTransmission/tabid/253/Default.aspx> (UNEP, No Year-a).

2. Release Inventories (precleaned)

2.1 Reports Available and Assessed

10. The number of reports, i.e., NR, NIP or other type of presentation of the release inventory, by Party, is a process indicator and reflects if the reporting has been provided as required. For reporting under the Stockholm Convention, there could be an optimum number of four NRs and four NIPs; thus, eight reports per Party, achieved. The number of reports are shown in **Table 2**. Within each report, there is a corresponding number of entries, i.e., value/amount for one combination of SG and release vector; thus, a complete inventory reported would have $9 \times 5 = 45$ entries. Since Parties can report more than one inventory in a report, e.g., in cases of entering information for multiple years, the number of entries can be much higher. A summary of the number of entries is provided in **Table 3**. The number of entries is reduced when the entry is zero, which is the case when:

- (a) No release exists; examples are 'Product' releases in the thermal processes of SG1, SG3, SG5 SG6;
- (b) A release vector was not considered at all: examples are when a country reports only releases to Air and not to the other vectors; or
- (c) The entry was reported zero; examples are where a certain emission source or the release does not exist in the location concerned.

11. **Table 2** lists the sources of information and their ISO3 alpha code, the location and the source of information where the PCDD/PCDF inventory was taken from. The sources are the second, third and fourth national reports (NR2, NR3, NR4), national implementation plans (NIP) or others, such as the project by UNEP Chemicals to test the Toolkit (Proj), scientific publication (SCI) and one unknown source (UKN).

12. In total, 98 Parties have provided quantitative information as to the releases of PCDD/PCDF (in TEQ/a). These were retrieved from 128 reports. In addition, the information considered includes a separate inventory submitted for Hong Kong special administrative region (SAR), China and an inventory submitted by Brunei Darussalam, which is not a Party to the Convention, bringing the total number of locations assessed to 100.

13. Since the national reporting system of the Convention automatically transfers information entered in a previous NR cycle to the following NR cycle, the earlier information was not used when found to be identical in the last available NR. In some cases, NRs showed differing amounts (g TEQ) in the releases or as to the type of releases. These numbers are included in chapter 3, where recommendations for follow-up are given.

Table 2. Sources of release inventories of unintentional POPs by location (PCDD/PCDF)

Region	Location	ISO3	NR3	NR4	NR2	NIP	Other	Total number of reports
Africa		25	7	9	6	8	1	31
Africa	Burkina Faso	BFA				1		1
Africa	Central African Republic	CAF	1					1
Africa	Côte d'Ivoire	CIV		1		1		2
Africa	Cameroon	CMR		1		1		2
Africa	Democratic Republic of the Congo	COD				1		1
Africa	Djibouti	DJI					UKN	1
Africa	Algeria	DZA			1			1
Africa	Egypt	EGY		1				1
Africa	Gabon	GAB				1		1
Africa	Ghana	GHA		1				1
Africa	Gambia	GMB				1		1
Africa	Kenya	KEN			1			1
Africa	Madagascar	MDG	1					1
Africa	Mali	MLI	1					1
Africa	Mauritius	MUS	1	1				2
Africa	Morocco	MAR	1	1				2
Africa	Rwanda	RWA		1				1
Africa	Sudan	SDN	1			1		2
Africa	Senegal	SEN			1			1
Africa	Eswatini	SWZ			1			1
Africa	Togo	TGO			1			1
Africa	Tunisia	TUN	1					1
Africa	United Republic of Tanzania	TZA			1			1
Africa	Uganda	UGA		1				1

Region	Location	ISO3	NR3	NR4	NR2	NIP	Other	Total number of reports
Africa	South Africa	ZAF		1		1		2
Asia-Pacific		23	1	12	3	7	3	26
Asia-Pacific	Azerbaijan	AZE		1				1
Asia-Pacific	Brunei Darussalam	BRN					Proj	1
Asia-Pacific	China	CHN				1		1
Asia-Pacific	Hong Kong SAR, China	HKG				1		1
Asia-Pacific	Micronesia	FSM		1				1
Asia-Pacific	Indonesia	IDN		1				1
Asia-Pacific	India	IND				1		1
Asia-Pacific	Iran	IRN			1			1
Asia-Pacific	Jordan	JOR					Proj	1
Asia-Pacific	Japan	JPN		1				1
Asia-Pacific	Cambodia	KHM		1				1
Asia-Pacific	Cyprus	CYP		1				1
Asia-Pacific	Republic of Korea	KOR		1				1
Asia-Pacific	Lao PDR	LAO			1			1
Asia-Pacific	Lebanon	LBN		1		1		2
Asia-Pacific	Sri Lanka	LKA		1		1		2
Asia-Pacific	Mongolia	MNG		1				1
Asia-Pacific	Philippines	PHL			1		Proj	2
Asia-Pacific	Singapore	SGP		1				1
Asia-Pacific	Seychelles	SYC				1		1
Asia-Pacific	Syrian Arab Republic	SYR				1		1
Asia-Pacific	Thailand	THA		1				1
Asia-Pacific	Viet Nam	VNM	1					1
EE		16	7	14	1	1	0	23
EE	Albania	ALB	1					1
EE	Armenia	ARM		1				1
EE	Bulgaria	BGR	1	1				2
EE	Belarus	BLR		1				1
EE	Czechia	CZE	1	1				2
EE	Estonia	EST		1				1
EE	Croatia	HRV		1				1
EE	Lithuania	LTU	1	1				2
EE	Latvia	LVA		1				1
EE	North Macedonia	MKD		1				1
EE	Montenegro	MNE		1				1
EE	Poland	POL	1	1	1			3
EE	Romania	ROU		1		1		2
EE	Serbia	SRB		1				1
EE	Slovakia	SVK	1					1
EE	Slovenia	SVN	1	1				2
GRULAC		18	3	16	2	0	1	22
GRULAC	Argentina	ARG		1				1
GRULAC	Brazil	BRA		1				1
GRULAC	Chile	CHL		1				1
GRULAC	Colombia	COL	1	1				2
GRULAC	Costa Rica	CRI	1	1				2
GRULAC	Cuba	CUB		1			Proj	2
GRULAC	Guatemala	GTM			1			1
GRULAC	Guyana	GUY		1				1
GRULAC	Honduras	HND		1				1
GRULAC	Saint Lucia	LCA		1				1
GRULAC	Mexico	MEX	1	1				2
GRULAC	Nicaragua	NIC		1				1
GRULAC	Panama	PAN			1			1
GRULAC	Peru	PER		1				1
GRULAC	Paraguay	PRY		1				1
GRULAC	Trinidad and Tobago	TTO		1				1
GRULAC	Uruguay	URY		1				1
GRULAC	Venezuela	VEN		1				1
WEOG		18	10	14	2	0	1	27
WEOG	Australia	AUS	1	1				2
WEOG	Austria	AUT	1					1

Region	Location	ISO3	NR3	NR4	NR2	NIP	Other	Total number of reports
WEOG	Belgium	BEL		1				1
WEOG	Canada	CAN	1	1				2
WEOG	Switzerland	CHE	1					1
WEOG	Germany	DEU	1	1				2
WEOG	Denmark	DNK		1				1
WEOG	Spain	ESP		1				1
WEOG	Finland	FIN	1	1				2
WEOG	France	FRA	1					1
WEOG	United Kingdom of Great Britain and Northern Ireland	GBR	1	1				2
WEOG	Ireland	IRL	1	1	1			3
WEOG	Netherlands	NLD	1	1				2
WEOG	Norway	NOR		1				1
WEOG	New Zealand	NZL		1				1
WEOG	Portugal	PRT			1		SCI	2
WEOG	Sweden	SWE		1				1
WEOG	Türkiye	TUR		1				1
	Total	100	28	65	14	16	6	128

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans; project: project reports; SCI: scientific publications; UKN: unknown sources.

14. **Table 3** summarizes the number of entries per region from all sources. Inventories in NR4 were considered as the main sources of information; reports from NR3 were maintained if (a) the Party did not from the report in NR4 or (b) differences between NR3 and NR4 reporting were observed. NIP and other sources of information was considered for those locations with no NR. Thus, **Table 3** is precleaned as to obvious duplicates. When zero releases for a SG and a vector were reported for a location, that entry was eliminated. From the right column, it can be seen that overall, all SGs were addressed. WEOG Parties provided 40% of all entries. All reference years are represented.

Table 3. Number of entries grouped according to certain parameters (precleaned)

Region	Africa	Asia-Pacific	EE	GRULAC	WEOG	Overall
Total Entries	415 (7.2%)	840 (14.5%)	1,692 (29.2%)	584 (10.1%)	2,257 (39.0%)	5,788 (100%)
Vector						
Air	204 (49.2%)	524 (62.4%)	1,266 (74.8%)	275 (47.1%)	1,373 (60.8%)	3,642 (62.9%)
Water	32 (7.7%)	85 (10.1%)	63 (3.7%)	50 (8.6%)	281 (12.5%)	511 (8.8%)
Land	31 (7.5%)	28 (3.3%)	48 (2.8%)	41 (7.0%)	230 (10.2%)	378 (6.5%)
Product	34 (8.2%)	48 (5.7%)	63 (3.7%)	54 (9.2%)	76 (3.4%)	275 (4.8%)
Residue	114 (27.5%)	155 (18.5%)	252 (14.9%)	164 (28.1%)	297 (13.2%)	982 (17.0%)
SG						
SG1	56 (13.5%)	105 (12.5%)	220 (13.0%)	63 (10.8%)	201(8.9%)	645 (11.1%)
SG2	49 (11.8%)	118 (14.0%)	257 (15.2%)	70 (12.0%)	248 (11.0%)	742 (12.8%)
SG3	48 (11.6%)	91 (10.8%)	254 (15.0%)	66 (11.3%)	321 (14.2%)	780 (13.5%)
SG4	51 (12.3%)	97 (11.6%)	198 (11.7%)	57 (9.8%)	240 (10.6%)	643 (11.1%)
SG5	31 (7.5%)	60 (7.1%)	202 (11.9%)	38 (6.5%)	170 (7.5%)	501 (8.7%)
SG6	75 (18.1%)	83 (9.9%)	202 (11.9%)	96 (16.4%)	236 (10.5%)	692 (12.0%)
SG7	36 (8.7%)	111 (13.2%)	120 (7.1%)	75 (12.8%)	297 (13.2%)	639 (11.0%)
SG8	17 (4.1%)	81 (9.6%)	102 (6.0%)	56 (9.6%)	274 (12.1%)	530 (9.2%)
SG9	52 (12.5%)	94 (11.2%)	137 (8.1%)	63 (10.8%)	270 (12.0%)	616 (10.6%)
Source						
NIP	67 (16.1%)	82 (9.8%)	16 (0.9%)	0 (0%)	0 (0%)	165 (2.9%)
NR2	35 (8.4%)	25 (3.0%)	7 (0.4%)	14 (2.4%)	21 (0.9%)	102 (1.8%)
NR3	128 (30.8%)	15 (1.8%)	249 (14.7%)	64 (11.0%)	545 (24.2%)	1,001 (17.3%)
NR4	179 (43.1%)	692 (82.4%)	1,420 (83.9%)	488 (83.6%)	1,679 (74.4%)	4,458 (77.0%)
Other	6 (1.4%)	26 (3.1%)	0 (0%)	18 (3.1%)	12 (0.5%)	62 (1.1%)
Period						
B2001	7 (1.7%)	18 (2.1%)	55 (3.3%)	58 (9.9%)	67 (3.0%)	205 (3.5%)
pre_SC	37 (8.9%)	70 (8.3%)	242 (14.3%)	135 (23.1%)	412 (18.3%)	896 (15.5%)
NR1	234 (56.4%)	289 (34.4%)	352 (20.8%)	115 (19.7%)	551 (24.4%)	1,541 (26.6%)
NR2	58 (14.0%)	195 (23.2%)	498 (29.4%)	81 (13.9%)	556 (24.6%)	1,388 (24.0%)
NR3	43 (10.4%)	222 (26.4%)	384 (22.7%)	146 (25.0%)	474 (21.0%)	1,269 (21.9%)
NR4	36 (8.7%)	46 (5.5%)	161 (9.5%)	49 (8.4%)	197 (8.7%)	489 (8.4%)
Year						
B2001	7 (1.7%)	18 (2.1%)	55 (3.3%)	58 (9.9%)	67 (3.0%)	205 (3.5%)

Region	Africa	Asia-Pacific	EE	GRULAC	WEOG	Overall
Total Entries	415 (7.2%)	840 (14.5%)	1,692 (29.2%)	584 (10.1%)	2,257 (39.0%)	5,788 (100%)
Year not defined	9 (2.2%)	27 (3.2%)	0 (0%)	0 (0%)	0 (0%)	27 (0.5%)
Y2001	0 (0%)	24 (3.0%)	102 (6.0%)	19 (3.3%)	140 (6.2%)	285 (4.9%)
Y2002	24 (5.8%)	23 (2.7%)	70 (4.1%)	75 (12.8%)	137 (6.1%)	329 (5.7%)
Y2003	13 (3.1%)	23 (2.7%)	70 (4.1%)	41 (7.0%)	135 (6.0%)	282 (4.9%)
Y2004	76 (18.3%)	150 (17.9%)	113 (6.7%)	41 (7.0%)	186 (8.2%)	566 (9.8%)
Y2005	45 (10.8%)	47 (5.6%)	99 (5.9%)	29 (5.0%)	175 (7.8%)	395 (6.8%)
Y2006	104 (25.1%)	74 (8.8%)	140 (8.3%)	45 (7.7%)	190 (8.4%)	553 (9.6%)
Y2007	32 (7.7%)	45 (5.4%)	154 (9.1%)	27 (4.6%)	197 (8.7%)	455 (7.9%)
Y2008	10 (2.4%)	58 (6.9%)	110 (6.5%)	30 (5.1%)	133 (5.9%)	341 (5.9%)
Y2009	7 (1.7%)	52 (6.2%)	127 (7.5%)	0 (0%)	104 (4.6%)	290 (5.0%)
Y2010	9 (2.2%)	40 (4.8%)	107 (6.3%)	24 (4.1%)	122 (5.4%)	302 (5.2%)
Y2011	15 (3.6%)	40 (4.8%)	121 (7.2%)	8 (1.4%)	106 (4.8%)	290 (5.0%)
Y2012	12 (2.9%)	40 (4.8%)	95 (5.6%)	24 (4.1%)	137 (6.1%)	308 (5.3%)
Y2013	16 (3.9%)	104 (12.4%)	92 (5.4%)	55 (9.4%)	116 (5.1%)	383 (6.6%)
Y2014	0 (0%)	38 (4.5%)	76 (4.5%)	59 (10.1%)	115 (5.1%)	288 (5.0%)
Y2015	25 (6.0%)	24 (2.9%)	75 (4.4%)	14 (2.4%)	99 (4.4%)	237 (4.1%)
Y2016	11 (2.7%)	18 (2.1%)	71 (4.2%)	21 (3.6%)	86 (3.8%)	207 (3.6%)
Y2017	0 (0%)	0 (0%)	14 (0.8%)	7 (1.2%)	12 (0.5%)	33 (0.6%)
Y2018	0 (0%)	4 (0.5%)	1 (0.1%)	7 (1.2%)	0 (0%)	12 (0.2%)

Note: NR1: first national report; NR2: second national reports; NR3: third national reports; NR4: fourth national reports; B2001: before 2001; pre_SC: before the entry into force of the Stockholm Convention; SG: source group.

15. The number of information/entries by release vector with reference year and region is summarized in **Figure 1**. The number of entries according to each reference year with their release vector and source group (SG) is shown in **Figure 2**.

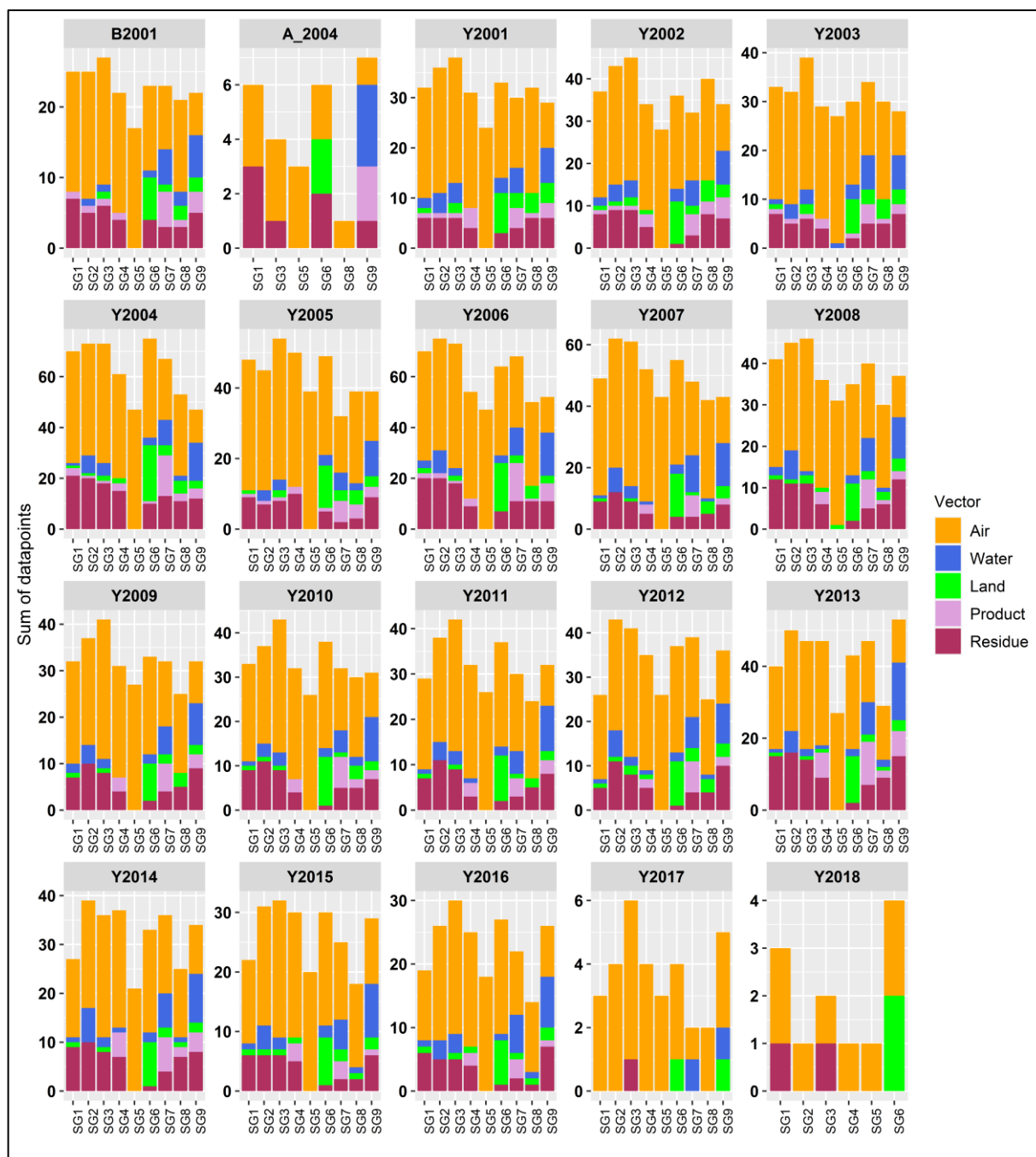


Figure 1. Reporting (pre-cleaned): Number of entries by year with source groups (SG) and vector (data from **Table 3**). (Note: B2001: before 2001; A_2004: year not defined.)

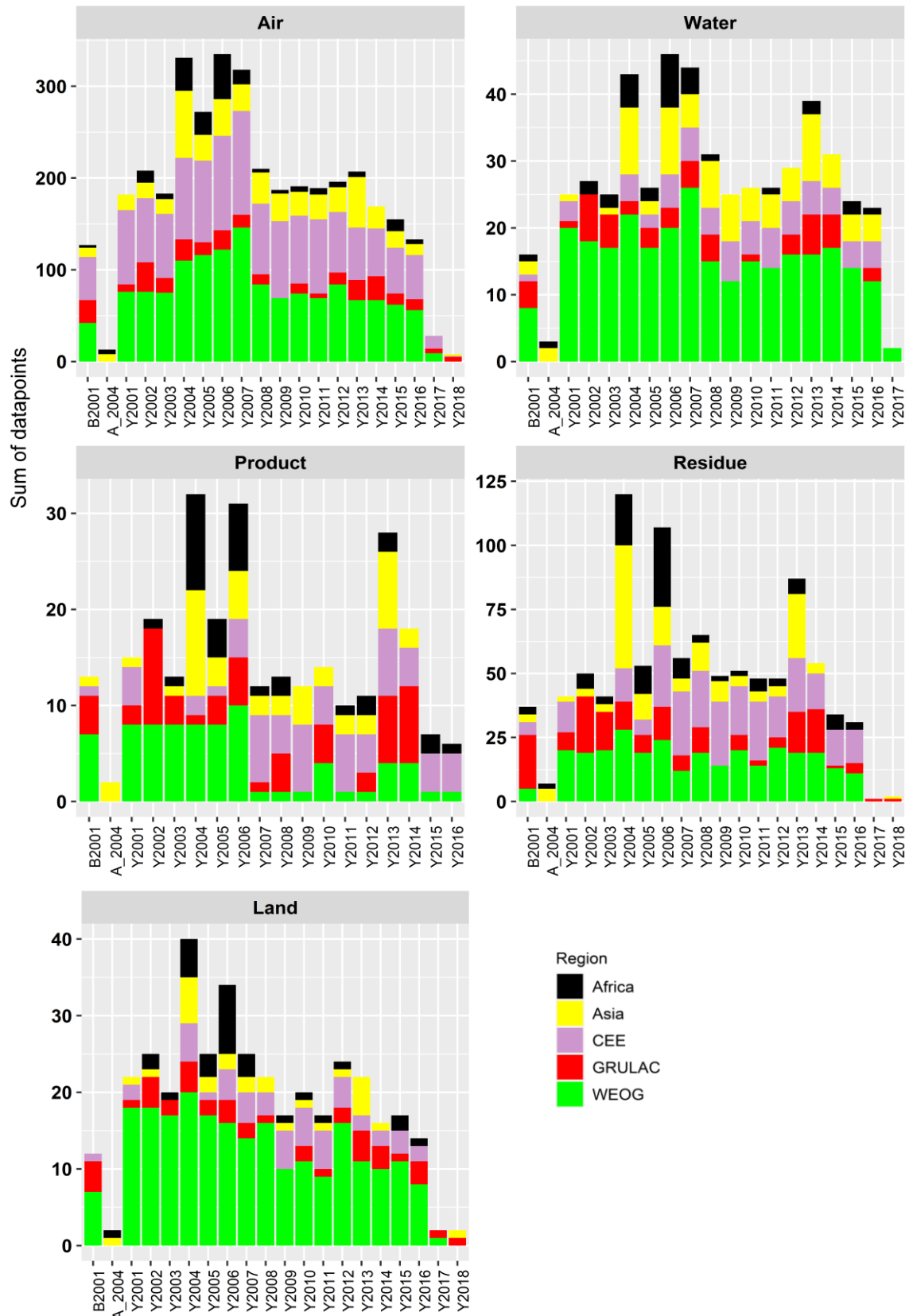


Figure 2. Reporting (pre-cleaned): Number of entries by vector with region and year. (Note: B2001: before 2001; A_2004: year not defined.)

2.2 Quantitative Inventories (precleaned)

16. The quantitative data from the reports listed in **Table 2** are summarized by region in **Table 4**. For location level information, please refer to **Table S1** set out in the appendix below. The total inventory reports (accumulated amounts) are of 8.8 kg of TEQ released overall / globally, whereby approx. 7.7 kg are reported in GRULAC.

Table 4. Quantitative release inventory by Region based on all reports (precleaned) (g TEQ/a)

Region	NR2	NR3	NR4	NIP	Project	SCI	UKN	Sub-total
Africa	24,060	756,952	84,851	21,837			119	887,819
Asia-Pacific	1,507	814	28,411	17,905	358			48,995
EE	399	6,195	97,168	590				104,352
GRULAC	244	2,164	7,684,734		445			7,687,587
WEOG	16	12,282	55,272			57		67,627
Total	26,225	778,407	7,950,436	40,332	803	57	119	8,796,379

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans; project: project reports; SCI: scientific publications; UKN: unknown sources.

17. **Figure 3** quantitatively illustrates 3-dimensional barplots of the amounts of total PCDD/PCDF released (as g TEQ/a) by region and source. **Figure 4** displays quantitative information of total PCDD/PCDF released (as g TEQ/a) by location (ISO3) and source. The ‘source’ refers to the report where the information was taken from. For location level quantitative information, please see **Figure S1** and **Figure S2** in the appendix below.

18. The analysis enabled identification of errors, which need to be corrected for an assessment to be made. From the graphs, duplicate or erroneous information could be retrieved such as different numbers for the same year, unit errors, different information between reports, among others.

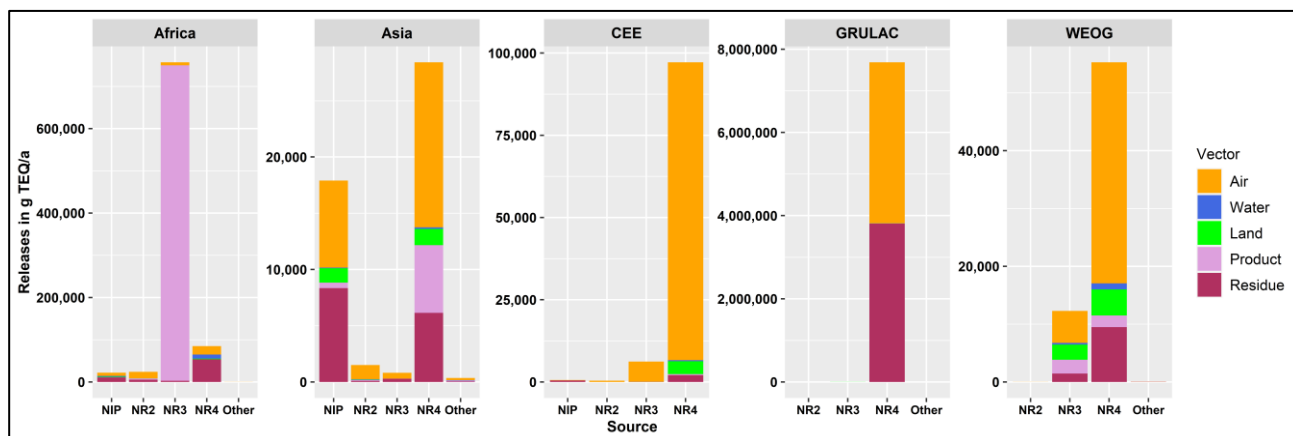


Figure 3. Reporting (pre-cleaned): Total releases by region and source (amounts in g TEQ/a). (Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports.)

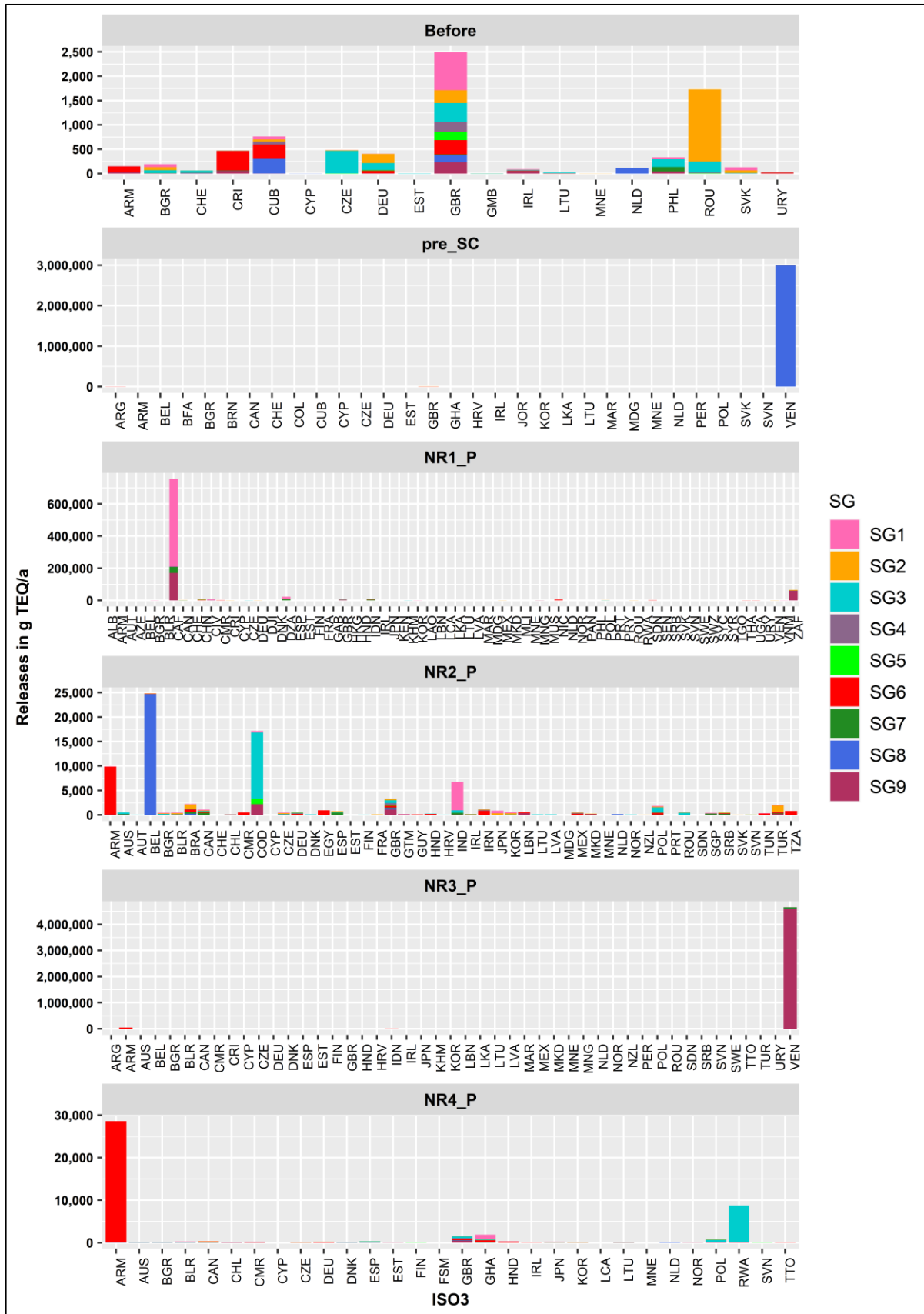


Figure 4. Quantitative reporting (pre-cleaned): Amounts reported for reporting period by location and source groups (SG) stacked (in g TEQ/a). Details in Error! Reference source not found.. (Note: pre_SC: before the entry into force of the Stockholm Convention; NR1_P: first national report; NR2_P: second national reports; NR3_P: third national reports; NR4_P: fourth national reports.)

3. Final inventories

19. Duplicate entries based on the amounts of release ('Amount' in g TEQ/a) were removed by applying the following:
- (a) Priority was given to the latest official report; *i.e.*, NR4; and
 - (b) In the absence of NR4, the previous NR was taken.
20. The following changes were made to national quantitative data:
- (a) BGR: NR3 amounts for the years B2001 to Y2007 from NR3 were eliminated since are contained in NR4. Observe the amounts in NR3 are different from amounts in NR4;
 - (b) AUS: NR3 report removed for Y2007 since contained in NR4 but with a different amount;
 - (c) CAN: NR3 removed for Y2004 and Y2007 although different amounts as in NR4 (confirmed by CAN);
 - (d) COL: NR3 removed although different amount in NR4;
 - (e) CRI: Y2006 amount in NR3 removed; identical with NR4; NR3 for B2001 maintained;
 - (f) CUB: Y2002 amount from SCI removed since different from NR4, Y2000 amount maintained;
 - (g) CZK: NR3 for B2001 maintained; other NR3 removed although different amounts;
 - (h) DEU: NR3 for B2001 maintained; other NR3 removed although different amounts;
 - (i) FIN: NR3 (Y2005-Y2007) removed since identical with NR4;
 - (j) GBR: NR3 for B2001 maintained; other NR3 removed although different amounts;
 - (k) IRL: until Y2007 NR2 removed although different numbers in NR3, NR3 removed although different numbers in NR4, B2001 amount maintained from NR3 since not in NR4;
 - (l) LBN: Project removed although different amount;
 - (m) LTU: NR3 for Y2007 removed;
 - (n) NLD: NR3 removed (B2001 until Y2007 although very small differences in amounts in NR4);
 - (o) PHL: same amount in NIP and NR2 but different years. NR2 report ref year changed to 1999 (expert judgment);
 - (p) POL: NR2 and NR3 removed although different amounts in NR4 (small differences); and
 - (q) SVN: NR3 removed although different amounts in NR4 (small differences).
21. The following observations are also made:
- (a) MAR report 2006 releases in NR3 but not in NR4;
 - (b) CIV has amount for Y2005 in NR4; amount for B2001 contained in NIP no tin NR;
 - (c) CMR: NIP inventory for Y2009 not contained in NR4;
 - (d) LKA has NIP and NR4 complementary with respect to years. Recommend including NIP amounts into NR; and
 - (e) PRT: Information from scientific publication for Y2006 (Fiedler, 2016) was removed since NR2 entry covered the same year. A scientific publication (Quina et al., 2011) used the 5-vector approach whereas the NR2 only the air emissions (which were not identical in the two sources). Another scientific publication reported releases for several years but only for the air vector (Relvas et al., 2013).

3.1 Reporting cleaned

22. The effect of the cleaning (removal of duplicates) is summarized in **Table 5** and detailed in **Note**: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans.

23. **Table 6**. Finally, the quantitative information on releases of PCDD/PCDF was assessed for 100 locations: 98 Parties, 1 signatory and 1 special administrative region of a Party from a total of 115 reports; 20 reports have been removed from the assessment as shown on the right side of **Note**: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans.

24. **Table 6.****Table 5.** Final number of reports used for the assessment after removal of duplicate information

Region	# ISO	Final sources						Removed sources					Report total
		NR2	NR3	NR4	NIP	Other	Total	NR2	NR3	NIP	Other	Total	
Africa	25	6	7	9	8	1	31	0	0	0	0	0	31
Asia-Pacific	23	3	1	12	6	2	24	0	0	1	1	2	26
EE	16	0	3	14	1		18	1	5	0	0	6	24
GRULAC	18	2	2	16	0	1	21	0	2	0	1	3	24
WEOG	18	1	6	14	0	0	21	1	7	0	1	9	30
Total	100	12	19	65	15	4	115	2	14	1	3	20	135

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans.

Table 6. Number and identity of reports used for the assessment after removal of duplicate information

Location	Final sources						Removed sources					Grand Total
	NR2	NR3	NR4	NIP	Other	Total	NR2	NR3	NIP	Other	Total	
Africa	6	7	9	8	1	31	0	0	0	0	0	31
BFA				1		1					0	1
CAF		1				1					0	1
CIV			1	1		2					0	2
CMR			1	1		2			1		0	2
COD				1		1					0	1
DJI					1	1					0	1
DZA	1					1					0	1
EGY			1			1					0	1
GAB				1		1					0	1
GHA			1			1					0	1
GMB				1		1					0	1
KEN	1					1					0	1
MAR		1	1			2					0	2
MDG		1				1					0	1
MLI		1				1					0	1
MUS		1	1			2					0	2
RWA			1			1					0	1
SDN		1		1		2					0	2
SEN	1					1					0	1
SWZ	1					1					0	1
TGO	1					1					0	1
TUN		1				1					0	1
TZA	1					1					0	1
UGA			1			1					0	1
ZAF			1	1		2					0	2
Asia-Pacific	3	1	12	6	2	24	0	0	1	1	2	26
AZE			1			1					0	1
BRN					1	1					0	1
CHN				1		1					0	1
CYP			1			1					0	1
FSM			1			1					0	1
HKG				1		1					0	1
IDN			1			1					0	1
IND				1		1					0	1
IRN	1					1					0	1
JOR					1	1					0	1
JPN			1			1					0	1
KHM			1			1					0	1
KOR			1			1					0	1
LAO	1					1					0	1
LBN			1			1			1		1	2
LKA			1	1		2					0	2
MNG			1			1					0	1
PHL	1					1				1	1	2
SGP			1			1					0	1
SYC				1		1					0	1
SYR				1		1					0	1

Location	Final sources					Total	Removed sources					Grand Total
	NR2	NR3	NR4	NIP	Other		NR2	NR3	NIP	Other	Total	
THA			1			1					0	1
VNM		1				1					0	1
EE	0	3	14	1		18	1	5	0	0	6	24
ALB		1				1					0	1
ARM			1			1					0	1
BGR			1			1		1			1	2
BLR			1			1					0	1
CZE		1	1			2		1			1	3
EST			1			1					0	1
HRV			1			1					0	1
LTU			1			1		1			1	2
LVA			1			1					0	1
MKD			1			1					0	1
MNE			1			1					0	1
POL			1			1	1	1			2	3
ROU			1	1		2					0	2
SRB			1			1					0	1
SVK		1				1					0	1
SVN			1			1		1			1	2
GRULAC	2	2	16	0	1	21	0	2	0	1	3	24
ARG			1			1					0	1
BRA			1			1					0	1
CHL			1			1					0	1
COL			1			1		1			1	2
CRI		1	1			2		1			1	3
CUB			1		1	2				1	1	3
GTM	1					1					0	1
GUY			1			1					0	1
HND			1			1					0	1
LCA			1			1					0	1
MEX		1	1			2					0	2
NIC			1			1					0	1
PAN	1					1					0	1
PER			1			1					0	1
PRY			1			1					0	1
TTO			1			1					0	1
URY			1			1					0	1
VEN			1			1					0	1
WEOG	1	6	14	0	0	21	1	7	0	1	9	30
AUS			1			1		1			1	2
AUT		1				1					0	1
BEL			1			1					0	1
CAN			1			1		1			1	2
CHE		1				1					0	1
DEU		1	1			2		1			1	3
DNK			1			1					0	1
ESP			1			1					0	1
FIN			1			1		1			1	2
FRA		1				1					0	1
GBR		1	1			2		1			1	3
IRL		1	1			2	1	1			2	4
NLD			1			1		1			1	2
NOR			1			1					0	1
NZL			1			1					0	1
PRT	1					1				1	1	2
SWE			1			1					0	1
TUR			1			1					0	1
Total	12	19	65	15	4	115	2	14	1	3	20	135

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans.

25. The summary of the effect of removal of entries in reports is shown **Table 7**. From NR4 no information was removed and in total, 674 entries were removed since they contained duplicated information as per the previous chapter 0; thus, 12% of the entries (data points) were removed.

Table 7. Number of entries according to source; either further assessed or removed

Status	NR2	NR3	NR4	NIP	Other	Total
Final	83	394	4458	148	31	5114
Removed	19	607		17	31	674
Grand Total	102	1001	4458	165	62	5788

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans.

26. **Table 8** summarizes the number of Parties and their relevant source of information. All reference years are represented. Most of the information is from NR4 (87%), followed by NR3 (7.7%). The NIPs were also an important information source, most importantly for retrieving inventory information for Africa and Asia-Pacific and to some extent for EE.

Table 8. Number of entries grouped according to certain parameters (cleaned)

Region	Africa	Asia-Pacific	EE	GRULAC	WEOG	Overall
	415 (8.1%)	814 (15.9%)	1,514 (29.6%)	537 (10.5%)	1,834 (35.9%)	5,114 (100%)
Vector						
Air	204 (49.2%)	514 (63.1%)	1092 (72.1%)	256 (47.7%)	1138(62.1%)	3204 (62.7%)
Water	32 (7.7%)	82 (10.1%)	63 (4.2%)	45 (8.4%)	230 (12.5%)	452 (8.8%)
Land	31 (7.5%)	27 (3.3%)	48 (3.2%)	39 (7.3%)	175 (9.5%)	320 (6.3%)
Product	34 (8.2%)	46 (5.7%)	63 (4.2%)	47 (8.8%)	32 (1.7%)	222 (4.3%)
Residue	114 (27.5%)	145 (17.8%)	248 (16.4%)	150 (27.9%)	259 (14.1%)	916 (17.9%)
SG						
SG1	56 (13.5%)	101 (12.4%)	195 (12.9%)	57 (10.6%)	159 (8.7%)	568 (11.1%)
SG2	49 (11.8%)	116 (14.3%)	226 (14.9%)	65 (12.1%)	210 (11.5%)	666 (13.0%)
SG3	48 (11.6%)	87 (10.7%)	222 (14.7%)	60 (11.2%)	264 (14.4%)	681 (13.3%)
SG4	51 (12.3%)	95 (11.7%)	181 (12.0%)	55 (10.2%)	199 (10.9%)	581 (11.4%)
SG5	31 (7.5%)	58 (7.1%)	171 (11.3%)	35 (6.5%)	141 (7.7%)	436 (8.5%)
SG6	75 (18.1%)	81 (10.0%)	194 (12.8%)	91 (16.9%)	197 (10.7%)	638 (12.5%)
SG7	36 (8.7%)	106 (13.0%)	111 (7.3%)	66 (12.3%)	249 (13.6%)	568 (11.1%)
SG8	17 (4.1%)	79 (9.7%)	84 (5.5%)	53 (9.9%)	211 (11.5%)	444 (8.7%)
SG9	52 (12.5%)	(11.2%)	130 (8.6%)	55 (10.2%)	204 (11.1%)	532 (10.4%)
Source						
NIP	67 (16.1%)	65 (8.0%)	16 (1.1%)			148 (2.9%)
NR2	35 (8.4%)	25 (3.1%)	0 (0%)	14 (2.6%)	9 (0.5%)	83 (1.6%)
NR3	128 (30.8%)	15 (1.8%)	78 (5.2%)	27 (5.0%)	146 (8.0%)	394 (7.7%)
NR4	179 (43.1%)	692 (85.0%)	1420 (93.8%)	488 (90.9%)	1679 (91.5%)	4458 (87.2%)
Other	6 (1.4%)	17 (2.1%)	0 (0%)	8 (1.5%)	0 (0%)	31 (0.6%)
Year						
B2001	7 (1.7%)	18 (2.2%)	49 (3.2%)	58 (10.8%)	65 (3.5%)	197 (3.9%)
Year not defined	9 (2.2%)	18 (2.2%)	0 (0%)	0 (0%)	0 (0%)	27 (0.5%)
Y2001	0 (0%)	24 (2.9%)	80 (5.3%)	19 (3.5%)	89 (4.9%)	212 (4.1%)
Y2002	24 (5.8%)	23 (2.8%)	48 (3.2%)	44 (8.2%)	86 (4.7%)	225 (4.4%)
Y2003	13 (3.1%)	23 (2.8%)	48 (3.2%)	41 (7.6%)	85 (4.6%)	210 (4.1%)
Y2004	76 (18.3%)	133 (16.3%)	91 (6.0%)	41 (7.6%)	119 (6.5%)	460 (9.0%)
Y2005	45 (10.8%)	47 (5.8%)	77 (5.1%)	29 (5.4%)	110 (6.0%)	308 (6.0%)
Y2006	104 (25.1%)	65 (8.0%)	113 (7.5%)	29 (5.4%)	120 (6.5%)	431 (8.4%)
Y2007	32 (7.7%)	45 (5.5%)	126 (8.3%)	27 (5.0%)	130 (7.1%)	360 (7.0%)
Y2008	10 (2.4%)	58 (7.1%)	106 (7.0%)	30 (5.6%)	133 (7.3%)	337 (6.6%)
Y2009	7 (1.7%)	52 (6.4%)	124 (8.2%)	0 (0%)	104 (5.7%)	287 (5.6%)
Y2010	9 (2.2%)	40 (4.9%)	107 (7.1%)	24 (4.5%)	122 (6.7%)	302 (5.9%)
Y2011	15 (3.6%)	40 (4.9%)	121 (8.0%)	8 (1.5%)	106 (5.8%)	290 (5.7%)
Y2012	12 (2.9%)	40 (4.9%)	95 (6.3%)	24 (4.5%)	137 (7.5%)	308 (6.0%)
Y2013	16 (3.9%)	104 (12.8%)	92 (6.1%)	55 (10.2%)	116 (6.3%)	383 (7.5%)
Y2014	0 (0%)	38 (4.7%)	76 (5.0%)	59 (11.0%)	115 (6.3%)	288 (5.6%)

Y2015	25 (6.0%)	24 (2.9%)	75 (5.0%)	14 (2.6%)	99 (5.4%)	237 (4.6%)
Y2016	11 (2.7%)	18 (2.2%)	71 (4.7%)	21 (3.9%)	86 (4.7%)	207 (4.0%)
Y2017	0 (0%)	0 (0%)	14 (0.9%)	7 (1.3%)	12 (0.7%)	33 (0.6%)
Y2018	0 (0%)	4 (0.5%)	1 (0.1%)	7 (1.3%)	0 (0%)	12 (0.2%)
Period						
B2001	7 (1.7%)	18 (2.2%)	49 (3.2%)	58 (10.8%)	65 (3.5%)	197 (3.9%)
pre_SC	0 (0%)	27 (3.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
NR1	271 (65.3%)	306 (37.6%)	457 (30.2%)	203 (37.8%)	663 (36.2%)	1873 (36.6%)
NR2	58 (14.0%)	195 (24.0%)	463 (30.6%)	81 (15.1%)	489 (26.7%)	1286 (25.1%)
NR3	43 (10.4%)	222 (27.3%)	384 (25.4%)	146 (27.2%)	474 (25.8%)	1269 (24.8%)
NR4	36 (8.7%)	46 (5.7%)	161 (10.6%)	49 (9.1%)	197 (10.7%)	489 (9.6%)

Note: NR1: first national report; NR2: second national reports; NR3: third national reports; NR4: fourth national reports; B2001: before 2001; pre_SC: before the entry into force of the Stockholm Convention; SG: source group.

27. The following analysis provides more detailed insights into the data set. From the following figures, specific information can be retrieved, per release vector and/or source group. The number of information/entries for the final, cleaned dataset by release vector with reference year and region is summarized in Error! Reference source not found.5. The number of entries according to each reference year with their release vector and source group (SG) is shown in **Figure 6.6**. As can be seen, most information is available for releases to Air.

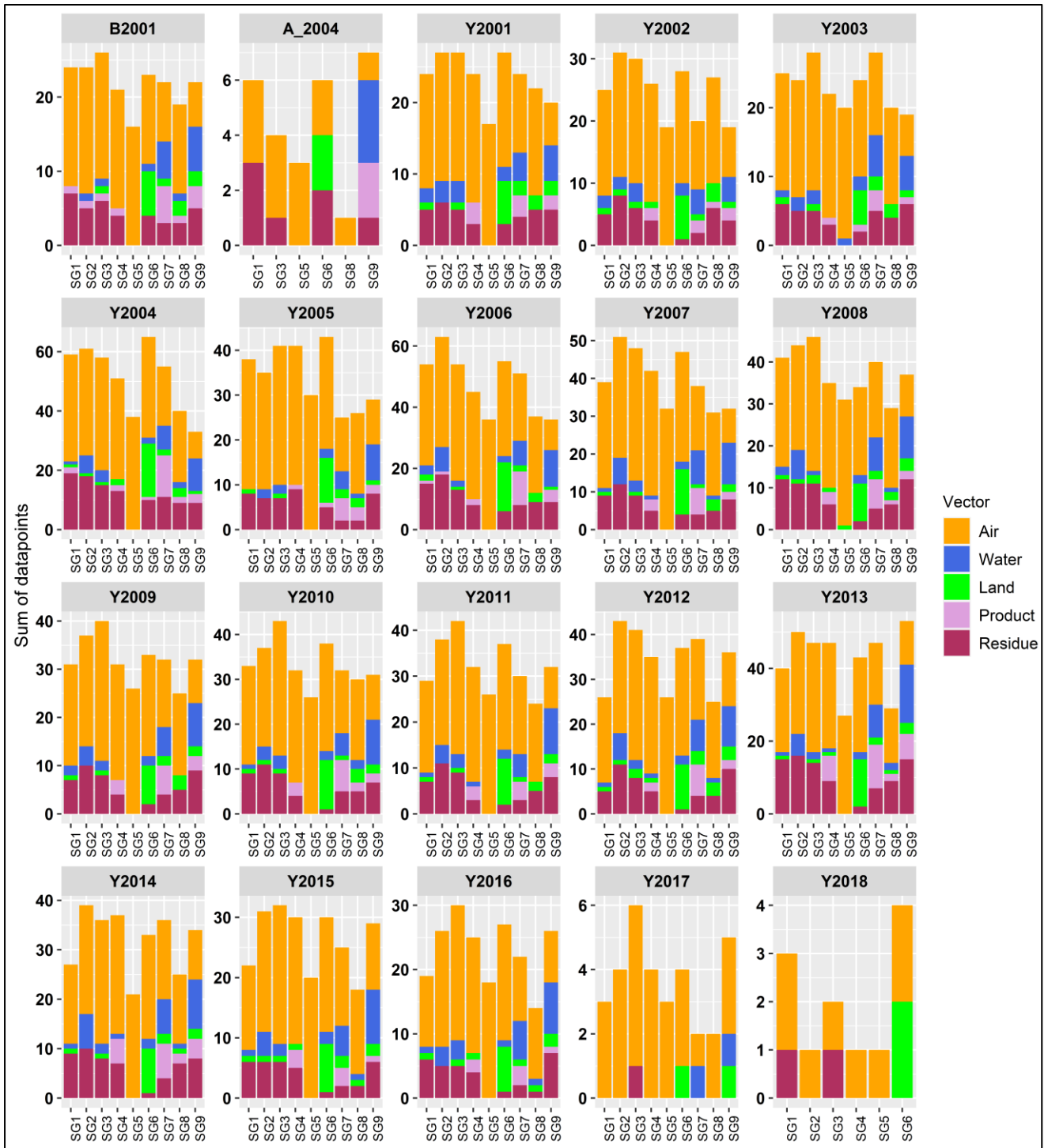
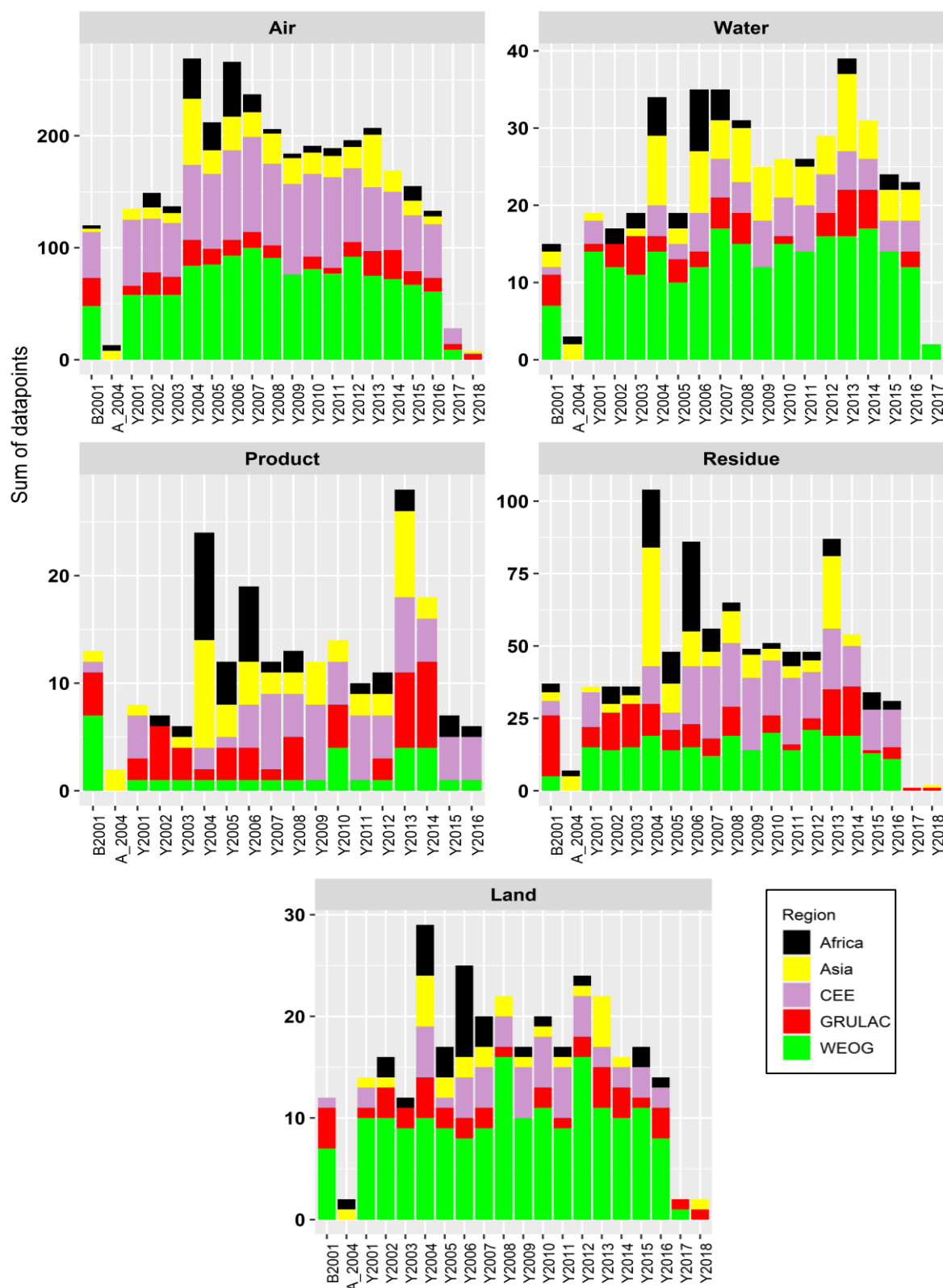


Figure 5. Reporting (cleaned): Number of entries by year with source groups (SG) and vector (data from Table 8). (Note: B2001: before 2001; A_2004: year not defined.)

Figure 6. Reporting (cleaned): Number of entries according to release vector and year with region (data from Table



8). (Note: B2001: before 2001; A_2004: year not defined.)

3.2 Quantitative Release Inventories (amounts cleaned)

28. The total releases after removal of duplicates by region are shown in Table 9. The total releases were reduced from 8,796,379 g TEQ to 8,780,342 g TEQ, corresponding to 0.2% (through removal of 624 datapoints). The errors are attributed to the amounts reported and not by the information collection system (national reporting formats).

Table 9. Quantitative release inventory by region based on reports (after removal)

Region	NR2	NR3	NR4	NIP	Other	Total
Africa	24,060	756,952	84,851	21,837	119	887,819
Asia-Pacific	1,507	814	28,411	17,739	25	48,496
EE		1,168	97,168	590		98,926
GRULAC	244	1,024	7,684,734		320	7,686,322
WEOG	8	3,499	55,272			58,779
Total	25,819	763,457	7,950,436	40,166	464	8,780,342

29. The graphs from **Figure 7** to Error! Reference source not found. visualize the findings – and allow the identification of possible errors with amounts reported. For further information at each location level, please refer to the appendix below.

30. From **Figure 77**, two types of errors are identified:

(a) Africa reported very high releases in products in NR3 reports, which were not included in the NR4 reports since the accumulated amounts from NR4 reports are much lower. The extreme high value is that of one Party that reported in NR3 but not NR4. For recommendations, see section 0 and **Table 12**;

(b) For GRULAC, the amounts from NR4 reporting are extremely high (orders of magnitude) and the share between air and residue releases is 1:1, which is an unusual/atypical ratio. For recommendations, see section 0 and **Table 12** and figures that visualize by country;

(c) EE and WEOG releases to air from NR4 appear high but they need to be considered together with the number of countries that reported and the number of years since these amounts are additive. For identification, see subsequent figures displaying information by country.

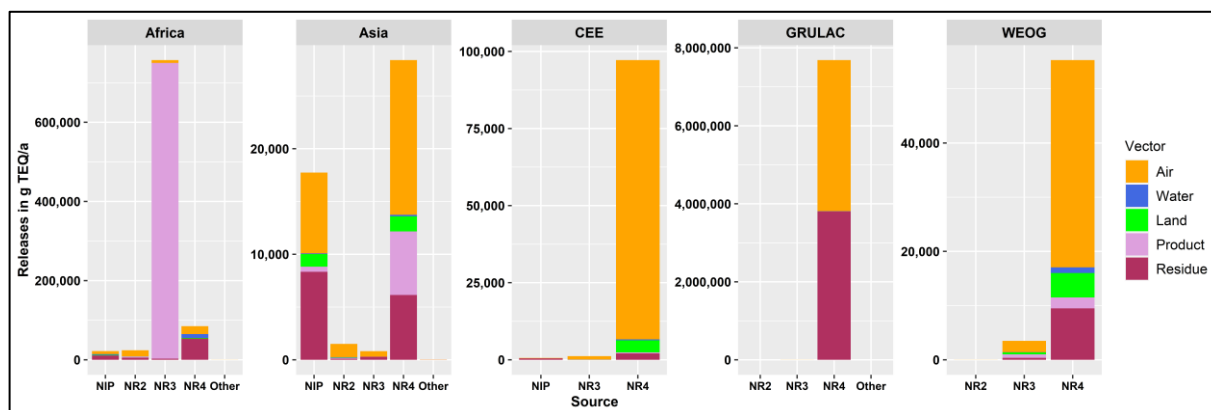


Figure 7. Total releases (g TEQ) reported by region according to release vector and source (detailed data in

Table S 2). (Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports.)

31. Subsequent figures present the quantitative findings with a view on the different parameters that have influenced the value. They also help to further identify potential errors.

32. **Figure 8** shows the total annual releases by location (years accumulated); the stacked bars show the accumulated releases to Air, Water, Land, Product or Residue by source group (SG). The cut-off value of 100 000 g TEQ/a on the y-axis of the graph was the highest amount reported by a Party (China). It can be seen that a number of smaller-sized countries exceed this value. Other countries report extremely high releases from SG9, which should be verified as well. **Figure 99** shows the amounts reported for reporting period. It can be noted that extremely high values are reported throughout all reporting periods. In addition, some countries have reported in two different sources of information (see **Figure S3**). For a global release inventory, such duplicates should be avoided and the different amounts reported under different schemes for the same year corrected. See recommendations and actions to be taken. **Figure 10** shows amounts (in g TEQ/a) by vector for each location and according to SG.

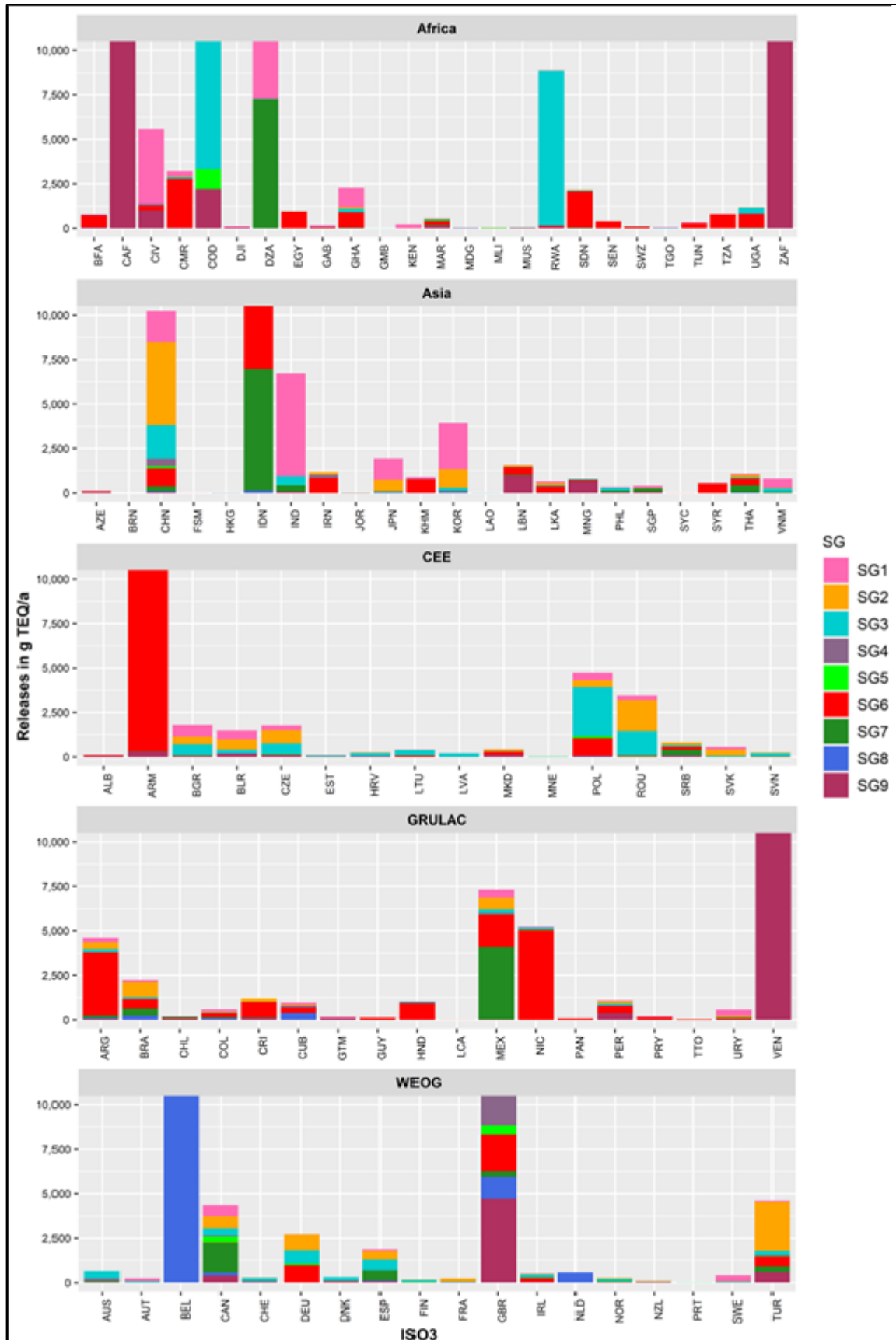


Figure 8. Quantitative releases (cleaned) by region for each location and with SG (amounts in g TEQ). Note: y-axis zoomed to 10,000 g TEQ; each source group (SG) may contain amounts from more than one year and more than one source.

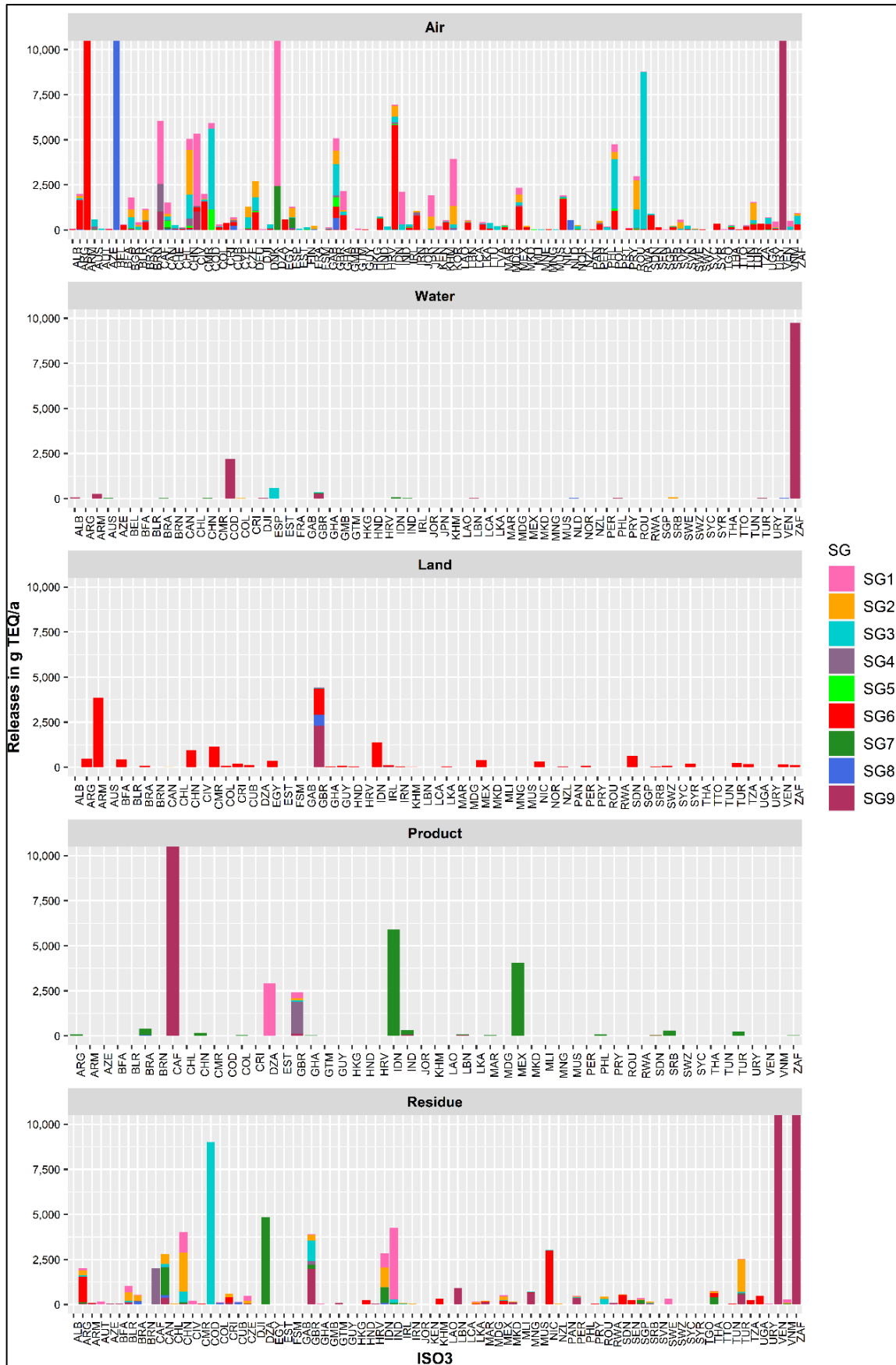


Figure 10. Quantitative reporting (cleaned): Amounts (in g TEQ/a) by vector for each location and according to source group (SG). Note: each SG may contain amounts from more than one year and more than one source.

33. Finally, **Figure 111** shows amounts as totals (in g TEQ/a) reported by each location on an annual basis (the inventory requirement under Article 5 of the Convention is every five years).

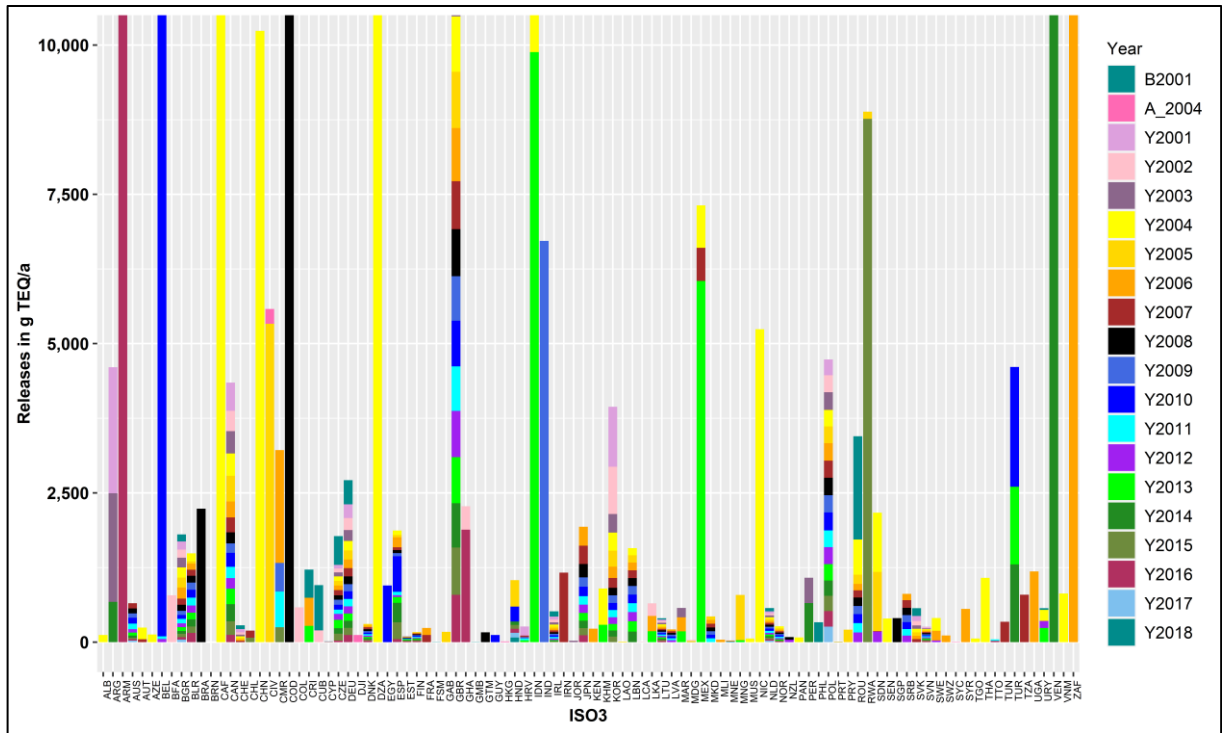


Figure 11. Quantitative reporting (cleaned): Amounts as totals (in g TEQ/a) by location and year. Note: each year may contain amounts from more than one source. (Note: B2001: before 2001; A_2004: year not defined.)

4. Discussion and Conclusion

34. 135 reports have been assessed and an attempt was made to resolve contradictions through expert judgment. Overall, 100 PCDD/PCDF inventories relating to 98 Parties, 1 Signatory and a special administrative region of a Party, were available. The European Union reports through the Member States, therefore, no inventory required.

35. The following observations are made:

(a) In a number of cases, release values suspected of being too high are reported; thus, errors may exist in scale for the whole inventory or only for one SG or sub-category. Alternatively, or in combination, this could result from incorrect unit usage (i.e., mg instead of g);

(b) Whereas 17 years have passed since the entry-into-force of the Convention, with release inventories developed and maintained/updated every five years, thus, a target of four inventories, questions remain on the quality (and usefulness) of the data in cases where:

(i) Inventories are available for only one or two years;

(ii) 5-year intervals are requested but annual frequency is done and the reporting is completed on a 4-year cycle as part of Article 15 reporting.

(c) The Convention had endorsed the 5-vector approach but in many cases only releases to air are reported; and

(d) Not all source groups are reported consistently and often only one is reported.

36. The information on release vectors is detailed in **Table S 3** and summarized in **Table 10**. The vector 'Air' was reported in relation to all locations. There were only 39 countries that reported for 5 release vectors; 41 for 4 release vectors (the latter ones may have omitted one of them, often 'Product'); 13 Parties reported for only one vector, that being the case especially in WEOG, where the majority of the inventories were only reported for Air and for one other vector. Error! Reference source not found.2 displays the number and identity of release vectors by location with quantitative amounts and grouped by region.

Table 10. Number of release vectors covered by region

No of vector reported	Africa	Asia-Pacific	EE	GRULAC	WEOG	Subtotal
5	10	9	7	11	2	39
4	5	8	1	4	3	21
3	7	3		3	3	16
2	3	1	2		5	11
1		2	6		5	13
Total	25	23	16	18	18	100

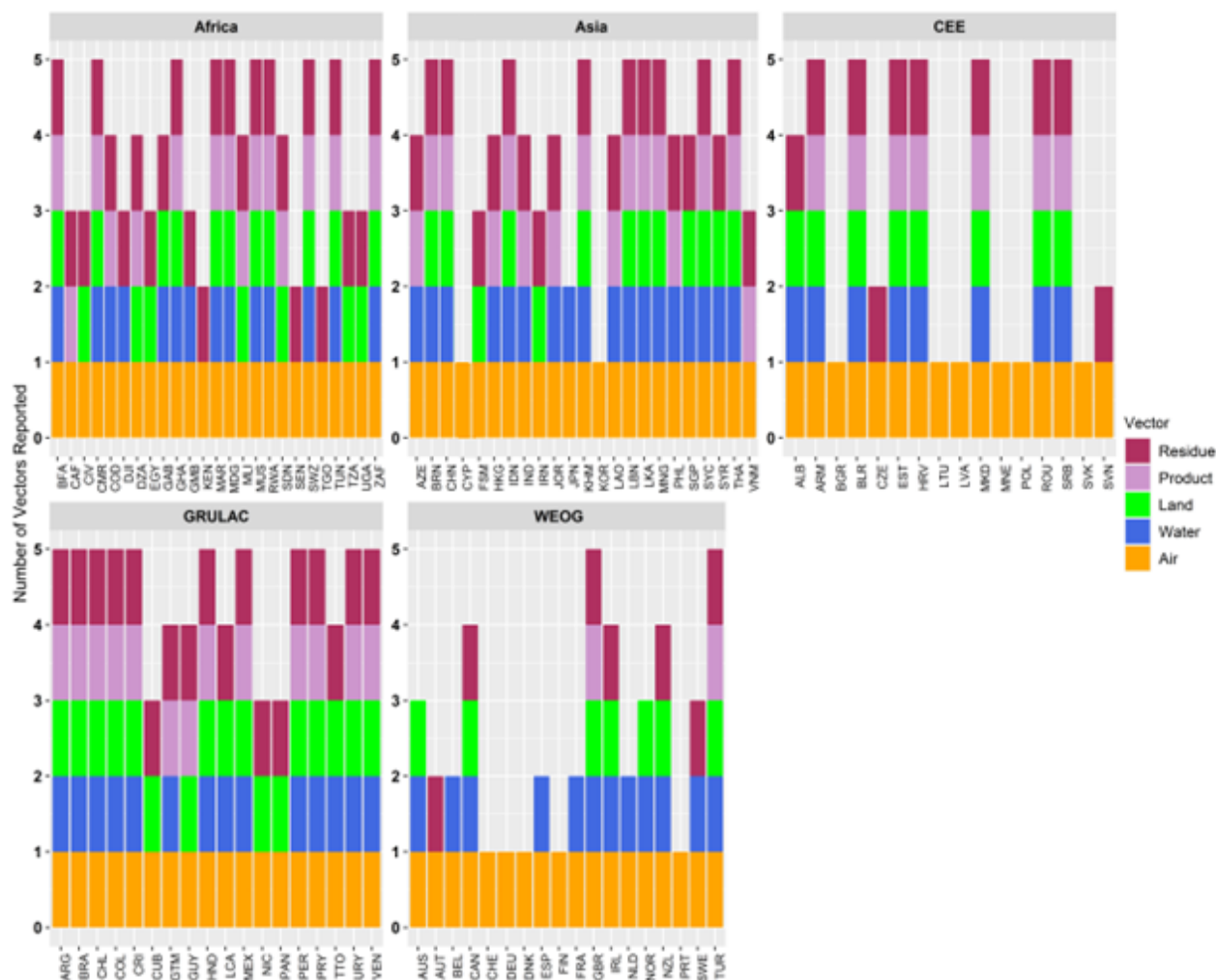


Figure 12. Number and identity of release vectors reported by location with quantitative amounts

37. Not included in this assessment is information on the methodology used. Although the reporting format for the PCDD/PCDF release inventories did not change since its inception or initial recommendation, the 2013 version of the Toolkit (UNEP, 2013) made improvements to the previous version (UNEP, 2003) with the following consequences:

(a) The T13 has added emission factors for certain classes within the source categories, so that certain activities (from PCDD/PCDF sources) could be quantified. This change is mostly associated with releases to water or to residues and with products in SG7. Subsequently, the quantitative inventory of releases would increase;

(b) T13 has introduced more classes under some subcategories such as for SG 2c (iron and steel production), SG 2f (lead production), SG 4 (biomass power plants and domestic heating), which may result in either increases or decreases of releases;

(c) SG 6 – open burning - has been revised for both SG 6a and SG 6b, by better defining the classes and how the emission factors should be related to the activity. In addition, some emission factors have been revised. Subsequently, the quantitative inventory of releases would decrease.

38. It remains unknown if the recommendation to recalculate the earlier reported releases from previous inventories using the latest T13 emission factors and classification is applied in practice. In addition, there is no documentation about use of own, national emission factors to quantify the releases in the reporting format.

39. As a consequence, it is not possible, based on the information available, to determine/conclude on reduction in releases. Determination of such reduction is also not possible since information on activities or on technologies implemented for curbing releases is not available/communicated. Reporting of application of BAT/BEP to eliminate sources or reduce PCDD/PCDF releases from such sources, and information on changes in technology and/or activity rates should accompany inventory data for making such assessment possible.

40. In a next step, it is recommended to unify national releases per capita to identify countries with high releases. Such assessment has been done in the past. Others would calculate releases on area basis (per km²) or income. Information for these denominators can be obtained from the World Bank database (World Bank, No Year).

5. RECOMMENDATIONS

41. The most important limitation that hampers to provide a conclusive picture on PCDD/PCDF releases is that only 100 PCDD/PCDF release inventories were available through any of the sources (after elimination of duplicates), i.e., national reports, NIPs or other. According to the provisions of the Stockholm Convention, release inventories should be reported in NR4; declining order would be in NR3 or NR2. We found 65 inventories in NR4, 11 inventories where NR3 was the latest to report, 12 inventories were reported in NR2 but not updated. Eight inventories were only found in NIPs and four inventories in other sources such as project reports or scientific publications. Of the 100 inventories, 98 were provided by Parties, one inventory was from Hong Kong, SAR, as part of the China Party inventory (reported in a NIP) and one from a Signatory, Brunei Darussalam, through a project report. Grenada became a Party to the Stockholm Convention on 13 January 2022 and Italy on 28 December 2022. To the date of this report, there is no reporting from these Parties in the Stockholm Convention reporting formats (NIPs, NRs).

42. With 186 Parties to the Stockholm Convention and 98 inventories available, there is a gap of 87 PCDD/PCDF release inventories from Parties to the Stockholm Convention (EU reports through the Member States). Parties that have not submitted a PCDD/PCDF release inventories are shown in **Table 11**.

Table 11. Parties that have not submitted a PCDD/PCDF release inventories

Africa	Asia-Pacific	EE	GRULAC	WEOG
N=27	N=32	N=6	N=14	N=8
AGO	AFG	BIH	ATG	EU *
BDI	ARE	GEO	BHS	GRC
BEN	BGD	HUN	BLZ	ISL
BWA	BHR	MDA	BOL	LIE
COG	COK	RUS	BRB	LUX
COM	FJI	UKR	DMA	MCO
CPV	IRQ		DOM	MLT
ERI	KAZ		ECU	ITA
ETH	KGZ		GRD	
GIN	KIR		JAM	
GNB	KWT		KNA	
GNQ	MHL		SLV	
LBR	MMR		SUR	
LBY	NIU		VCT	
LSO	NPL			
MDV	NRU			
MOZ	OMN			
MRT	PAK			
MWI	PLW			
NAM	PNG			
NER	PRK			
NGA	PSE			
SLE	QAT			
SOM	SAU			
STP	SLB			
TCD	TJK			
ZMB	TON			
	TUV			
	UZB			
	VUT			
	WSM			
	YEM			

*Pursuant to paragraph 3 of Article 25, regional economic integration organizations and their member states shall not be entitled to exercise rights under the Convention concurrently.

43. Reporting of releases of unintentional POPs as part of national reports pursuant to Article 15 of the Convention is required every four years and follows the source categories listed in Annex C to the Convention, grouped into the source groups specified in the Toolkit. All Parties are encouraged to use the T13 emission factors and subcategories to develop the release inventory: in practice, there is a need to recalculate the previous values using the same set of emission factors. This request makes the early inventories obsolete. By complying with this approach, Parties ensure that the following conditions are met:

- (a) Estimates of unintentional POPs releases are readily comparable;
- (b) Regional and global release summaries can be easily prepared; and
- (c) Time trends can be elaborated for the purpose of effectiveness evaluation under Article 16 of the Convention.

44. With respect to clarity, it is recommended that the NR reporting should have a general commenting field where information should be provided if / why previously reported numbers have been corrected.

45. Finally, Parties having not provided complete inventories on the 5 release vectors are urged to complete their inventory. For example, EU member states have reported releases to air only.

46. **Table 12** lists the locations by their ISO3 code within the UN region and general recommendations or some specific recommendations to improve the information for assessment. For 45 Parties that have submitted an inventory in NR4, no obvious errors were found, therefore, no specific recommendation is given other than updating for subsequent years in NR5.

47. Some Parties provide complementary or contradictory information in two NRs or other sources. In these cases, harmonized (and updated) information should be provided. Other recommendations include transferring the information contained (only) in the NIP to the NR; some Parties have no NRs so far. Finally, information found outside of the reporting obligations (NIP or NR) should be included in future NRs.

48. A second level of recommendations includes observations as to the verification of the information. From the amounts released and reported errors are easily identifiable; these need to be corrected for an assessment of releases to provide the information that is needed for concluding on the effectiveness of Article 5 of the Convention. If information perceived as inaccurate in this report but is in fact correctly reported, confirmation of the specific entry to resolve the issue is important (see also specific recommendations in **Table 12** below).

49. The observations and recommendations in **Table 12** should be considered together with the quantitative information shown in

50. Table S 2, which contains the information on PCDD/PCDF reported releases after removal of duplicate information, and confirmed by consulting Error! Reference source not found., which contains the original information as provided (with duplicates or errors as shown in the previous tables and figures).

Table 12. Recommendations resulting from the assessment of the PCDD/PCDF release inventories (as developed in chapter 3)

Region	Source	NR2	NR3	NR4	NIP	Other	Number of Parties
NR4 available		0	0	45	0	0	45
Africa	EGY			x			NR4 reports with release inventory available; Parties are encouraged to update the information and report in NR5. Comment: the amounts reported appear consistent. Reporting should be completed according to the Toolkit scheme with 5 release vectors and for all SGs.
Africa	UGA			x			
Asia-Pacific	AZE			x			
Asia-Pacific	FSM			x			
Asia-Pacific	IDN			x			
Asia-Pacific	JPN			x			
Asia-Pacific	KHM			x			
Asia-Pacific	KOR			x			
Asia-Pacific	LBN			x			
Asia-Pacific	MNG			x			
Asia-Pacific	SGP			x			
Asia-Pacific	THA			x			
Asia-Pacific	CYP			x			
EE	BGR			x			
EE	BLR			x			
EE	EST			x			
EE	HRV			x			
EE	LTU			x			
EE	LVA			x			
EE	MKD			x			
EE	MNE			x			
EE	POL			x			
EE	SRB			x			
EE	SVN			x			
GRULAC	ARG			x			
GRULAC	BRA			x			
GRULAC	CHL			x			
GRULAC	COL			x			
GRULAC	GUY			x			
GRULAC	HND			x			
GRULAC	LCA			x			
GRULAC	PER			x			
GRULAC	PRY			x			
GRULAC	TTO			x			
GRULAC	URY			x			
WEOG	AUS			x			
WEOG	CAN			x			
WEOG	DNK			x			
WEOG	ESP			x			
WEOG	FIN			x			
WEOG	NLD			x			
WEOG	NOR			x			
WEOG	NZL			x			
WEOG	SWE			x			
WEOG	TUR			x			
Errors in NR4		0	0	6	0	0	6
Africa	GHA			x			Inconsistent between years, strong increase
Africa	RWA			x			Amounts do not match; 2014 suspected to be too high
EE	ARM			x			Releases increase strongly with year
GRULAC	VEN			x			Amount suspected to be far too high; check vector; 2006 most reasonable
GRULAC	NIC			x			
WEOG	BEL			x			Check 2010; seems that decimal is wrong
Inconsistencies NR4 with others		8	14	5	1		14
Africa	MAR		x	x			Inconsistencies between reports; some to be merged, often 'Before 2001' not transferred
Africa	MUS		x	x			
GRULAC	CRI		x	x			

Region	Source	NR2	NR3	NR4	NIP	Other	Number of Parties	
Asia-Pacific	LKA			x	x		Resolve issues of differences in NR3 or NIP or other and NR4, especially with respect to numbers reported but also for reference year Amounts are very different between reports	
GRULAC	CUB			x		x		
EE	CZE		x	x				
WEOG	GBR		x	x				
WEOG	IRL		x	x				
GRULAC	MEX		x	x			Amounts are very different between years, esp. 2006	
WEOG	DEU		x	x			Amounts are different between reports (NR4 higher for same year)	
Africa	CIV			x	x		Amounts are very different between years, and potentially too high	
Africa	CMR			x	x		Amounts are very different between years	
EE	ROU			x	x		Before 2001 and 2004 very different from other years	
Africa	ZAF			x	x		Amounts reported do not match with other countries and not between reports	
NR3 is last		0	9	0	0	0	9	
Africa	CAF		x				Update NR inventories in future NRs	
Africa	MLI		x					
Africa	TUN		x					
Asia-Pacific	VNM		x					
EE	ALB		x					
EE	SVK		x					
WEOG	AUT		x					
WEOG	CHE		x					
WEOG	FRA		x					
NR3 with errors		0	2	0	1	0	2	
Africa	MDG		x				Numbers vary by factor of 10	
Africa	SDN		x		x		Amounts vary too much	
NR2 last		12	0	0	0	0	12	
Africa	KEN	x					Update NR inventories in future NRs	
Africa	SEN	x						
Africa	SWZ	x						
Africa	TGO	x						
Africa	TZA	x						
Asia-Pacific	IRN	x						
Asia-Pacific	LAO	x						
Asia-Pacific	PHL	x						
GRULAC	GTM	x						
GRULAC	PAN	x						
WEOG	PRT	x						
Africa	DZA	x						
No NR		0	0	0	8	0		8
Africa	BFA				x			No NR, move information from NIP into NR, and update
Africa	GAB				x			
Africa	GMB				x			
Asia-Pacific	CHN				x			
Asia-Pacific	SYC				x			
Asia-Pacific	SYR				x			
Asia-Pacific	IND				x			
Africa	COD				x		Increase with years	
No NR		0	0	0	0	2	2	
Africa	DJI					x	No NR, move information from other sources into NR, and update	
Asia-Pacific	JOR					x		
Total		12	19	65	14	4	98	

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports.

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Appendix: Supplementary information

Table S 1. Quantitative releases inventories (g TEQ/a) based on information as provided in Table 2

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
ALB		119.35						119
Y2004		119.35						119
ARG			4,604.65					4,605
Y2001			2,110.92					2,111
Y2003			1,818.60					1,819
Y2014			675.13					675
ARM			82,490.75					82,491
B2001			151.09					151
Y2001			52.85					53
Y2006			16.50					17
Y2007			19.80					20
Y2008			12.60					13
Y2009			5,377.52					5,378
Y2010			4,497.63					4,498
Y2011			4,981.17					4,981
Y2012			11,203.74					11,204
Y2013			14,246.59					14,247
Y2014			13,329.89					13,330
Y2015			13,586.69					13,587
Y2016			15,014.68					15,015
AUS		146.40	650.99					797
Y2007		146.40	87.20					234
Y2008			82.36					82
Y2009			73.63					74
Y2010			96.90					97
Y2011			93.00					93
Y2012			58.10					58
Y2013			49.50					50
Y2014			36.50					37
Y2015			23.70					24
Y2016			24.50					25
Y2017			25.60					26
AUT		243.63						244
Y2004		195.65						196
Y2007		47.98						48
AZE			127.79					128
Y2004			127.79					128
BEL			25,305.71					25,306
Y2001			75.36					75
Y2002			64.07					64
Y2003			64.46					64
Y2004			65.04					65
Y2005			56.60					57
Y2006			53.02					53
Y2007			51.89					52
Y2008			76.65					77
Y2009			48.49					48
Y2010			24,653.28					24,653
Y2011			45.06					45
Y2012			51.79					52
BFA				784.73				785
Y2002				784.73				785
BGR		850.99	1,803.91					2,655
B2001		74.00	118.36					192
Y2001		90.94	135.25					226
Y2002		94.55	136.68					231
Y2003		113.38	162.24					276
Y2004		124.22	170.86					295
Y2005		112.09	165.69					278
Y2006		148.88	185.34					334

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2007		92.93	104.31					197
Y2008			101.62					102
Y2009			68.45					68
Y2010			65.06					65
Y2011			74.86					75
Y2012			63.60					64
Y2013			65.69					66
Y2014			47.04					47
Y2015			56.23					56
Y2016			40.65					41
Y2017			41.98					42
BLR			1,487.66					1,488
Y2004			134.71					135
Y2005			37.79					38
Y2006			101.43					101
Y2007			102.02					102
Y2008			114.86					115
Y2009			119.38					119
Y2010			131.49					131
Y2011			132.85					133
Y2012			118.96					119
Y2013			112.95					113
Y2014			118.53					119
Y2015			109.06					109
Y2016			153.63					154
BRA			2,235.00					2,235
Y2008			2,235.00					2,235
BRN						0.15		0
Y2001						0.15		0
CAF		755,092.60						755,093
Y2004		755,092.60						755,093
CAN		822.63	4,346.76					5,169
Y2001			472.99					473
Y2002			340.01					340
Y2003			374.01					374
Y2004		589.02	374.52					964
Y2005			429.85					430
Y2006			266.00					266
Y2007		233.61	249.94					484
Y2008			186.59					187
Y2009			157.82					158
Y2010			234.34					234
Y2011			188.00					188
Y2012			177.38					177
Y2013			258.99					259
Y2014			288.07					288
Y2015			227.21					227
Y2016			121.04					121
CHE		283.00						283
B2001		64.60						65
Y2001		53.50						54
Y2002		40.10						40
Y2003		27.40						27
Y2004		26.00						26
Y2005		25.10						25
Y2006		24.30						24
Y2007		22.00						22
CHL			193.00					193
Y2007			118.07					118
Y2015			74.93					75
CHN				10,237.74				10,238
Y2004				10,237.74				10,238
CIV			5,331.30	248.55				5,580
Year not defined				248.55				249
Y2005			5,331.30					5,331

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
CMR			2,737.22	479.79				3,217
Y2006			1,891.03					1,891
Y2009				479.79				480
Y2011			596.49					596
Y2015			249.70					250
COD				17,144.90				17,145
Y2008				17,144.90				17,145
COL		666.92	583.50					1,250
Y2002		666.92	583.50					1,250
CRI		943.12	744.02					1,687
B2001		470.06						470
Y2006		473.06	473.06					946
Y2013			270.96					271
CUB			635.46		444.92			1,080
B2001			438.56					439
Y2000					320.02			320
Y2002			196.90		124.90			322
CYP			14.04					14
B2001			2.18					2
Y2001			2.61					3
Y2002			2.65					3
Y2003			0.95					1
Y2004			0.42					0
Y2005			0.44					0
Y2006			0.45					0
Y2007			0.47					0
Y2008			0.47					0
Y2009			0.46					0
Y2010			0.43					0
Y2011			0.43					0
Y2012			0.44					0
Y2013			0.39					0
Y2014			0.37					0
Y2015			0.42					0
Y2016			0.46					0
CZE		2,713.81	1,294.48					4,008
B2001		480.98						481
Y2001		494.59	61.93					557
Y2002		332.92	64.08					397
Y2003		511.64	68.12					580
Y2004		320.27	74.53					395
Y2005		304.85	77.99					383
Y2006		150.21	76.80					227
Y2007		118.35	87.35					206
Y2008			72.57					73
Y2009			85.94					86
Y2010			80.44					80
Y2011			70.88					71
Y2012			101.10					101
Y2013			139.42					139
Y2014			91.72					92
Y2015			114.99					115
Y2016			26.62					27
DEU		765.38	2,560.96					3,326
B2001		151.70	253.46					405
Y2001		131.26	228.71					360
Y2002		109.95	202.49					312
Y2003		92.50	181.77					274
Y2004		69.25	159.44					229
Y2005		68.93	151.43					220
Y2006		70.84	145.47					216
Y2007		70.95	137.57					209
Y2008			129.49					129
Y2009			119.57					120
Y2010			127.78					128

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2011			124.06					124
Y2012			121.14					121
Y2013			121.62					122
Y2014			118.31					118
Y2015			119.30					119
Y2016			119.35					119
DJI							119.32	119
Year not defined							119.32	119
DNK			304.65					305
Y2005			27.82					28
Y2006			28.29					28
Y2007			32.41					32
Y2008			31.54					32
Y2009			25.99					26
Y2010			25.81					26
Y2011			23.91					24
Y2012			22.84					23
Y2013			21.85					22
Y2014			20.25					20
Y2015			21.45					21
Y2016			22.49					22
DZA	22,472.67							22,473
Y2004	22,472.67							22,473
EGY			947.66					948
Y2010			947.66					948
ESP			1,870.07					1,870
Y2004			75.60					76
Y2005			38.81					39
Y2006			167.29					167
Y2007			46.71					47
Y2008			50.93					51
Y2009			53.32					53
Y2010			594.31					594
Y2011			57.34					57
Y2012			30.83					31
Y2013			96.64					97
Y2014			325.32					325
Y2015			283.06					283
Y2016			48.74					49
Y2017			1.17					1
EST			102.00					102
B2001			3.40					3
Y2001			3.54					4
Y2002			3.76					4
Y2003			4.12					4
Y2004			3.81					4
Y2005			3.37					3
Y2006			2.77					3
Y2007			4.91					5
Y2008			5.18					5
Y2009			4.86					5
Y2010			5.53					6
Y2011			5.42					5
Y2012			3.97					4
Y2013			10.97					11
Y2014			12.69					13
Y2015			11.75					12
Y2016			11.95					12
FIN			168.34					204
Y2005		11.84	11.84					24
Y2006		12.36	12.36					25
Y2007		11.84	11.84					24
Y2008			14.39					14
Y2009			10.55					11
Y2010			16.44					16

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2011			14.19					14
Y2012			15.08					15
Y2013			15.36					15
Y2014			16.15					16
Y2015			14.42					14
Y2016			15.72					16
FRA		237.36						237
Y2006		118.80						119
Y2007		118.56						119
FSM			3.01					3
Y2018			3.01					3
GAB				173.05				173
Y2005				173.05				173
GBR		8,950.33	13,703.12					22,653
B2001		2,495.72						2,496
Y2001		1,077.69	1,100.95					2,179
Y2002		1,070.46	1,072.60					2,143
Y2003		1,086.58	1,049.92					2,137
Y2004		1,078.28	926.67					2,005
Y2005		989.68	943.23					1,933
Y2006		924.07	890.91					1,815
Y2007		227.85	801.63					1,029
Y2008			789.12					789
Y2009			744.91					745
Y2010			765.66					766
Y2011			744.87					745
Y2012			773.80					774
Y2013			771.67					772
Y2014			742.83					743
Y2015			791.60					792
Y2016			792.75					793
GHA			2,275.50					2,276
Y2002			391.58					392
Y2016			1,883.92					1,884
GMB				3.16				3
Y2000				3.16				3
GTM	164.62							165
Y2008	164.62							165
GUY			119.88					120
Y2010			119.88					120
HKG				11.24				11
Year not defined				11.24				11
HND			1,038.03					1,038
Y2005			442.46					442
Y2010			249.92					250
Y2014			58.08					58
Y2015			63.94					64
Y2016			66.78					67
Y2017			80.45					80
Y2018			76.40					76
HRV			260.81					261
Y2001			151.85					152
Y2007			23.50					24
Y2009			25.90					26
Y2011			30.01					30
Y2013			29.55					30
IDN			17,215.03					17,215
Y2004			7,334.03					7,334
Y2013			9,881.00					9,881
IND				6,718.97				6,719
Y2009				6,718.97				6,719
IRL	7.86	526.91	428.03					963
B2001		87.62						88
Y2001		67.44	49.57					117
Y2002		71.42	47.88					119

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2003		75.73	35.56					111
Y2004		64.88	33.17					98
Y2005	3.91	61.11	33.76					99
Y2006		62.12	32.08					94
Y2007	3.95	36.59	28.87					69
Y2008			27.50					28
Y2009			26.56					27
Y2010			26.34					26
Y2011			26.95					27
Y2012			25.93					26
Y2013			11.21					11
Y2014			11.01					11
Y2015			11.64					12
IRN	1,164.30							1,164
Y2007	1,164.30							1,164
JOR					24.72			25
Y2003					24.72			25
JPN			1,931.94					1,932
Y2006			317.30					317
Y2007			306.63					307
Y2008			222.64					223
Y2009			156.61					157
Y2010			159.78					160
Y2011			142.32					142
Y2012			137.71					138
Y2013			130.18					130
Y2014			123.06					123
Y2015			120.20					120
Y2016			115.51					116
KEN	224.45							224
Y2006	224.45							224
KHM			896.92					897
Y2004			606.67					607
Y2013			290.25					290
KOR			3,941.50					3,942
Y2001			1,004.00					1,004
Y2002			792.10					792
Y2003			311.20					311
Y2004			301.60					302
Y2005			268.90					269
Y2006			188.60					189
Y2007			164.50					165
Y2008			127.60					128
Y2009			126.50					127
Y2010			118.50					119
Y2011			121.00					121
Y2012			111.60					112
Y2013			111.50					112
Y2014			100.40					100
Y2015			93.50					94
LAO	9.30							9
Y2004	3.30							3
Y2005	6.00							6
LBN			1,574.32	165.84				1,740
Y2004			119.54	165.84				285
Y2005			122.06					122
Y2006			129.20					129
Y2007			130.08					130
Y2008			132.26					132
Y2009			144.27					144
Y2010			145.76					146
Y2011			148.62					149
Y2012			152.90					153
Y2013			172.30					172
Y2014			177.33					177

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
LCA			1.63					2
Y2005			0.55					1
Y2016			1.08					1
LKA			439.49	210.63				650
Y2002				210.63				211
Y2006			257.54					258
Y2013			181.95					182
LTU		16.69	399.35					416
B2001			21.23					21
Y2001			26.87					27
Y2002			26.97					27
Y2003			26.09					26
Y2004			24.45					24
Y2005			25.03					25
Y2006			26.12					26
Y2007		16.69	23.58					40
Y2008			23.84					24
Y2009			23.74					24
Y2010			23.50					24
Y2011			23.94					24
Y2012			22.77					23
Y2013			22.06					22
Y2014			20.68					21
Y2015			19.41					19
Y2016			19.07					19
LVA			212.98					213
Y2006			29.97					30
Y2007			29.50					30
Y2008			28.04					28
Y2009			31.20					31
Y2010			30.64					31
Y2011			31.77					32
Y2012			31.86					32
MAR		235.55	337.20					573
Y2003			157.40					157
Y2006		235.55						236
Y2013			179.80					180
MDG		36.79						37
Y2002		16.22						16
Y2003		1.94						2
Y2004		13.72						14
Y2005		2.10						2
Y2006		1.68						2
Y2007		1.13						1
MEX		553.91	6,761.94					7,316
Y2004			712.78					713
Y2007		553.91						554
Y2013			6,049.16					6,049
MKD			429.56					430
Y2005			58.79					59
Y2006			61.43					61
Y2007			64.62					65
Y2008			61.35					61
Y2009			59.33					59
Y2010			58.92					59
Y2011			65.12					65
MLI		39.89						40
Y2006		39.89						40
MNE			28.79					29
B2001			0.25					0
Y2001			1.75					2
Y2002			1.97					2
Y2003			2.42					2
Y2004			2.53					3
Y2005			2.57					3

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2006			2.74					3
Y2007			2.76					3
Y2008			2.88					3
Y2009			2.64					3
Y2010			2.81					3
Y2011			2.76					3
Y2012			0.08					0
Y2013			0.06					0
Y2014			0.04					0
Y2015			0.11					0
Y2016			0.14					0
Y2017			0.14					0
Y2018			0.14					0
MNG			789.60					790
Y2005			756.77					757
Y2013			32.83					33
MUS		30.40	30.40					61
Y2004		30.40	30.40					61
NIC			5,239.36					5,239
Y2004			5,239.36					5,239
NLD		270.40	571.30					842
B2001		57.00	56.00					113
Y2001		30.80	34.00					65
Y2002		29.70	32.80					63
Y2003		28.40	31.40					60
Y2004		28.50	31.30					60
Y2005		40.50	32.30					73
Y2006		27.70	30.80					59
Y2007		27.80	30.80					59
Y2008			33.50					34
Y2009			32.00					32
Y2010			38.80					39
Y2011			33.50					34
Y2012			26.60					27
Y2013			26.90					27
Y2014			24.10					24
Y2015			27.30					27
Y2016			26.10					26
Y2017			23.10					23
NOR			265.07					265
Y2004			34.56					35
Y2005			23.81					24
Y2006			23.61					24
Y2007			23.37					23
Y2008			23.00					23
Y2009			21.27					21
Y2010			25.39					25
Y2011			22.79					23
Y2012			21.91					22
Y2013			13.13					13
Y2014			10.08					10
Y2015			9.87					10
Y2016			12.28					12
NZL			84.88					85
Y2008			44.36					44
Y2012			40.52					41
PAN	78.89							79
Y2004	78.89							79
PER			1,078.95					1,079
Y2003			424.12					424
Y2014			654.83					655
PHL	333.57				333.56			667
Y1999					333.56			334
Y2006	333.57							334
POL	398.88	1,851.05	4,733.67					6,984

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2001		267.07	263.57					531
Y2002		264.45	285.16					550
Y2003		262.40	296.17					559
Y2004		251.59	276.44					528
Y2005		231.12	280.74					512
Y2006		313.95	293.02					607
Y2007		260.47	286.02					546
Y2008	160.92		291.37					452
Y2009	237.96		288.50					526
Y2010			302.52					303
Y2011			279.32					279
Y2012			284.96					285
Y2013			274.04					274
Y2014			256.33					256
Y2015			255.62					256
Y2016			260.88					261
Y2017			259.01					259
PRT	7.69					56.99		65
Y2004	3.18							3
Y2006	2.45					56.99		59
Y2008	2.06							2
PRY			208.87					209
Y2005			208.87					209
ROU			2,857.97	589.90				3,448
B2001			1,729.00					1,729
Y2004				589.90				590
Y2005			153.99					154
Y2006			108.60					109
Y2007			119.23					119
Y2008			142.04					142
Y2009			136.72					137
Y2010			149.79					150
Y2011			156.25					156
Y2012			162.35					162
RWA			8,884.49					8,884
Y2005			120.17					120
Y2015			8,764.32					8,764
SDN		1,175.95		991.58				2,168
Y2004				991.58				992
Y2005		991.57						992
Y2007		8.28						8
Y2012		176.10						176
SEN	396.00							396
Y2004	396.00							396
SGP			401.19					401
Y2008			401.19					401
SRB			808.95					809
Y2006			105.76					106
Y2007			127.72					128
Y2008			122.06					122
Y2009			118.21					118
Y2010			116.26					116
Y2011			110.54					111
Y2012			108.40					108
SVK		567.63						568
B2001		128.36						128
Y2001		86.48						86
Y2002		72.55						73
Y2003		56.80						57
Y2004		58.62						59
Y2005		60.06						60
Y2006		54.09						54
Y2007		50.67						51
SVN		75.15	257.35					333
Y2001		10.37	13.30					24

Location/Year	NR2	NR3	NR4	NIP	Project	SCI	UKN	Total
Y2002		10.23	13.75					24
Y2003		10.37	14.09					24
Y2004		10.38	14.37					25
Y2005		10.28	14.72					25
Y2006		13.49	18.10					32
Y2007		10.03	17.90					28
Y2008			18.65					19
Y2009			16.74					17
Y2010			17.46					17
Y2011			17.54					18
Y2012			17.14					17
Y2013			17.30					17
Y2014			15.15					15
Y2015			15.36					15
Y2016			15.78					16
SWE			404.35					404
Y2004			213.52					214
Y2006			162.63					163
Y2012			28.20					28
SWZ	112.24							112
Y2006	112.24							112
SYC				5.41				5
Year not defined				5.41				5
SYR				555.36				555
Y2006				555.36				555
TGO	61.39							61
Y2004	61.39							61
THA			1,075.86					1,076
Y2004			1,075.86					1,076
TTO			46.00					46
Y2011			23.50					24
Y2016			22.50					23
TUN		340.70						341
Y2007		340.70						341
TUR			4,608.20					4,608
Y2010			2,005.00					2,005
Y2013			1,301.60					1,302
Y2014			1,301.60					1,302
TZA	793.42							793
Y2007	793.42							793
UGA			1,184.26					1,184
Y2006			1,184.26					1,184
URY			568.40					568
B2001			28.00					28
Y2004			185.40					185
Y2012			118.40					118
Y2013			236.60					237
VEN			7,660,675.63					7,660,676
Y2002			3,000,547.20					3,000,547
Y2006			1,100.23					1,100
Y2012			3,000,915.60					3,000,916
Y2014			1,658,112.60					1,658,113
VNM		814.02						814
Y2004		814.02						814
ZAF			63,122.48	2,010.91				65,133
Y2006			63,122.48	2,010.91				65,133
Total	26,225	778,407	7,950,436	40,332	803	57	119	8,796,379

Note: NR2: second national reports; NR3: third national reports; NR4: fourth national reports; NIP: national implementation plans; project: project reports; SCI: scientific publications; UKN: unknown sources; B2001: before 2001.

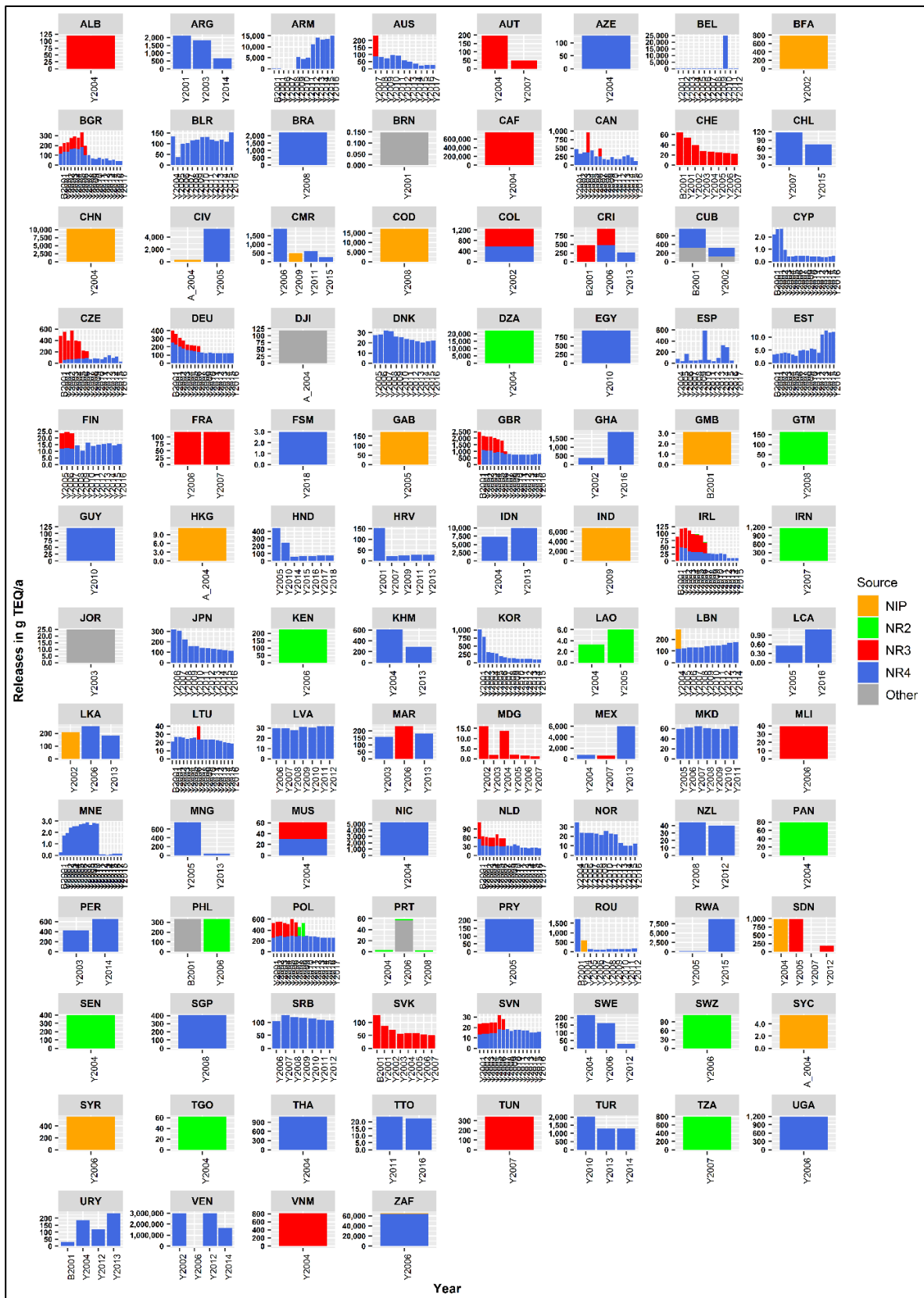


Figure S1. Quantitative reporting (pre-cleaned): Amounts (in g TEQ/a) by location with year and source. Details in Error! Reference source not found.. Note: For some locations, two reports were available for the same year; thus, only one amount is shown as the cumulative amounts from both reports. Duplicated entries, which may correspond to the same amount or different amounts were corrected and the scales clarified. It shall also be noted that the parameters plotted may/often include more than one entry, which may result from duplicated inventories but also be an aggregated number (by addition). (Note: NIP: national implementation plans; NR2: second national reports; NR3: third national reports; NR4: fourth national reports.)

For example, in the total amount shown on the y-axis for Cameroon (CMR, top left) is the sum of releases from all SGs but may include more than one reporting year; for Venezuela (VEN, bottom left) the value is only from SG8 (only blue column) and no other SG.

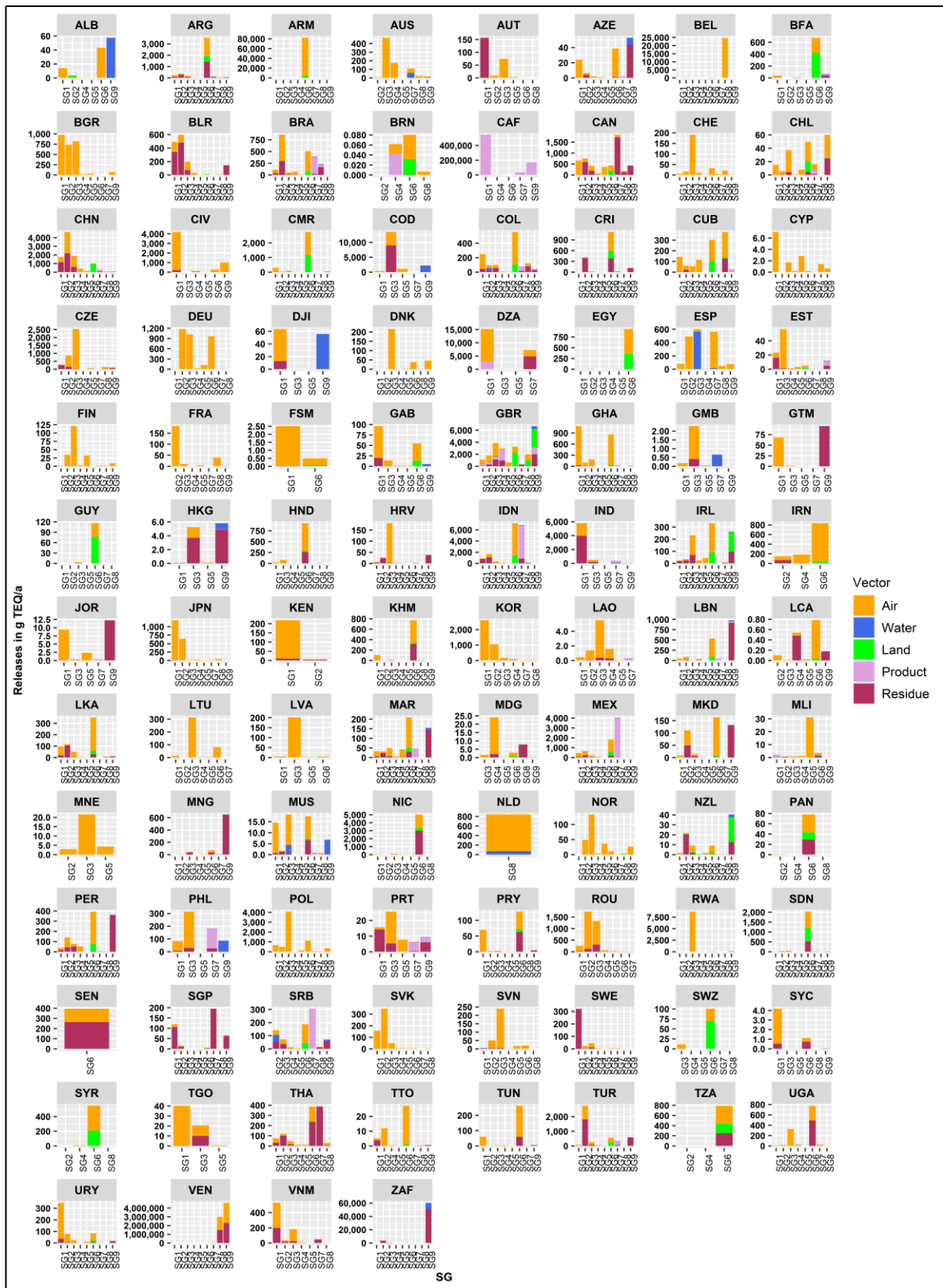


Figure S2. Quantitative reporting (pre-cleaned): Amounts (in g TEQ/a) by location with vector and according to SG. Note: all years accumulated. Details in Error! Reference source not found.

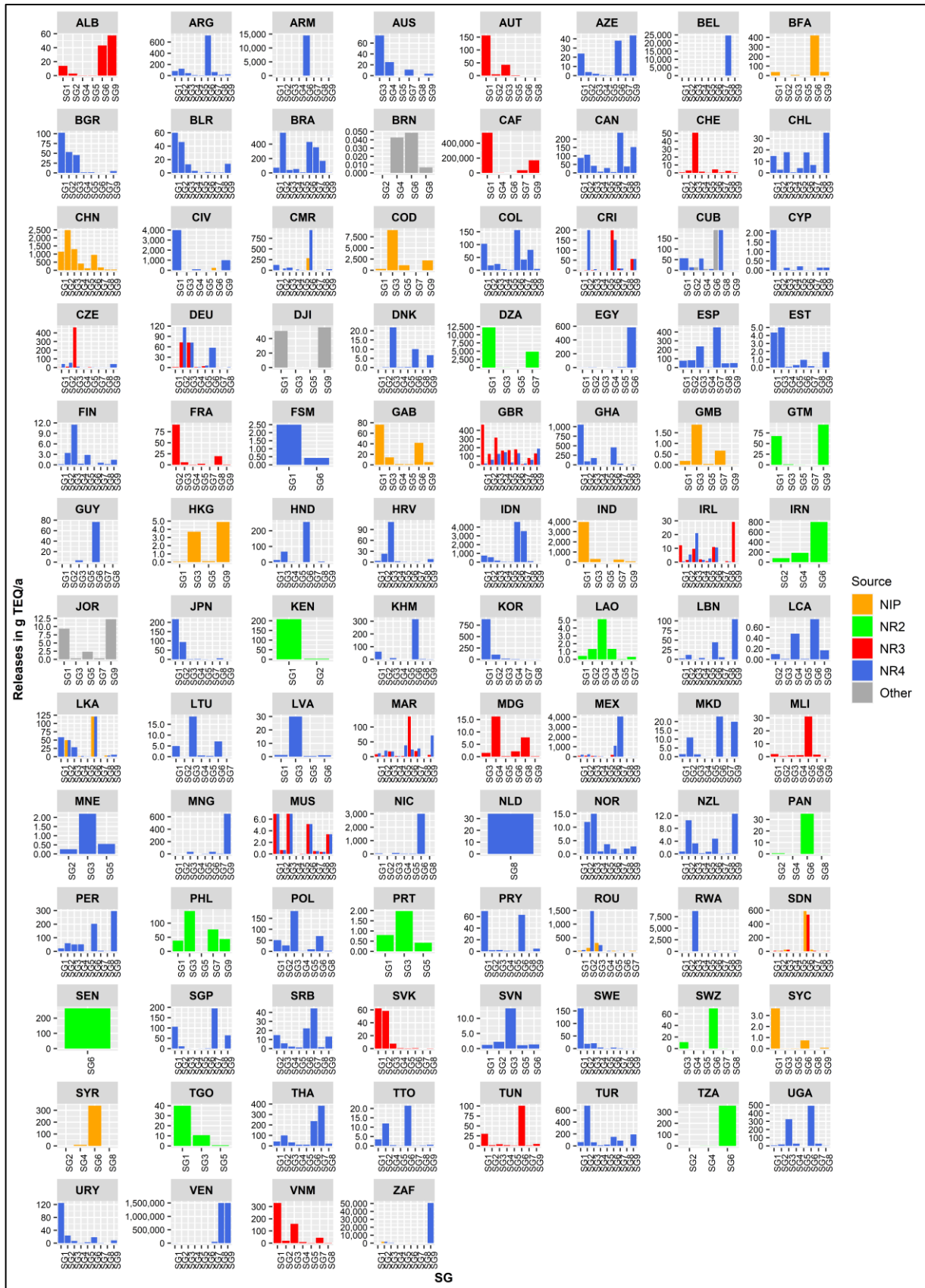


Figure S3. Quantitative reporting (cleaned) by location with source and reference year: Amounts from all SG included in g TEQ/a. Note: each SG may contain amounts from more than one year. (Note: NIP: national implementation plans; NR2: second national reports; NR3: third national reports; NR4: fourth national reports.)

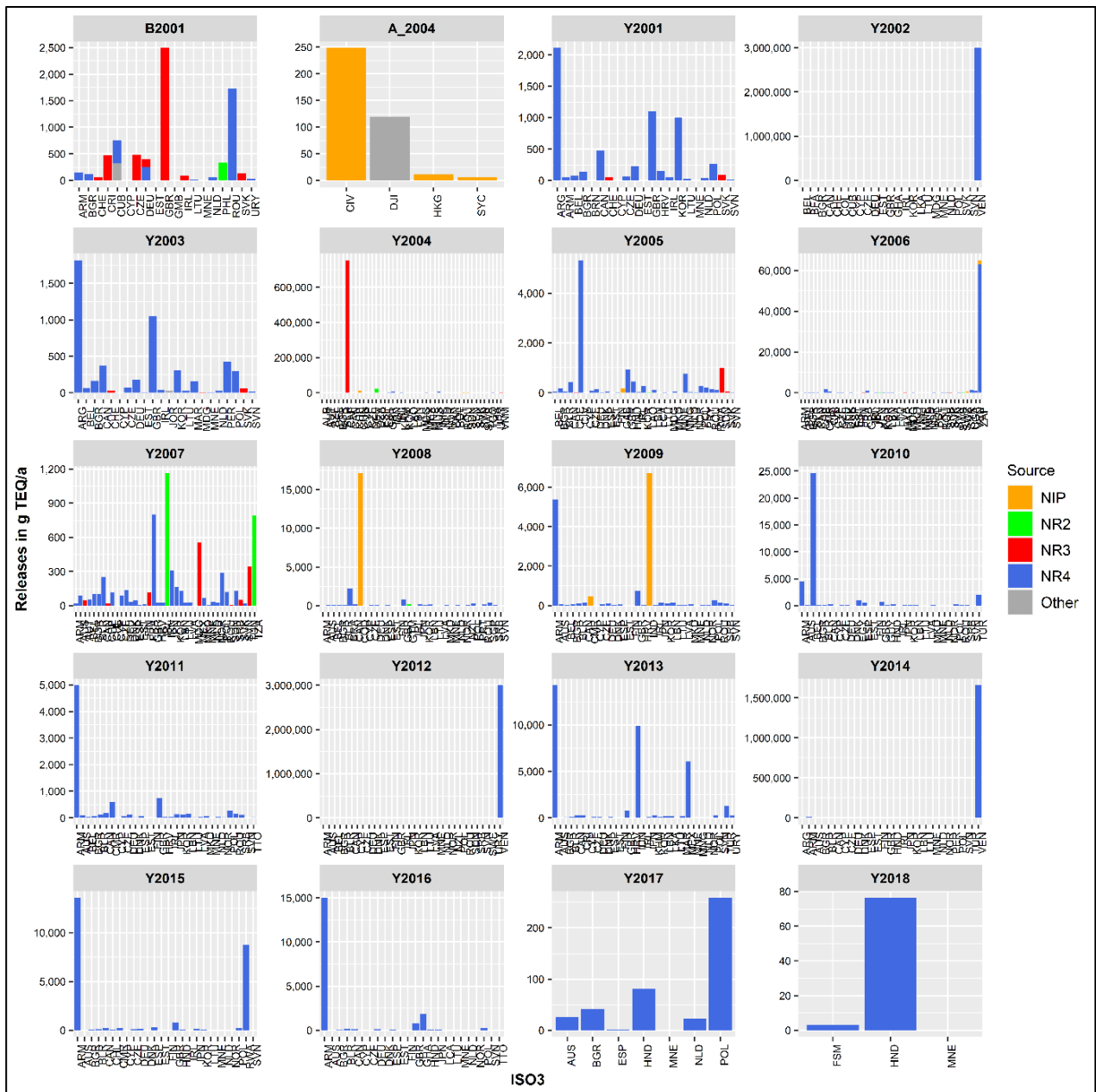


Figure S4. Quantitative reporting (cleaned): Amounts (in g TEQ/a) by year for location and source. (Note: NIP: national implementation plans; NR2: second national reports; NR3: third national reports; NR4: fourth national reports.)

Table S 2. PCDD/PCDF reported releases by location after removal of duplicate information by removing the sources as described in section 0. Amounts in g TEQ

Location	Final	Remove
ALB	119	
ARG	4,605	
ARM	82,491	
AUS	651	146
AUT	244	
AZE	128	
BEL	25,306	
BFA	785	
BGR	1,804	851
BLR	1,488	
BRA	2,235	
BRN	0.15	
CAF	755,093	
CAN	4,347	823
CHE	283	
CHL	193	
CHN	10,238	
CIV	5,580	
CMR	3,217	
COD	17,145	
COL	584	667
CRI	1,214	473
CUB	955	125
CYP	14	
CZE	1,775	2,233
DEU	2,713	614
DJI	119	
DNK	305	
DZA	22,473	
EGY	948	
ESP	1,870	
EST	102	
FIN	168	36
FRA	237	
FSM	3.01	
GAB	173	
GBR	16,199	6,455
GHA	2,276	
GMB	3.16	
GTM	165	
GUY	120	
HKG	11	
HND	1,038	
HRV	261	
IDN	17,215	
IND	6,719	
IRL	516	447
IRN	1,164	
JOR	25	
JPN	1,932	

Location	Final	Removed
KEN	224	
KHM	897	
KOR	3,942	
LAO	9.30	
LBN	1,574	166
LCA	1.63	
LKA	650	
LTU	399	17
LVA	213	
MAR	573	
MDG	37	
MEX	7,316	
MKD	430	
MLI	40	
MNE	29	
MNG	790	
MUS	61	
NIC	5,239	
NLD	571	270
NOR	265	
NZL	85	
PAN	79	
PER	1,079	
PHL	334	334
POL	4,734	2,250
PRT	7.69	57
PRY	209	
ROU	3,448	
RWA	8,884	
SDN	2,168	
SEN	396	
SGP	401	
SRB	809	
SVK	568	
SVN	257	75
SWE	404	
SWZ	112	
SYC	5.41	
SYR	555	
TGO	61	
THA	1,076	
TTO	46	
TUN	341	
TUR	4,608	
TZA	793	
UGA	1,184	
URY	568	
VEN	7,660,676	
VNM	814	
ZAF	65,133	
Total	8,780,342	16,038

Table S 3. PCDD/PCDF releases reported by vector (for final inventories covered in Chapter 3; x indicates that a quantitative release to the vector was reported)

Region	Location	Air 100	Water 66	Land 63	Product 53	Residue 80	Number of vectors
Africa	BFA	x	x	x	x	x	5
Africa	CMR	x	x	x	x	x	
Africa	GHA	x	x	x	x	x	
Africa	MAR	x	x	x	x	x	
Africa	MDG	x	x	x	x	x	
Africa	MUS	x	x	x	x	x	
Africa	RWA	x	x	x	x	x	
Africa	SWZ	x	x	x	x	x	
Africa	TUN	x	x	x	x	x	
Africa	ZAF	x	x	x	x	x	
Africa	COD	x	x		x	x	4
Africa	DZA	x		x	x	x	
Africa	GAB	x	x	x		x	
Africa	MLI	x		x	x	x	
Africa	SDN	x		x	x	x	
Africa	CAF	x			x	x	3
Africa	CIV	x		x		x	
Africa	DJI	x	x			x	
Africa	EGY	x		x		x	
Africa	GMB	x	x			x	
Africa	TZA	x		x		x	
Africa	UGA	x		x		x	
Africa	KEN	x				x	2
Africa	SEN	x				x	
Africa	TGO	x				x	
Asia-Pacific	BRN	x	x	x	x	x	5
Asia-Pacific	CHN	x	x	x	x	x	
Asia-Pacific	IDN	x	x	x	x	x	
Asia-Pacific	KHM	x	x	x	x	x	
Asia-Pacific	LBN	x	x	x	x	x	
Asia-Pacific	LKA	x	x	x	x	x	
Asia-Pacific	MNG	x	x	x	x	x	
Asia-Pacific	SYC	x	x	x	x	x	
Asia-Pacific	THA	x	x	x	x	x	
Asia-Pacific	AZE	x	x		x	x	
Asia-Pacific	HKG	x	x		x	x	
Asia-Pacific	IND	x	x		x	x	
Asia-Pacific	JOR	x	x		x	x	
Asia-Pacific	LAO	x	x		x	x	
Asia-Pacific	PHL	x	x		x	x	
Asia-Pacific	SGP	x	x	x		x	
Asia-Pacific	SYR	x	x	x		x	3
Asia-Pacific	FSM	x		x		x	
Asia-Pacific	IRN	x		x		x	
Asia-Pacific	VNM	x			x	x	2
Asia-Pacific	JPN	x	x				1
Asia-Pacific	CYP	x					
Asia-Pacific	KOR	x					
EE	ARM	x	x	x	x	x	5
EE	BLR	x	x	x	x	x	
EE	EST	x	x	x	x	x	
EE	HRV	x	x	x	x	x	
EE	MKD	x	x	x	x	x	
EE	ROU	x	x	x	x	x	
EE	SRB	x	x	x	x	x	
EE	ALB	x	x	x		x	4

Region	Location	Air	Water	Land	Product	Residue	Number of vectors
		100	66	63	53	80	
EE	CZE	x				x	2
EE	SVN	x				x	
EE	BGR	x					1
EE	LVA	x					
EE	MNE	x					
EE	POL	x					
EE	SVK	x					
GRULAC	ARG	x	x	x	x	x	
GRULAC	BRA	x	x	x	x	x	
GRULAC	CHL	x	x	x	x	x	
GRULAC	COL	x	x	x	x	x	
GRULAC	CRI	x	x	x	x	x	
GRULAC	HND	x	x	x	x	x	
GRULAC	MEX	x	x	x	x	x	
GRULAC	PER	x	x	x	x	x	
GRULAC	PRY	x	x	x	x	x	
GRULAC	URY	x	x	x	x	x	
GRULAC	VEN	x	x	x	x	x	
GRULAC	GTM	x	x		x	x	
GRULAC	GUY	x		x	x	X	
GRULAC	LCA	x	x	x		X	
GRULAC	TTO	x	x	x		X	
GRULAC	CUB	x		x		x	3
GRULAC	NIC	x		x		x	
GRULAC	PAN	x		x		x	
WEOG	GBR	x	x	x	x	x	5
WEOG	TUR	x	x	x	x	x	
WEOG	CAN	x	x	x		x	4
WEOG	IRL	x	x	x		x	
WEOG	NZL	x	x	x		x	3
WEOG	AUS	x	x	x			
WEOG	NOR	x	x	x			
WEOG	SWE	x	x			x	2
WEOG	AUT	x				x	
WEOG	BEL	x	x				2
WEOG	ESP	x	x				
WEOG	FRA	x	x				
WEOG	NLD	x	x				1
WEOG	CHE	x					
WEOG	DEU	x					
WEOG	DNK	x					
WEOG	FIN	x					
WEOG	LTU	x					
WEOG	PRT	x					