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Switzerland's Second Initial Report under the Kyoto Protocol

Report to facilitate the calculation of the assigned amount pursuant to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol for the second commitment period 2013–2020

Update following the in-country review by an expert review team coordinated by the UNFCCC secretariat

7 November 2016

Introduction

On 15 April 2016, Switzerland submitted its report to facilitate the calculation of the assigned amount pursuant to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol for the second commitment period 2013–2020 (Switzerland's Second Initial Report under the Kyoto Protocol). The related submission of Switzerland's greenhouse gas inventory as well as Switzerland's Second Initial Report itself were subject to an in-depth review by an expert review team coordinated by the UNFCCC secretariat, including an in-country visit in Bern from 5 to 10 September 2016. During the review, the expert review team raised issues, the resolution of which had an impact on parts of the content of Switzerland's Second Initial Report.

The first issue concerned CO_2 emissions from aluminium production, which were obtained by a country-specific emission factor. It was assumed that the anode consisted completely of carbon and that it was fully oxidized during the production process. The expert review team was of the view that inclusion of indirect CO_2 emissions from this process represents a double counting, as the carbon content of the CO measured in the stack of the aluminium foundries have been accounted for in the estimation of the direct CO_2 emissions (in contrast, NMVOC emissions from the respective source category solely originate from the production of the electrodes at the plants). The respective revision led to a minor correction of the entire time series 1990–2006 (no aluminium production in Switzerland thereafter), thereby affecting the assigned amount and the commitment period reserve.

The second issue concerned the open burning of residues from forests. The related CH_4 and N_2O emissions were reported in the waste sector, however, the expert review team considered that they should be reported in the LULUCF sector (the CO_2 emissions from both on-site and off-site burning of biomass in forest land have already been correctly included in the carbon stock changes of the biomass pool). The respective revision led to a minor redistribution of emissions between the waste and the LULUCF sector for the entire time series 1990–2014, thereby affecting the assigned amount and the commitment period reserve (as the LULUCF sector is not considered for the calculation of Switzerland's base year emissions).

The third issue concerned cold start emissions from road transportation, which were hitherto not included in the model applied. The respective revision led to a minor correction of the entire time series 1990–2014, thereby affecting the assigned amount and the commitment period reserve.

Finally, with regard to the content of Switzerland's Second Initial Report, the expert review team noted that Switzerland did not provide specific information on each type of natural disturbances and their definitions whose emissions it wishes to exclude from accounting during the second commitment period of the Kyoto Protocol. Further, the expert review team noted that according to the 2006 IPCC Guidelines, in forest land, non-CO_2 emissions need to be reported for all fires (prescribed fires and wildfires).

The resulting modifications of the content of Switzerland's Second Initial Report under the Kyoto Protocol are documented in this update. The affected excerpts are presented in the same format as in the original report (including identical numbering of sections, tables and figures) for simpler comparison. A complete summary is provided on the next page. After official consideration by the National Inventory System Supervisory Board (NISSB) on 12 October 2016 and official approval by the directorate of the Federal Office for the Environment FOEN on 18 October 2016 this update was submitted to the UNFCCC secretariat on 7 November 2016 for publication on its website as a complement to the original report.

1   Summary

The **key points** of Switzerland's Second Initial Report under the Kyoto Protocol, as **updated following the in-country review** by an expert review team coordinated by the UNFCCC secretariat, can be summarized as follows:

- Switzerland continues to use 1990 as the base year for emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6), and also chooses **1990 as the base year for emissions of nitrogen trifluoride (NF_3)**.

- Switzerland has **not reached an agreement under Article 4** of the Kyoto Protocol to fulfil its commitments under Article 3 of the Kyoto Protocol jointly with other Parties and is thus responsible for its own level of emissions.

- Switzerland's **assigned amount** for the second commitment period is **361'768'527 t CO_2 equivalent (361'768.527 kt CO_2 equivalent)**.

- Switzerland's **commitment period reserve** is **325'591'674 t CO_2 equivalent** (**325'591.674 kt CO_2 equivalent**).

- The **definition of forest, the definition of afforestation and reforestation, the definition of deforestation, and the definition of forest management** for the second commitment period **remain the same** as defined in Switzerland's Initial Report for the first commitment period (*FOEN*, 2006h).

- **Forest management is accounted for** in the second commitment period and **Switzerland does not elect any additional activities** under Article 3, paragraph 4, of the Kyoto Protocol. All lands under activities under Article 3, paragraphs 3 and 4, starting from 1 January 1990 onwards, are accounted for.

- Switzerland chooses to **account over the entire commitment period for emissions and removals** from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

- Switzerland's **forest management reference level (FMRL)** inscribed in the appendix to the annex to Decision 2/CMP.7 **amounts to +220 kt CO_2 equivalent per year**. The FMRL may be subject to technical corrections.

- Switzerland **intends to apply**, in the case of significant magnitude events, **the provision to exclude emissions from natural disturbances for units of lands under forest management** under Article 3, paragraph 4, of the Kyoto Protocol during the second commitment period in accordance with Decision 2/CMP.7. **Switzerland will not apply this provision for afforestation and reforestation** under Article 3, paragraph 3, of the Kyoto Protocol.

- For Switzerland, the **cap for additions to the assigned amount resulting from forest management** under Article 3, paragraph 4, **and from forest management project activities** undertaken under Article 6, **amounts to 15'037'884 t CO_2 (15'037.884 kt CO_2)** for the entire commitment period 2013–2020.

2   Switzerland's National Greenhouse Gas Inventory 1990–2014

While other content of section 2 of Switzerland's Second Initial Report was also affected by the revisions (e.g. various values in the text, tables and figures), only updates of Table 1 and Table 2 are presented here, as these two tables serve as the basis for the calculations related to Switzerland's Second Initial Report (see updated CRF tables for more details).

Table 1 > Switzerland's greenhouse gas emissions in the base year 1990.

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total (excl. indirect CO_2)	Indirect CO_2	Total (incl. indirect CO_2)
	[kt CO_2 equivalent]									
1 Energy	40'907	636.1	294.2	0.0	0.0	0.0	0.0	**41'837**	43.4	**41'881**
2 Industrial processes and product	3'095	1.8	171.4	0.0	116.5	137.0	0.0	**3'521**	365.7	**3'887**
3 Agriculture	49.3	4'509	2'246	0.0	0.0	0.0	0.0	**6'804**	NA	**6'804**
5 Waste	53.7	938.8	140.5	0.0	0.0	0.0	0.0	**1'133**	2.0	**1'135**
Total (excl. LULUCF)	44'105	6'086	2'852	0.0	116.5	137.0	0.0	**53'296**	411.2	**53'707**
4 Land use, land-use change and forestry	-994.0	29.4	86.9	0.0	0.0	0.0	0.0	**-877.7**	NA	**-877.7**
International bunkers	3'126	2.2	29.6	0.0	0.0	0.0	0.0	**3'157**	NA	**3'157**

Table 2 > Switzerland's greenhouse gas emissions from 1990 to 2014 (two-year steps until 2008). The mean value of emissions of the years 2008, 2009 and 2010 (total excl. LULUCF, incl. indirect CO_2) is used for the calculations in Table 6. NA = Not applicable, NO = Not occurring.

	1990	1992	1994	1996	1998	2000	2002	2004
	[kt CO_2 equivalent]							
CO_2 (excl. LULUCF and indirect CO_2)	44'105	45'963	42'602	44'076	44'510	43'533	43'361	45'137
CH_4 (excl. LULUCF)	6'086	5'943	5'783	5'736	5'523	5'388	5'395	5'285
N_2O (excl. LULUCF)	2'852	2'814	2'717	2'699	2'600	2'561	2'554	2'466
HFCs	0.0	15.7	81.7	297.5	456.5	625.9	803.2	1'021
PFCs	116.5	80.6	20.9	20.4	23.8	49.9	32.9	65.3
SF_6	137.0	141.4	106.9	90.1	152.6	143.8	158.4	186.1
NF_3	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Total (excl. LULUCF)	**53'296**	**54'958**	**51'312**	**52'920**	**53'266**	**52'302**	**52'304**	**54'159**
Indirect CO_2	411.2	357.0	295.2	252.1	212.1	186.4	161.8	133.9
Total (excl. LULUCF, incl. indirect CO_2)	**53'707**	**55'315**	**51'607**	**53'172**	**53'478**	**52'488**	**52'466**	**54'293**

	2006	2008	2009	2010	2011	2012	2013	2014
	[kt CO_2 equivalent]							
CO_2 (excl. LULUCF and indirect CO_2)	45'338	44'664	43'496	45'014	40'960	42'229	43'169	39'252
CH_4 (excl. LULUCF)	5'316	5'375	5'291	5'271	5'206	5'164	5'094	5'094
N_2O (excl. LULUCF)	2'457	2'508	2'474	2'523	2'473	2'461	2'425	2'452
HFCs	1'118	1'243	1'253	1'329	1'410	1'489	1'513	1'501
PFCs	51.5	57.9	63.0	64.6	67.8	71.3	52.0	43.9
SF_6	185.6	222.2	179.6	148.0	159.5	208.9	252.5	258.8
NF_3	NA, NO	0.1	5.1	8.5	6.2	0.4	0.1	0.4
Total (excl. LULUCF)	**54'467**	**54'070**	**52'762**	**54'359**	**50'282**	**51'623**	**52'506**	**48'603**
Indirect CO_2	127.0	124.4	123.3	123.8	123.0	120.9	120.0	119.6
Total (excl. LULUCF, incl. indirect CO_2)	**54'594**	**54'195**	**52'885**	**54'483**	**50'405**	**51'744**	**52'626**	**48'722**

5   Calculation of Switzerland's assigned amount

(…)

Article 3, paragraph 7bis, of the Kyoto Protocol further prescribes that 'those Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount'. In Switzerland, land-use change and forestry constituted a net sink in 1990 (see section 2, the revisions did not change this conclusion) and is thus not included in the base year emissions for the purposes of calculating the assigned amount.

(…)

Table 5 > Calculation of Switzerland's assigned amount for the second commitment period (2013–2020) on the basis of *FOEN* (2016).

Base year emissions	Base year emissions multiplied by eight	Quantified emission limitation or reduction commitment (2013–2020)	Assigned amount for the second commitment period
[t CO$_2$ equivalent]	[t CO$_2$ equivalent]	[% of base year]	[t CO$_2$ equivalent]
53'706'729	53'706'729 x 8 = 429'653'832	84.2	429'653'832 x 84.2/100 = 361'768'527

> **Switzerland's assigned amount for the second commitment period is 361'768'527 t CO$_2$ equivalent (361'768.527 kt CO$_2$ equivalent).**

According to Article 3, paragraph 7ter, 'any positive difference between the assigned amount of the second commitment period for a Party included in the Annex I and average annual emissions for the first three years of the preceding commitment period multiplied by eight shall be transferred to the cancellation account of that Party'. As highlighted in Table 6, the respective difference is negative for Switzerland (the revisions did not change this conclusion). Accordingly, no transfer of assigned amount units (AAUs) to the cancellation account is needed for Switzerland.

Table 6 > Calculations with regard to Article 3, paragraph 7ter, on the basis of *FOEN* (2016). See Table 2 for relevant emissions.

Average emissions for the first three years of preceding commitment period (2008, 2009, 2010)	Average emissions for the first three years of preceding commitment period (2008, 2009, 2010) multiplied by eight	Assigned amount for the second commitment period (see Table 5)	Difference between the assigned amount for the second commitment period and average annual emissions for the first three years of the preceding commitment period multiplied by eight
[kt CO$_2$ equivalent]	[kt CO$_2$ equivalent]	[kt CO$_2$ equivalent]	[kt CO$_2$ equivalent]
53'854	53'854 x 8 = 430'832	361'769	361'769 - 430'832 = -69'063

6   Calculation of Switzerland's commitment period reserve

(…)

Table 7 > Calculation of Switzerland's commitment period reserve on the basis of *FOEN* (2016). The lower value resulting from the two different calculations corresponds to the commitment period reserve.

90 per cent of assigned amount (see section 5)	Total emissions without LULUCF in 2013 (see Table 2) times eight
[t CO$_2$ equivalent]	[t CO$_2$ equivalent]
361'768'527 x 90/100 = 325'591'674	52'625'811 x 8 = 421'006'488

Accordingly, a commitment period reserve of 325'591'674 t CO$_2$ equivalent (325'591.674 kt CO$_2$ equivalent) results for Switzerland.

(…)

8   Election of activities under Article 3, paragraph 4

(…)

In accordance with the annex to Decision 2/CMP.7, paragraph 13, additions to the assigned amount resulting from forest management under Article 3, paragraph 4, and from forest management project activities undertaken under Article 6, are capped in the second commitment period (3.5 per cent of base year emissions excluding LULUCF times eight). For Switzerland the cap amounts to 53'706'729 x 3.5/100 x 8 = 15'037'884 t CO$_2$ for the entire commitment period 2013–2020.

(…)

12   Exclusion of natural disturbances

(…)

12.1   Definition of the types of natural disturbances to be excluded from accounting

Disturbance types, which are considered for the calculation of the background level and the margin, are based on events which have occurred during the calibration period from 1990 to 2009. They are listed in Table I and are the following: Wildfires, insect pests, disease infestations, extreme weather events, and geological disturbances.

12.2   Establishment of a consistent and initially complete time series for the calibration period

Except for wildfires in forests, no complete time series for the individual disturbance types are available for the calibration period. For some disturbance types, incomplete or regional data are available, but no regular inventory (e.g. insect pests like *Scolytinae sp.*, drought stress). For other disturbance types, there are no specific data at all since they are not systematically monitored (e.g. geological disturbances like landslides or avalanches) or a monitoring network has not been established yet (e.g. insect pests by recently introduced species like the Asian long-horned beetle, *Anoplophora glabripennis*). The greenhouse gas emissions from the types of natural disturbances having occurred in Switzerland during the calibration period from 1990 to 2009 are calculated separately for CO$_2$ gases and non-CO$_2$ gases and listed in Table I.

A time series of CO$_2$ emissions from combined natural disturbance types is derived from NFI mortality data (Swiss National Forest Inventory, NFI). The NFI mortality data cover (a) CO$_2$ emissions from mortality caused by all natural disturbance types having occurred during the calibration period 1990–2009, (b) mortality after harvest as well as (c) density-related mortality (e.g. caused by competition for light). An average value for NFI mortality is derived from the

NFI 1 and NFI 2 datasets for the years 1985 to 1994, from the NFI 2 and NFI 3 datasets for the years 1995 to 2005 and from the NFI 3 and NFI 4b datasets for the years 2006 to 2013 (for detailed information see Chapter 6.4.2.1 in *FOEN*, 2016). To calculate annual values of mortality for the years 1985 to 1994, 1995 to 2005 and 2006 to 2013, the average amount of mortality was weighted by the percentage of the relative harvesting amounts taken from the forest statistics (see description in Chapter 6.4.2.5 in *FOEN*, 2016). These relative harvesting amounts are considered to be a good proxy for mortality caused by natural disturbances since in the past in years with high mortality rates, harvesting rates (including salvage logging) were also higher.

CO_2 emissions due to wildfires from living biomass, dead wood, litter and soil are included in the carbon stock changes reported in Table 4.A and Table 4(KP-I)B.1 (see *FOEN*, 2016 Chapter 6.4.2.12).

CO_2 emissions from mineral soils that might be caused by different kinds of natural disturbances are not estimated since there are neither data nor methods available (not listed in Table I).

Non-CO_2 greenhouse gas emissions from wildfires are not included in the NFI mortality nor in the Yasso07 estimates. They are included separately in the calculation of the background level and the margin (Table I).

Non-CO_2 emissions caused by other types of natural disturbances than wildfires are considered to be negligible in Switzerland and are not estimated (NE). They are not included in the calculation of the background level and the margin.

Table I > Types of natural disturbances and annual values of area-specific greenhouse gas emissions for the calibration period 1990–2009.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Area-specific emissions (t CO_2 equivalent ha^{-1} year^{-1})																			
CO_2 emissions																				
NFI mortality	1.48	1.07	1.05	1.03	1.09	1.11	1.46	1.61	1.77	1.73	3.38	2.07	1.67	1.88	1.89	1.94	1.38	1.37	1.27	1.18
Wildfires	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Insect pests	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Disease infestations	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Extreme weather events	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Geological disturbances	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CH_4 and N_2O emissions																				
Wildfires	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Sum of all gases and disturbance types under FM	1.50	1.08	1.05	1.03	1.10	1.11	1.47	1.63	1.78	1.73	3.38	2.07	1.68	1.88	1.89	1.94	1.38	1.38	1.27	1.18

12.3   Definition of the background level and the margin

(…)

Based on the time series shown in Table I, the background level and the margin have been calculated using the iterative approach described in Chapter 2.3.9.6 of *IPCC* (2014). The times series for the calibration period from 1990 to 2009, the background level and the margin are shown in Table 8 and Figure 3.

- Excluding outliers from the calibration period: One data point has been excluded from the time series covering 1990 to 2009. The reason for this outlier in the year 2000 is the winter storm 'Lothar' at the end of 1999 which caused great damages in the forest stands and increased harvesting.

- The background level amounts to 1.49 t CO_2 equivalent ha^{-1} year^{-1}, which is equal to a mortality of 16.39 per cent relative to the total mean cut and mortality (losses in living biomass) from 1990 to 2009 (9.10 t CO_2 ha^{-1} year^{-1}).

This background level is included in the FMRL by setting mortality in the model MASSIMO3 equal to the background level.

- The margin amounts to 0.65 t CO_2 equivalent ha^{-1} $year^{-1}$.

Greenhouse gas emissions from natural disturbances higher than the upper confidence interval (background level + margin) of 2.15 t CO_2 equivalent ha^{-1} $year^{-1}$ or 23.56 per cent relative to total mean cut and mortality can be excluded from the accounting.

Table 8 > Annual values of total greenhouse gas emissions for the calibration period from 1990 to 2009 including all types of natural disturbances which occurred during that period. Shown are the results (arithmetic mean, twice the standard deviation and the upper confidence interval) of the first and the final (second) iteration.

	Iteration 1	Iteration 2
	Area specific emissions [t CO_2 equivalent ha^{-1} $year^{-1}$]	
1990	1.50	1.50
1991	1.08	1.08
1992	1.05	1.05
1993	1.03	1.03
1994	1.10	1.10
1995	1.11	1.11
1996	1.47	1.47
1997	1.63	1.63
1998	1.78	1.78
1999	1.73	1.73
2000	3.38	
2001	2.07	2.07
2002	1.68	1.68
2003	1.88	1.88
2004	1.89	1.89
2005	1.94	1.94
2006	1.38	1.38
2007	1.38	1.38
2008	1.27	1.27
2009	1.18	1.18
Arithmetic mean = background level	1.59	1.49
2 * SD = margin	1.04	0.65
Upper CI = background level + margin	2.63	2.15

Figure 3 > Time series of emissions from natural disturbances for the calibration period from 1990 to 2009, background level and upper confidence interval (background level + margin). The outlier in the year 2000 results from the winter storm 'Lothar' at the end of 1999.
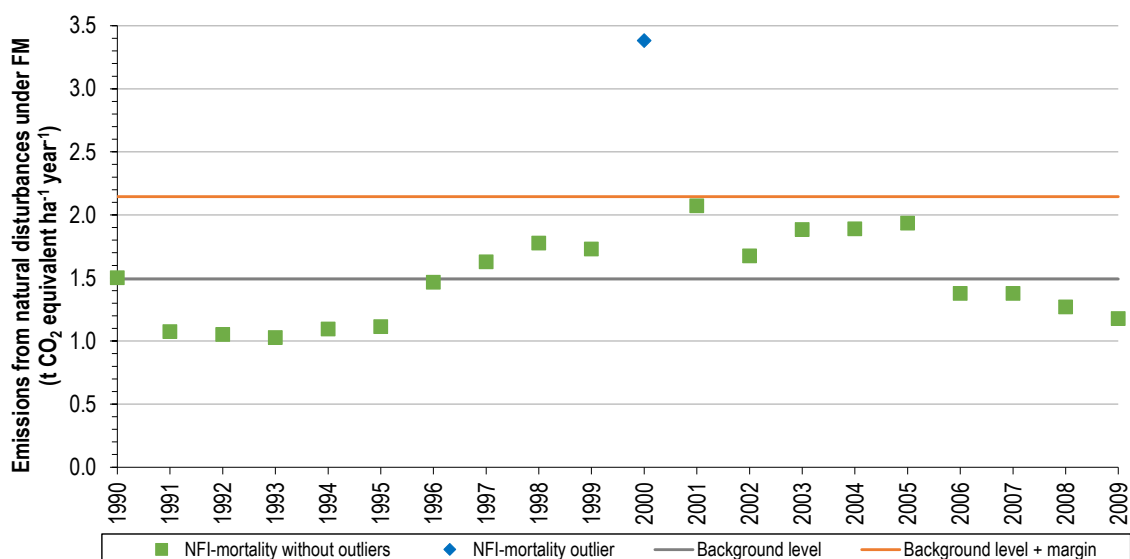
Currently, it is not yet possible to tune mortality in the Model MASSIMO3 at a flexible level as required. For the calculations of Switzerland's FMRL, the mortality rate in MASSIMO3 amounts to the constant value of 14 per cent of total cut and mortality, reflecting the level of mortality in NFI 1–2 (from 1985 to 1994; 1.12 t CO_2 ha^{-1} year^{-1}) and NFI 3–4b (from 2006 to 2013; 1.30 t CO_2 ha^{-1} year^{-1}). Over the next years, MASSIMO3 will be substantially modified and adjusted, such that it will be possible to tune mortality at a desired level. As soon as this will be possible, Switzerland's FMRL will be subject to a technical correction.

(…)