ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

Austria's Annual Air Emission Inventory 1990—2017

Emissions of SO_2, NO_x, NMVOC, NH_3 and $PM_{2,5}$

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Project Manager

Melanie Tista

Authors

Michael Anderl, Simone Haider,
Elisabeth Kampel, Christoph Lampert,
Marion Pinterits, Stephan Poupa,
Maria Purzner, Günther Schmidt,
Gudrun Stranner, Barbara Schodl,
Melanie Tista, Michaela Titz

Reviewed and approved by

Klaus Radunsky

Type setting

Elisabeth Riss

Title photograph

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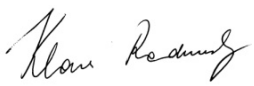

Dr. Klaus Radunsky
(Head of the inspection body)

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1 EINLEITUNG

Dieser Bericht beinhaltet eine Zusammenfassung der jährlichen SO_2, NO_x, NH_3, NMVOC und $PM_{2.5}$-Emissionen. Es werden der aktuelle Datenstand, der am 15. Februar 2019 an die Europäische Kommission übermittelt wurde, die wichtigsten Trends sowie die wesentlichen methodischen Änderungen gegenüber dem Vorjahr dargestellt.

- Annex 1 beinhaltet die Emissionstrends der Schadstoffe SO_2, NO_x, NH_3, NMVOC und $PM_{2.5}$ abzüglich der Emissionsmengen aus Kraftstoffexport („fuel used“).
- Annex 2 enthält die Gesamtemissionen dieser Schadstoffe basierend auf dem inländischen Kraftstoffabsatz („fuel sold“).

Die sektorale Gliederung der im Anhang präsentierten Überblickstabellen hält sich an die Nomenclature For Reporting (NFR), Nomenklatur der United Nations Economic Commission for Europe (UNECE). Der vollständige Datensatz wurde der Europäischen Kommission im NFR-Format der UNECE in digitaler Form übermittelt.

Das Umweltbundesamt führt jährlich die Österreichische Luftschadstoff-Inventur (OLI) durch, die als Grundlage für die Erfüllung der nationalen und internationalen Berichtspflichten herangezogen wird. Die OLI wird erforderlichenfalls auch für zurückliegende Jahre aktualisiert, um eine konsistente Zeitreihe zur Verfügung zu haben. Die in diesem Bericht publizierten Emissionsdaten ersetzen somit die publizierten Daten und Zeitreihen vorhergehender Berichte.

Die folgende Tabelle gibt den Stand der Daten und das Berichtsformat der vorliegenden Publikation an:

Tabelle 1: Datengrundlage des vorliegenden Berichts.

Inventur	Datenstand	Berichtsformat
OLI 2018	11. Februar 2019	NFR-Format der UNECE

Der vorliegende Bericht wurde vom Umweltbundesamt auf Grundlage des Umweltkontrollgesetzes (BGBl. Nr. 152/1998) erstellt. Dem Umweltbundesamt wird in diesem Bundesgesetz in § 6 (2) Z. 19 unter anderem die Aufgabe übertragen, an der Erfüllung der Berichtspflichten an die Europäische Kommission gemäß Richtlinien und Entscheidungen der EU mitzuwirken. In § 6 (2) Z. 20 werden die Erstellung und Führung von Inventuren und Bilanzen zur Dokumentation des Zustandes und der Entwicklung der Umwelt sowie der Umweltbelastungen und ihrer Ursachen ausdrücklich als besondere Aufgaben des Umweltbundesamtes genannt.

2 EMISSIONSTRENDS

Die offiziellen Inventurdaten für den Vergleich mit den nationalen Emissionshöchstmengen ab 2010 werden für Österreich nicht auf Basis des verkauften Kraftstoffs sondern auf Basis des verbrauchten Kraftstoffs ermittelt (EU-Emissionshöchstmengenrichtlinie, NEC-Richtlinie (EU) 2016/2284; Anhang IV). Die Emissionen durch Kraftstoffexport in Fahrzeugtanks sind daher in der offiziellen NEC-Emissionsmenge Österreichs nicht enthalten.

2.1 Emissionen ohne Kraftstoffexport

Abbildung 1 und Tabelle 2 zeigen die österreichischen Inventurdaten der Schadstoffe SO_2, NO_x, NH_3, NMVOC und $PM_{2.5}$ ohne Berücksichtigung der Emissionen aus dem Kraftstoffexport (Emissionen berechnet auf Basis “fuel used“).

Tabelle 2: Gesamtemissionen Österreichs ohne Kraftstoffexport, 1990–2017. (Quelle: Umweltbundesamt)

	Emissionen ohne Kraftstoffexport in Kilotonnen				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	72,98	204,33	322,24	65,15	25,87
1995	45,80	180,72	237,09	66,90	24,83
2000	31,08	177,49	179,43	64,00	23,80
2001	31,87	179,32	173,44	63,85	23,86
2002	30,85	177,16	167,10	62,72	22,73
2003	30,68	179,25	164,03	62,51	22,36
2004	26,95	177,47	151,62	62,33	21,91
2005	25,42	178,66	152,16	62,17	20,62
2006	26,26	177,75	155,66	62,66	20,11
2007	22,98	172,32	151,66	64,07	19,25
2008	19,95	166,35	147,42	63,85	18,87
2009	14,59	153,03	134,26	65,46	17,83
2010	15,83	152,51	135,55	65,40	18,49
2011	15,06	150,44	130,04	64,96	17,50
2012	14,55	146,34	127,45	65,44	17,07
2013	14,44	144,79	132,17	65,70	17,65
2014	14,60	141,34	119,43	66,49	15,93
2015	13,94	139,25	123,08	67,18	15,91
2016	13,50	136,33	121,30	68,05	15,60
2017	12,78	131,48	119,30	68,85	15,38

Während für die Emissionen von SO_2, NO_x, NMVOC und $PM_{2.5}$ von 2016 auf 2017 leichte Rückgänge ermittelt wurden, sind die Emissionen von NH_3 im selben Zeitraum geringfügig angestiegen.

In der EU-Emissionshöchstmengenrichtlinie (engl.: National Emission Ceilings, „NEC"-Directive), national umgesetzt im Emissionsgesetz-Luft 2018 (EG-L 2018, BGBl. I Nr. 75/2018) sind für die Jahre ab 2010 Emissionshöchstmengen für die Luftschadstoffe Schwefeldioxid (SO_2), Stickstoffoxide (NO_x), flüchtige Kohlenwasserstoffe ohne Methan (NMVOC) und Ammoniak (NH_3) festgelegt. Für den Vergleich mit den zulässigen nationalen Emissionshöchstmengen ab 2010 werden für Österreich die Emissionen ohne Kraftstoffexport herangezogen[1].

Minderungsziele für die Feinstaubfraktion $PM_{2.5}$ sind in der NEC-Richtlinie erst für den Zeitraum ab 2020 festgeschrieben.

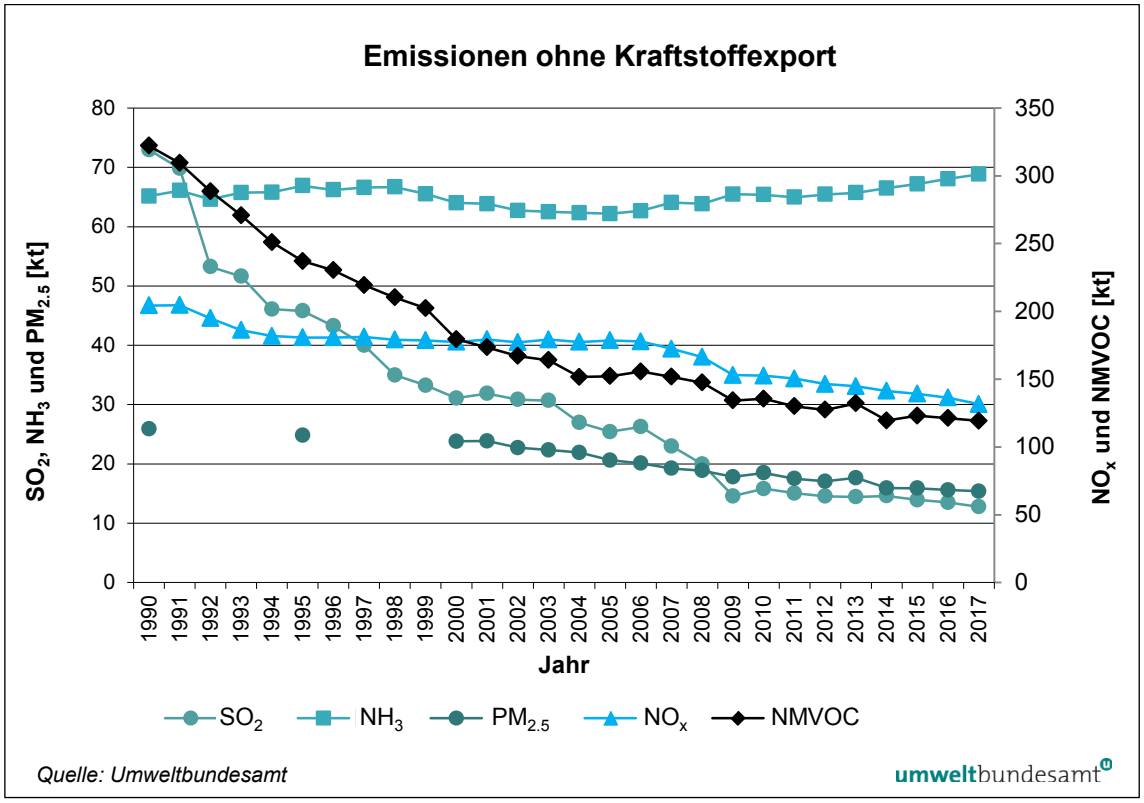

Abbildung 1: SO_2, NO_x, NMVOC, NH_3 und $PM_{2.5}$-Emissionen ohne Kraftstoffexport.

[1] Richtlinie (EU) 2016/2284 des Europäischen Parlaments und des Rates vom 14. Dezember 2016 über die Reduktion der nationalen Emissionen bestimmter Luftschadstoffe, zur Änderung der Richtlinie 2003/35/EG und zur Aufhebung der Richtlinie 2001/81/EG. Anhang II.

2.2 Flexibilitätsregelungen

Gemäß revidierter NEC-Richtlinie 2016/2284 können die EU-Mitgliedstaaten unter bestimmten, detailliert zu begründenden Umständen Flexibilitätsregelungen für die Zielerreichung nutzen.

2.2.1 Einreichung von Inventur-Anpassungsvorschlägen

Österreich hat in den Jahren 2017[2] und 2018[3] Vorschläge zur Anpassung spezifischer Inventurdaten für die NO_x- und NH_3-Zielerreichung bei der Europäischen Kommission eingereicht. Ausschlaggebend dafür sind die mangelnde Wirksamkeit der auf EU-Ebene erlassenen Kfz-Abgasvorschriften (NO_x) sowie der Umstand, dass bestimmte Emissionsquellen im Landwirtschaftssektor bei der Festlegung der Zielwerte nicht berücksichtigt wurden (NO_x, NH_3).

Die Vorschläge wurden von der Europäischen Kommission bewilligt[4,5]. Damit ist es legitim, die Anpassungswerte für den NEC-Zielvergleich von der nationalen Emissionsmenge abzuziehen.

Am 15. Februar 2019 wurden die neue Inventur-Zeitreihe 1990–2017 sowie eine Aktualisierung der in den Jahren 2017 und 2018 bewilligten Anpassungswerte von Österreich an die Europäische Kommission übermittelt.

In Tabelle 3 sind die bewilligten Anpassungswerte (aktualisiert für die Jahre 2010–2017), die angepassten nationalen Emissionswerte sowie die nationalen Emissionshöchstwerte zusammengefasst dargestellt.

Tabelle 3: Bewilligte Anpassungswerte, angepasste Inventurdaten und Emissionshöchstmengen 2010–2017. (Quelle: Umweltbundesamt)

	Bewilligte Anpassungswerte („approved adjustments“)		**Angepasste Inventurdaten (2019)**		**Zulässige Emissionshöchstmengen (ab 2010)**	
	NO_x	**NH_3**	**NO_x**	**NH_3**	**NO_x**	**NH_3**
2010	– 35,44 kt	*	117,07 kt	*	103 kt	66 kt
2011	– 37,88 kt	*	112,56 kt	*	103 kt	66 kt
2012	– 39,12 kt	*	107,23 kt	*	103 kt	66 kt
2013	– 40,55 kt	*	104,24 kt	*	103 kt	66 kt
2014	– 41,79 kt	– 1,11 kt	99,54 kt	65,38 kt	103 kt	66 kt
2015	– 41,41 kt	– 1,18 kt	97,84 kt	66,00 kt	103 kt	66 kt
2016	– 40,04 kt	– 1,11 kt	96,29 kt	66,94 kt	103 kt	66 kt
2017	– 37,38 kt	– 1,11 kt	94,10 kt	67,74 kt	103 kt	66 kt

** keine Anpassung, da die NEC-Emissionshöchstmenge nicht überschritten wurde.*

[2] UMWELTBUNDESAMT (2017): Anderl, M., Kriech, M.: Austria’s Informative Adjustment Report 2017. Austria’s applications for inventory adjustment pursuant to Article 5 (1) of the NEC Directive 2016/2284 (Addendum to Austria’s IIR 2017). Reports, Bd. REP-0613. Umweltbundesamt, Wien.

[3] UMWELTBUNDESAMT (2018): Anderl, M., Haider, S., Kriech, M., Stranner, G.: Austria´s Inventory Adjustment Report 2018. Austria’s applications for inventory adjustment pursuant to Article 5 (1) of the NEC Directive 2016/2284 (Addendum to Austria´s IIR 2018). Reports, Bd. REP-0648. Umweltbundesamt, Wien.

[4] EEA – European Environment Agency(2017): Final Review Report – 2017 Comprehensive Technical Review of National Emission Inventories pursuant to the Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants (Directive (EU) 2016/2284) – Austria. Reference: No 07.0201/2016/741511/SER/ENV.C.3

[5] EEA – European Environment Agency (2018): Final Review Report 2018 – Second Phase of review of national air pollution emission inventory data pursuant to the Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants (Directive (EU) 2016/2284 or ‘NECD’) – Austria. Reference: 070203/2017/765105/SER/ENV.C.3

Auf Basis der NEC-Emissionsberichterstattung 2019 (Zeitreihe 1990–2017) stellt sich der Zielvergleich wie folgt dar:

- Die festgesetzte Emissionshöchstmenge für NO_x (103 kt) wird in den Jahren 2010–2013 unter Berücksichtigung der bewilligten Anpassungen überschritten. Seit 2014 wird die festgesetzte Emissionshöchstmenge unterschritten.
- Die festgesetzte Emissionshöchstmenge für NH_3 wird in den Jahren 2010 bis 2013 unterschritten. Unter Berücksichtigung der bewilligten Anpassungen wird die nationale Emissionshöchstmenge in den Jahren 2014 und 2015 ebenfalls unterschritten, und in den Jahren 2016 und 2017 um 0,94 kt bzw. 1,74 kt überschritten.
- Für die Luftschadstoffe SO_2 und NMVOC werden die festgesetzten Emissionshöchstmengen (39 kt für SO_2 und 159 kt für NMVOC) seit vielen Jahren unterschritten.

2.3 Emissionen inklusive Kraftstoffexport

Im Folgenden sind die Trends der SO_2, NO_x, NH_3, NMVOC und $PM_{2.5}$-Emissionen Österreichs auf Basis der in Österreich verkauften Treibstoffmengen („fuel sold“) dargestellt. Dabei ist zu beachten, dass in Österreich insbesondere in den letzten Jahren ein beachtlicher Teil der verkauften Treibstoffmenge zwar im Inland getankt, jedoch im Ausland verfahren wurde (Kraftstoffexport in Fahrzeugtanks, oft auch als „Tanktourismus“ bezeichnet).

Tabelle 4: Gesamtemissionen Österreichs inklusive Kraftstoffexport, 1990–2017. (Quelle: Umweltbundesamt)

	Gesamtemissionen Österreichs inklusive Kraftstoffexport [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	73,76	219,33	324,40	65,19	26,37
1995	46,83	198,92	236,98	66,82	25,51
2000	31,65	214,18	179,56	63,73	24,65
2001	32,56	224,13	174,67	63,76	24,94
2002	31,59	230,28	170,08	63,00	24,13
2003	31,47	238,99	168,01	63,00	23,98
2004	27,01	236,28	155,66	62,86	23,52
2005	25,47	237,87	156,10	62,70	22,21
2006	26,30	224,54	158,72	63,15	21,40
2007	23,02	214,39	154,37	64,53	20,37
2008	19,98	198,50	149,29	64,17	19,67
2009	14,62	183,52	135,97	65,77	18,54
2010	15,86	183,14	137,17	65,70	19,19
2011	15,09	173,43	131,34	65,23	18,03
2012	14,58	168,01	128,63	65,70	17,53
2013	14,48	168,76	133,29	65,93	18,12
2014	14,63	160,14	120,40	66,71	16,29
2015	13,97	156,28	124,10	67,44	16,22
2016	13,53	151,36	122,31	68,32	15,88
2017	12,81	144,71	120,19	69,09	15,61

2.4 Kraftstoffexport

Im Jahr 2004 wurde vom Bundesministerium für Nachhaltigkeit und Tourismus (damals Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft) eine Studie in Auftrag gegeben[6], in welcher die Auswirkungen des Kraftstoffexports in Fahrzeugtanks auf den Treibstoffverbrauch und die Entwicklung der verkehrsbedingten Emissionen in Österreich abgeschätzt wurden. Eine Folgestudie aus dem Jahr 2008/2009[7] bestätigte das Ausmaß des Kraftstoffexports. Methodisch lassen sich die über die Grenzen verschobenen Kraftstoffmengen aus der Differenz zwischen Kraftstoffabsatz in Österreich und dem berechneten Inlandsverbrauch ermitteln. Davon können die Fahrleistungen (Kfz-km) von Pkw und schweren Nutzfahrzeugen abgeleitet werden und in weiterer Folge die zugehörigen Emissionen für den „Kraftstoffexport in Kfz".

Gründe für diesen Effekt sind strukturelle Gegebenheiten (Binnenland mit hohem Exportanteil in der Wirtschaft) sowie Unterschiede im Kraftstoffpreisniveau zwischen Österreich und seinen Nachbarländern.

Nachstehende Tabelle gibt Auskunft über die Emissionsmengen, die auf den Kraftstoffexport in Fahrzeugtanks zurückzuführen sind. Im Jahr 2017 sind 13,2 kt, das sind rund 10 % der NO_x-Gesamtemissionen Österreichs, auf diesen Effekt zurückzuführen. Besonders ab Ende der 90er Jahre kam es – bedingt durch den zunehmenden Kraftstoffexport – zu einem verstärkten Anstieg der NO_x-Emissionen, vor allem im Schwerverkehr. Im Jahr 2003 wurde ein Höchstwert erreicht; seither nimmt der Kraftstoffexport kontinuierlich ab.

Tabelle 5: Emissionen aus Kraftstoffexport in Fahrzeugtanks. (Quelle: Umweltbundesamt)

	Emissionen in tausend Tonnen [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	0,78	15,00	2,16	0,03	0,50
1995	1,03	18,19	– 0,10	– 0,08	0,69
2000	0,58	36,69	0,12	– 0,27	0,85
2001	0,69	44,81	1,23	– 0,09	1,07
2002	0,74	53,12	2,98	0,28	1,40
2003	0,80	59,74	3,97	0,50	1,63
2004	0,06	58,81	4,04	0,53	1,61
2005	0,05	59,21	3,94	0,52	1,59
2006	0,04	46,79	3,06	0,49	1,28
2007	0,04	42,07	2,71	0,46	1,12
2008	0,03	32,15	1,88	0,32	0,80
2009	0,03	30,49	1,71	0,31	0,72
2010	0,03	30,63	1,63	0,30	0,71
2011	0,03	22,99	1,30	0,28	0,53
2012	0,03	21,67	1,18	0,26	0,47

[6] HAUSBERGER, S. & MOLITOR, R. (2004): Abschätzung der Auswirkungen des Tanktourismus auf den Treibstoffverbrauch und die Entwicklung der CO_2-Emissionen in Österreich. TU Graz im Auftrag des Lebensministeriums, nicht veröffentlicht. Graz, 2004.

[7] HAUSBERGER, S. & MOLITOR, R. (2009): Abschätzung der Auswirkungen des Tanktourismus auf den Treibstoffverbrauch und die Entwicklung der CO_2-Emissionen in Österreich. TU Graz im Auftrag des BMLFUW und BMVIT, nicht veröffentlicht. Graz, 2009.

	Emissionen in tausend Tonnen [Kilotonnen]				
	SO_2	NO_x	NMVOC	NH_3	$PM_{2.5}$
2013	0,04	23,98	1,13	0,24	0,48
2014	0,03	18,80	0,97	0,22	0,36
2015	0,03	17,02	1,02	0,26	0,32
2016	0,03	15,02	1,01	0,27	0,27
2017	0,03	13,23	0,89	0,24	0,23

2.5 Beschreibung der Trends

2.5.1 SO_2-Emissionen

2017 betrugen die SO_2-Emissionen 12,8 kt (ohne Kraftstoffexport). Seit 1990 (73,0 kt) nahmen die Emissionen stetig ab.

Seit 1990 konnten die SO_2-Emissionen (ohne Kraftstoffexport) um 82,5 % reduziert werden. Das ist vorwiegend auf die Absenkung des Schwefelanteils in Mineralölprodukten und Treibstoffen (gemäß Kraftstoffverordnung), den Einbau von Entschwefelungsanlagen in Kraftwerken (gemäß Luftreinhaltegesetz für Kesselanlagen) sowie die verstärkte Nutzung schwefelärmerer Brennstoffe, wie z. B. Erdgas, zurückzuführen. Die Wirtschaftskrise verursachte einen Einbruch der SO_2-Emissionen im Jahr 2009, der allerdings bereits 2010 durch die Erholung der Wirtschaft ausgeglichen wurde. Die starke Reduktion der Emissionen von 1991–1992 ist auf den reduzierten Kohleeinsatz in Kraftwerken (1.A.1.a) und die Einführung von Minderungsmaßnahmen bei Ölkraftwerken (1.A.1) sowie der Eisen- und Stahl (1.A.2.a) und Papierindustrie (1.A.2.d) zurückzuführen.

Von 2016 auf 2017 sind die SO_2-Emissionen (ohne Kraftstoffexport) um 0,7 kt (– 5,3 %) weiter gesunken; dies geschah hauptsächlich aufgrund von Reduktionen der SO_2-Emissionen in der Eisen- und Stahlindustrie (1.A.2.a, – 0,5 kt).

Die SO_2-Emissionen inklusive Kraftstoffexport beliefen sich im Jahr 1990 auf 73,8 kt. Bis zum Jahr 2017 nahmen sie um 82,6 % auf 12,8 kt ab. Zwischen 2016 und 2017 sanken die Emissionen um 5,3 %.

2.5.2 NO_X-Emissionen

Für das Jahr 2017 wurde ein Ausstoß von rund 131,5 kt NO_x berechnet (ohne Kraftstoffexport). Im Jahr 1990 betrugen die NO_x-Emissionen ohne Kraftstoffexport 204,3 kt.

Seit 1990 nahmen die NO_x-Emissionen (ohne Kraftstoffexport) um 35,7 % ab. Von 1991 bis 1993 gab es eine auffällige Reduktion der NO_x-Emissionen, die auf die Sektoren 1.A.3.b (Passenger cars) sowie Minderungsmaßnahmen bei großen Kohle- und Ölkraftwerken (1.A.1.a) und der Chemischen Industrie (2.B.10.a) zurückzuführen ist. Die Wirtschaftskrise war hauptverantwortlich für die Reduktion der NO_x-Emissionen von 2008 auf 2009.

Von 2016 auf 2017 setzte sich der rückläufige Trend der NO_x-Emissionen (ohne Kraftstoffexport) mit einer Reduktion um 4,9 kt (– 3,6 %) fort. Hierfür verantwortlich sind vor allem die Rückgänge im Straßenverkehr, insbesondere im Bereich der schweren Kraftfahrzeuge (1.A.3.b.3). Der überwiegende Anteil der nationalen NO_x-Emissionen entsteht bei der Verbrennung von Brenn- und Kraftstoffen, wobei der größte Anteil an den NO_x-Emissionen im Jahr 2017 auf den Straßenverkehr mit 43,8 % (exklusive Kraftstoffexport) entfiel.

Die NO_x-Emissionen inklusive Kraftstoffexport sind im Zeitraum 1990 bis 2017 um 34,0 % von 219,3 kt auf rund 144,7 kt gesunken. Die NO_x-Emissionen inklusive Kraftstoffexport haben in den Jahren 2003 bis 2005 einen Höchstwert erreicht und gehen seither kontinuierlich zurück, was hauptsächlich auf geringere Emissionen des Schwerverkehrs zurückzuführen ist. Vor allem die Fortschritte bei der Abgasnachbehandlung schwerer Nutzfahrzeuge (LKW und Busse) zeigten hier Wirkung. Verglichen mit 2016 beträgt der Rückgang im Jahr 2017 4,4 %. Der größte Anteil an den NO_x-Gesamtemissionen im Jahr 2017 fiel auf den Straßenverkehr mit 48,9 %.

2.5.3 NMVOC Emissionen

Die NMVOC-Emissionen ohne Kraftstoffexport betrugen im Jahr 2017 119,3 kt und im Jahr 1990 322,2 kt.

Die NMVOC-Emissionen (ohne Kraftstoffexport) sind seit 1990 um 63,0 % zurückgegangen. Seit 1990 konnten die größten Reduktionen im Verkehrssektor erzielt werden, im Wesentlichen durch den verstärkten Einsatz von Katalysatoren und Diesel-Kfz. Im Lösemittelsektor konnten die Reduktionen aufgrund diverser gesetzlicher Regelungen (Lösungsmittelverordnung, HKW-Anlagen-Verordnung sowie VOC-Anlagen-Verordnung) erzielt werden.

Von 2016 auf 2017 sind die NMVOC Emissionen (ohne Kraftstoffexport) um 2,0 kt (– 1,7 %) gesunken.

Die NMVOC Emissionen inklusive Kraftstoffexport beliefen sich im Jahr 1990 auf 324,4 kt. Bis zum Jahr 2017 nahmen sie um 63,0 % auf 120,2 kt ab. Zwischen 2016 und 2017 sanken die Emissionen um 1,7 %.

2.5.4 NH_3-Emissionen

Für das Jahr 2017 wurde ein Ausstoß von rund 68,9 kt NH_3 berechnet (ohne Kraftstoffexport). Im Jahr 1990 betrugen die NH_3-Emissionen ohne Kraftstoffexport 65,2 kt.

Von 1990 bis 2017 nahmen die NH_3-Emissionen (ohne Kraftstoffexport) um 5,7 % zu. Die österreichischen NH_3-Emissionen stammen nahezu ausschließlich vom Sektor Landwirtschaft (93,8 %). Grundsätzlich unterliegen die Emissionen seit 1990 nur wenigen Veränderungen. Die leichte Zunahme der NH_3-Emissionen trotz eines etwas sinkenden Rinderbestandes lässt sich durch die vermehrte Haltung in Laufställen (aus Gründen des Tierschutzes und EU-rechtlich vorgeschrieben) und die Zunahme von leistungsstärkeren Milchkühen erklären. Außerdem kam es zu einem verstärkten Einsatz von Harnstoff als Stickstoffdünger (kostengünstiges, aber wenig effizientes Düngemittel).

Verglichen mit 2016 nahmen die NH_3-Emissionen (ohne Kraftstoffexport) im letzten Berichtsjahr um 0,8 kt (+ 1,2 %) zu. Hauptgrund ist der größere Milchkuhbestand bei steigender durchschnittlicher Milchleistung. Auch der Pferdebestand ist im Vergleich zum Vorjahr merklich angestiegen; die Anzahl an Schweinen, Ziegen und Schafen ist ebenso zunehmend.

Die NH_3-Emissionen einschließlich Kraftstoffexport beliefen sich im Jahr 1990 auf 65,2 kt. Bis zum Jahr 2017 nahmen sie um 6,0 % auf 69,1 kt zu. Zwischen 2016 und 2017 stiegen die Emissionen um 1,1 %.

2.5.5 $PM_{2.5}$-Emissionen

Die $PM_{2.5}$-Emissionen ohne Kraftstoffexport betrugen im Jahr 2017 15,4 kt und im Jahr 1990 25,9 kt.

Seit 1990 nahmen die $PM_{2.5}$-Emissionen (ohne Kraftstoffexport) um 40,5 % ab. Größere Abnahmen gab es beim Hausbrand (1.A.4.b.1) wegen des stark reduzierten Kohleverbrauchs sowie bei den mobilen Landwirtschaftlichen Maschinen 1.A.4.c.2 (Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery). Von 2013 auf 2014 gab es eine auffällige Reduktion der $PM_{2.5}$-Emissionen, die auf die sehr warme Witterung im Jahr 2014 und den damit verbundenen starken Rückgang des Biomasseeinsatzes in den Haushalten zurückzuführen ist. Die Wirtschaftskrise verursachte einen Einbruch der $PM_{2.5}$-Emissionen im Jahr 2009, der allerdings bereits 2010 durch die Erholung der Wirtschaft ausgeglichen wurde.

Von 2016 auf 2017 sind die $PM_{2.5}$-Emissionen (ohne Kraftstoffexport) um 0,2 kt (– 1,4 %) gesunken; hauptsächlich aufgrund von Reduktionen im Straßenverkehr.

Die $PM_{2.5}$-Emissionen einschließlich Kraftstoffexport sind im Zeitraum 1990 bis 2017 um 40,8 % von 26,4 kt auf rund 15,6 kt gesunken. Verglichen mit 2016 beträgt der Rückgang im Jahr 2017 1,7 %.

3 INTRODUCTION

This report provides a summary of Austria's SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ emissions for the years 1990 until 2017. Trend tables 1990–2017 (SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$) for the main NFR sectors are presented in the following Annexes:

- Annex 1: national emission data on the basis of fuel used;
- Annex 2: national emission data on the basis of fuel sold.

The complete tables in the NFR format have been uploaded to the Central Data Repository (CDR)[8] of EIONET in digital form (excel files).

[8] http://cdr.eionet.europa.eu/at/eu/nec

4 EMISSION TRENDS

Austria reports official inventory data on the basis of fuel used (NECD 2016/2284, Annex IV). Thus, 'fuel export' emissions are not included in the Austrian total under the NEC Directive. Emission data based on fuel sold are listed in Annex 2 of this report.

4.1 Emissions not including 'fuel exports'

Table 1 and Figure 1 show the national total of the SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ emissions not including fuel exports (fuel used).

If fuel prices vary between neighbouring countries, fuel bought in a Member State where it is sold at a cheaper price tends to be exported to (and used in) other countries. Austria has experienced a considerable amount of 'fuel exports' in the last few years; this needs to be taken into account when reporting emissions for the Austrian territory.

Details regarding 'fuel exports' are presented in Chapter 4.3.

Table 1: Austria's emissions 1990–2017 not including fuel exports. (Source: Umweltbundesamt)

	Austria's Air Emissions not including 'fuel exports' [Kilotonnes]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	72.98	204.33	322.24	65.15	25.87
1995	45.80	180.72	237.09	66.90	24.83
2000	31.08	177.49	179.43	64.00	23.80
2001	31.87	179.32	173.44	63.85	23.86
2002	30.85	177.16	167.10	62.72	22.73
2003	30.68	179.25	164.03	62.51	22.36
2004	26.95	177.47	151.62	62.33	21.91
2005	25.42	178.66	152.16	62.17	20.62
2006	26.26	177.75	155.66	62.66	20.11
2007	22.98	172.32	151.66	64.07	19.25
2008	19.95	166.35	147.42	63.85	18.87
2009	14.59	153.03	134.26	65.46	17.83
2010	15.83	152.51	135.55	65.40	18.49
2011	15.06	150.44	130.04	64.96	17.50
2012	14.55	146.34	127.45	65.44	17.07
2013	14.44	144.79	132.17	65.70	17.65
2014	14.60	141.34	119.43	66.49	15.93
2015	13.94	139.25	123.08	67.18	15.91
2016	13.50	136.33	121.30	68.05	15.60
2017	12.78	131.48	119.30	68.85	15.38

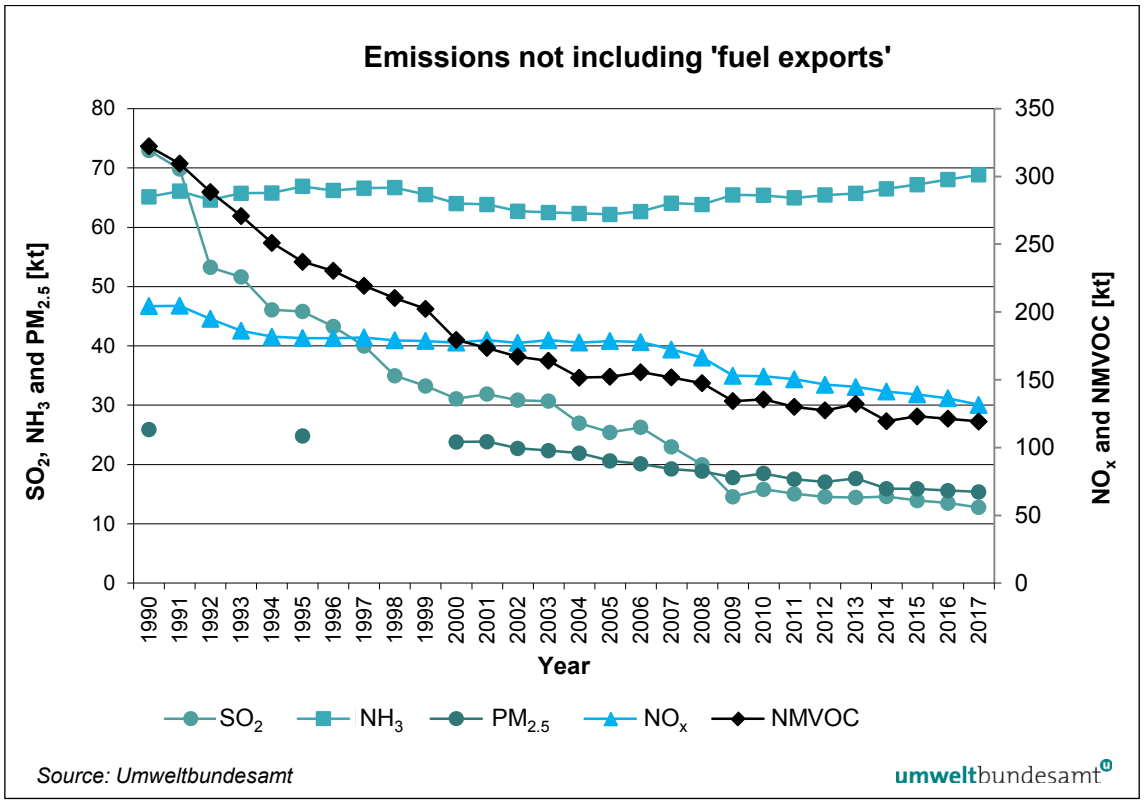

Figure 1: SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$ emissions not including 'fuel exports'.

4.2 Emissions including 'fuel exports'

According to the 2013 Reporting Guidelines, Parties within the EMEP[9] region are required to calculate and report emissions in conformity with their national energy balances reported to Eurostat or the International Energy Agency (IEA). Emissions from road vehicle transport should therefore be calculated and reported on the basis of fuel sold.

Table 2 shows Austria's total emissions based on fuel sold.

Table 2: Austria's total emissions 1990–2017 including fuel exports. (Source: Umweltbundesamt)

	Austria's Total Emissions [Kilotonnes]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	73.76	219.33	324.40	65.19	26.37
1995	46.83	198.92	236.98	66.82	25.51
2000	31.65	214.18	179.56	63.73	24.65
2001	32.56	224.13	174.67	63.76	24.94
2002	31.59	230.28	170.08	63.00	24.13

[9] EMEP – Co-operative programme for monitoring and evaluation of long-range transmission of air pollutants in Europe http://www.emep.int/

2003	31.47	238.99	168.01	63.00	23.98
2004	27.01	236.28	155.66	62.86	23.52
2005	25.47	237.87	156.10	62.70	22.21
2006	26.30	224.54	158.72	63.15	21.40
2007	23.02	214.39	154.37	64.53	20.37
2008	19.98	198.50	149.29	64.17	19.67
2009	14.62	183.52	135.97	65.77	18.54
2010	15.86	183.14	137.17	65.70	19.19
2011	15.09	173.43	131.34	65.23	18.03
2012	14.58	168.01	128.63	65.70	17.53
2013	14.48	168.76	133.29	65.93	18.12
2014	14.63	160.14	120.40	66.71	16.29
2015	13.97	156.28	124.10	67.44	16.22
2016	13.53	151.36	122.31	68.32	15.88
2017	12.81	144.71	120.19	69.09	15.61

4.3 Emissions from ‘fuel exports’

In the year 2004, a study[10] was commissioned to analyse the effects of fuel price differences between Austria and its neighbouring countries, including the so-called ‘fuel export’ effect, which means that fuel which is sold in Austria is used abroad. Relevant calculations were based on extensive questionnaires (for truckers at the border and truckage companies), results from the Austrian transport model, and traffic counts. The importance of ‘fuel exports’ was confirmed by an update of the study in 2008/2009[11].

The following Table 3 provides information on the quantities of emissions that can be attributed to fuel exports in vehicle tanks. In 2017, about 10% of the reported NO_x emissions were due to ‘fuel exports’.

[10] HAUSBERGER, S. & MOLITOR, R. (2004): Assessment of the effects of fuel tourism on fuel consumption and CO_2 emission trends in Austria (in German). TU Graz on behalf of the Austrian Ministry of Life, not published. Graz, 2004.

[11] HAUSBERGER, S.& MOLITOR, R. (2009): Assessment of the effects of fuel tourism on fuel consumption and CO_2 emission trends in Austria (in German). TU Graz on behalf of the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management and the Austrian Federal Ministry of Transport, Innovation and Technology, not published. Graz, 2009.

Table 3: NEC emissions from 'fuel exports'.

	Emissions [Kilotonnes]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	0.78	15.00	2.16	0.03	0.50
1995	1.03	18.19	– 0.10	– 0.08	0.69
2000	0.58	36.69	0.12	– 0.27	0.85
2001	0.69	44.81	1.23	– 0.09	1.07
2002	0.74	53.12	2.98	0.28	1.40
2003	0.80	59.74	3.97	0.50	1.63
2004	0.06	58.81	4.04	0.53	1.61
2005	0.05	59.21	3.94	0.52	1.59
2006	0.04	46.79	3.06	0.49	1.28
2007	0.04	42.07	2.71	0.46	1.12
2008	0.03	32.15	1.88	0.32	0.80
2009	0.03	30.49	1.71	0.31	0.72
2010	0.03	30.63	1.63	0.30	0.71
2011	0.03	22.99	1.30	0.28	0.53
2012	0.03	21.67	1.18	0.26	0.47
2013	0.04	23.98	1.13	0.24	0.48
2014	0.03	18.80	0.97	0.22	0.36
2015	0.03	17.02	1.02	0.26	0.32
2016	0.03	15.02	1.01	0.27	0.27
2017	0.03	13.23	0.89	0.24	0.23

4.4 Description of trends

4.4.1 SO_2 emissions

In 2017, SO_2 emissions amounted to 12.8 kt (not including 'fuel exports'). Since 1990 (73.0 kt), emissions have decreased continuously.

SO_2 emissions (not including 'fuel exports') have decreased since 1990 by 82.5%. This decline is mainly caused by a reduction of the sulphur content in mineral oil products and fuels (according to the Austrian Fuel Ordinance), the installation of desulphurisation units in plants (according to the Clean Air Act for boilers) and an increased use of low-sulphur fuels like natural gas. The economic crisis in 2009 caused a decrease in emissions, followed by an increase due to the recovery of the economy. The strong reduction in emissions between 1991 and 1992 can be explained by reduced coal consumption in power plants (*1.A.1.a*) and a reduction of SO_2 emissions from oil fired power plants (*1.A.1.a*) as well as from iron and steel (*1.A.2.a*) and pulp and paper (*1.A.2.d*) production.

From 2016 to 2017 SO_2 emissions (not including 'fuel exports') decreased by 0.7 kt (– 5.3%). This was mainly caused by reductions in emissions from iron and steel (*1.A.2.a*, – 0.5 kt).

SO_2 emissions including 'fuel exports' amounted to 73.8 kt in the year 1990 and decreased by 82.6% by 2017 (12.8 kt). Between 2016 and 2017 SO_2 emissions decreased by 5.3%.

4.4.2 NO_X emissions

In 1990, NO_x emissions without 'fuel exports' amounted to 204.3 kt, and in 2017 to 131.5 kt.

Since 1990, NO_x emissions (not including 'fuel exports') have decreased by 35.7%. The reduction in NO_x emissions from 1991 to 1993 was mainly due to reductions in sector *1.A.3.b* (passenger cars), sector *1.A.1.a* (large oil and coal power plants) and sector *2.B.10.a* (chemicals industries). The economic crisis caused a decrease in emissions from 2008 to 2009.

From 2016 to 2017 the downward trend in NO_x emissions (not including 'fuel exports') continued with a decrease of 4.9 kt (– 3.6%). This was caused by the decline in road traffic, especially of heavy duty vehicles (*1.A.3.b.3*). The predominant share of the national NO_x emissions originates from fuel combustion. Road transport accounted for the biggest part of Austria's total NO_x emissions in the year 2017 with a contribution of 43.8%, not including 'fuel exports'.

NO_x emissions including 'fuel exports' decreased from 1990 to 2017 by 34.0% from 219.3 kt to 144.7 kt. NO_x emissions including 'fuel exports' showed extreme values in the years 2003 until 2005 and have since then decreased continuously. This is mainly due to reduced emissions from heavy trucks, especially because of improvements in the automobile industry. Compared with 2016, emissions were 4.4% lower in the year 2017. Road transport accounts for the biggest part of Austria's total NO_x emissions in the year 2017, contributing 48.9%.

4.4.3 NMVOC emissions

NMVOC emissions without 'fuel exports' amounted to 322.2 kt in 1990, and to 119.3 kt in 2017.

Since 1990, NMVOC emissions (not including 'fuel exports') decreased by 63.0%. The largest reductions were achieved in the road transport sector due to an increased use of catalytic converters and diesel cars. Reductions in the solvent sector were achieved due to various regulations (Solvent Ordinance, Cogeneration Act, VOC Emissions Ordinance).

From 2016 to 2017 NMVOC emissions (not including 'fuel exports') decreased by 2.0 kt (– 1.7%).

NMVOC emissions including 'fuel exports' amounted to 324.4 kt in the year 1990 and decreased by 63.0% by 2017 (120.2 kt). Between 2016 and 2017 NMVOC emissions decreased by 1.7%.

4.4.4 NH_3 emissions

NH_3 emissions without 'fuel exports' amounted to 65.2 kt in 1990, and to 68.9 kt in 2017.

Since 1990, NH_3 emissions (not including 'fuel exports') have increased by 5.7%. Austria's NH_3 emissions arise almost entirely from the agriculture sector (93.8%). There have been only slight changes in the emissions since 1990. The slight increase in NH_3 emissions (in spite of a decrease in the number of cattle) can be explained by an increase in loose housing systems (to ensure animal welfare and according to EU law) and an increase of high-capacity dairy cows. Additionally, there has been an increase in the use of urea as nitrogen fertiliser (a cost-efficient but otherwise less efficient fertiliser).

From 2016 to 2017 NH_3 emissions (not including 'fuel exports') increased by 0.8 kt (+ 1.2%). The main reason for this short-term increase is the larger number of dairy cows and their increased performance. Similarly, the livestock numbers of horses, swine, sheep and goats increased compared to the previous year.

NH_3 emissions including 'fuel exports' amounted to 65.2 kt in the year 1990 and increased by 6.0% by 2017 (69.1 kt). Between 2016 and 2017 NH_3 emissions increased by 1.1%.

4.4.5 $PM_{2.5}$ emissions

$PM_{2.5}$ emissions without 'fuel exports' amounted to 25.9 kt in 1990, and to 15.4 kt in 2017.

Since 1990, the $PM_{2.5}$ emissions (not including 'fuel exports') have decreased by 40.5%. Large reductions were achieved through reduced coal consumption in households (*1.A.4.b.1*) and for off-road vehicles and other machinery in the agriculture and forestry sector (*1.A.4.c.2*). There was a remarkable reduction in $PM_{2.5}$ emissions from 2013 to 2014, mainly caused by the low number of heating degree days in 2014 and therefore less biomass consumption by residential space heating in 2014. The economic crisis in 2009 caused a decrease in emissions, followed by an increase due to the recovery of the economy.

From 2016 to 2017 $PM_{2.5}$ emissions (not including 'fuel exports') decreased by 0.2 kt (– 1.4%), mainly due to reductions in road transport.

$PM_{2.5}$ emissions including 'fuel exports' amounted to 26.4 kt in the year 1990 and decreased by 40.8% by 2017 (15.6 kt). Between 2016 and 2017 $PM_{2.5}$ emissions decreased by 1.7%.

5 METHOD OF REPORTING

5.1 Methodology

The Austrian air emission inventory for the period 1990 to 2017 has been compiled according to the revised Guidelines for Reporting Emissions and Projections Data as approved by the Executive Body for the UNECE/LRTAP Convention at its 32nd session.

In Austria, emissions of air pollutants as well as emissions of greenhouse gases are all gathered in a database based on the CORINAIR nomenclature (CORe INventory AIR)/SNAP (Selected Nomenclature for sources of Air Pollution). This nomenclature was designed by the EEA to estimate emissions of all kinds of air pollutants. To comply with the reporting obligations under the UNECE/LRTAP Convention, emissions are then transformed into the NFR (Nomenclature for Reporting) format.

The complete set of tables in the NFR format, including – in particular – sectoral reports and sectoral background tables, is submitted separately in digital form only (excel files). In the report at hand, NFR summary tables are presented in Annexes 1 and 2.

The following table summarizes the status of the present report:

Table 4: Status of the present report.

Format	Inventory	Version
NFR Format (UNECE)	OLI 2018	February 11th 2019

Data presented in this report are based on the Austrian Air Emission Inventory 2018 (Österreichische Luftschadstoff-Inventur, OLI 2018) prepared by the Umweltbundesamt for the years 1990 to 2017. The Austrian air emission inventory is subject to continuous improvement, resulting in recalculations as outlined in Chapter 6.

5.2 Sources of Data

Table 5 presents the main data sources used for activity data as well as information on who carried out the actual calculations.

Table 5: Main data sources for activity data and emission values.

Sector	Data Sources for Activity Data
Energy	Energy Balance from Statistik Austria; EU-ETS; LCP emission declarations; direct information from industry or associations of industry
Transport	Energy Balance from Statistik Austria
	Yearly growth rates of transport performance on Austrian roads from the Austrian Ministry for Transport, Technology and Innovation
	Flight movements from AustroControl
IPPU	National production statistics, import/export statistics; economic indicators EU-ETS; direct information from industry or associations of industry
	Surveys conducted at companies and associations

Sector	Data Sources for Activity Data
	Reports submitted under the Industrial Emissions Directive
Agriculture	National studies, national agricultural statistics obtained from Statistik Austria
Waste	Federal Waste Management Plans
	(Data sources: Database on landfills (1998–2007), EDM – Electronic Data Management (from 2008 onwards))
	EMREG-OW (Electronic Emission Register of Surface Water Bodies)

Emission calculations and related inventory work (reporting, QA/QC, documentation and archiving, etc.) are carried out by the IBE sector experts.

If the IBE's capabilities or resources are exceeded, some of the inventory activities are subcontracted, in some cases as a matter of routine (e.g. the emission inventory for road transport), in other cases they are subcontracted if required (e.g. revision of methodologies for a complex emission source). Subcontracts have so far been entered into with:

- Technical University Graz (road and off-road transport)
- University of Natural Resources and Applied Life Sciences (agriculture)

A final QC to assess whether the requirements have been fulfilled is performed by the IBE experts.

A detailed description of activity data, emission factors, and the methodologies applied will be provided in Austria's Informative Inventory Report (IIR) 2019, which is to be submitted under the UNECE Convention on Long-range Transboundary Air Pollution and NECD 2016/2284 on 15 March 2019.

6 RECALCULATIONS

Following the continuous improvements made to the Austria's Annual Air Emission Inventory, some sources have been recalculated on the basis of updated activity data or revised methodologies. Thus the emission data for the period from 1990 to 2016 submitted this year may differ from the data reported previously.

The figures presented in this report replace former data reported by the Umweltbundesamt under the reporting framework of the UNECE/LRTAP Convention and the NEC Directive of the European Union.

Table 6: Recalculation difference with respect to the previous submission. (Source: Umweltbundesamt)

	Recalculation Difference [%]			
	NEC		**LRTAP**	
	1990	**2016**	**1990**	**2016**
SO_2	– 0.04%	– 2.24%	– 0.18%	– 2.24%
NO_x	– 0.21%	– 2.32%	– 0.39%	– 1.88%
NMVOC	6.69%	– 11.29%	7.21%	– 11.12%
NH_3	– 1.49%	0.60%	– 1.44%	0.67%
$PM_{2.5}$	0.52%	– 10.01%	0.36%	– 9.81%

Recalculations of NMVOC for the year 1990 were performed mainly in the categories *3.D.a.2.a – Animal manure* and *3.B.1.b – Non-dairy cattle*. These changes were necessary as NMVOC emissions from manure application were estimated for the first time and due to revisions of the calculations for all livestock categories (see chapters 6.3.2.6 and 6.3.2.3 for further details).

The largest downward revisions of NMVOC for the year 2016 can be found in the sector *2.D.3 – Solvent use*. This is due to a new set-up of the model on Solvent use which led to a decrease of NMVOC emissions between 2000 – 2016 (see chapter 6.2.2.6 for further details). Some upward revisions of NMVOC for the year 2016 can be found in the categories *3.B.1 – Cattle* and *3.D.a.2.a – Animal manure*, due to revisions of the calculations for all livestock categories and due to the fact that NMVOC emissions from manure application were estimated for the first time (see chapters 6.3.2.3 and 6.3.2.6 for further details).

The largest downward revisions of $PM_{2.5}$ for the year 2016 can be found in the category *1.A.2.gviii – Other Stationary Combustion in Manufacturing Industries and Construction*. This emission reduction is the result of shifting the biomass share of waste fuels used in cement plants from *1.A.2.gviii* to *1.A.2.f* and a revision of $PM_{2.5}$ emission factors (see chapter 6.1.5 for further details).

The following section describes the methodological changes made to the inventory since the previous submission (for each sector).

6.1 ENERGY (1)

6.1.1 Revision of the energy balance

The energy balance was revised by Statistik Austria for the years 1990 to 2016 with the following main implications for energy consumption:

- Natural gas gross inland consumption 2003 and 2004 has been revised downwards by – 1.0 to – 1.2 PJ. Natural gas gross inland consumption 2015 to 2016 has been revised downwards by – 0.2 and – 2.7 PJ. Natural gas consumption of oil refineries has been revised downwards for the period 2012 to 2016 by – 2.1 PJ to – 5.0 PJ (– 3.4 PJ in 2016) and has mainly been shifted to final energy consumption. For the years 2013 to 2016, a considerable share (between – 0.1 to – 2.1 PJ, 2016: – 0.1 PJ) of natural gas consumption has been shifted from power plants to final energy consumption. As a result, final energy consumption of natural gas for the period 2011–2016 has been revised by + 1.1 to + 6.2 PJ (2016: + 1.4 PJ). Natural gas consumption in private households (*1.A.4.b*) 2005 to 2016 has been strongly revised upwards (e.g. + 19.7 PJ for 2005 and + 9.8 PJ for 2016) mainly due to a shift from the commercial sector (*1.A.4.a*) and for 2012 to 2016 also from the industrial sector (*1.A.2*) and the oil refinery (*1.A.1.b*).
- For liquid fuels minor revisions have been carried out for the period 1990 to 2004, mostly because data from the Eurostat/JQ has been replaced by data from the national energy balance. Gasoil gross inland consumption 2006 to 2016 has been revised by + 4.7 PJ to – 2.6 PJ (2016: – 2.6 PJ), which mostly affects the NFR category *1.A.4 Other sectors* and, for the years 2014 and 2015, category NFR *1.A.2 Manufacturing industries and construction* (+ 3.4 PJ and + 1.9 PJ). The total revisions of liquid fuel consumption 2005 to 2016 amount to between – 1.7 PJ and + 6 PJ (2016: + 1.3 PJ) with the biggest change affecting the year 2007.
- For solid fuels minor revisions of gross inland consumption have been carried out for the years 1999 (+ 0.4 PJ) and for 2003 to 2016 (between – 1.4 PJ and + 2.5 PJ), which mainly affected category *1.A.4 Other sectors*.
- For 'other fuels' a major revision of the energy balance has taken place for the years 2005 to 2016, mainly for industrial waste. A major change for 2016 was the reallocation of industrial waste (– 4.2 PJ) to municipal solid waste (+ 2.6 PJ).

6.1.2 Changes according to recommendations of the NECD Review 2018

Following a recommendation of the NECD 2018 review, Cd, Hg, Pb, PCB and PAH emissions from category *1.A.1.c Manufacture of Solid fuels and Other Energy Industries* have been estimated.

6.1.3 Stationary combustion 1A1a, 1A1b, 1A1c, 1A2a-1A2g and 1A4a-1A4c

In general, recalculations follow the revisions of the energy balance. Revisions of methodologies are outlined in the paragraphs below.

6.1.4 Non-metallic Minerals (1.A.2.f)

NO_x emissions from glass manufacturing industries have been revised downwards by – 0.4 kt for 2016. The revised emission factors are based on new measurements (previous emission factors did not consider new abatement technologies applicable since 2003).

6.1.5 Other Stationary Combustion in Manufacturing Industries and Construction (1.A.2.g.viii)

The biomass share of waste fuels used in cement plants has been shifted from *1.A.2.gviii* to *1.A.2.f* (without changing emissions of *1.A.2.f*). This reduces the emissions by about – 0.4 kt NO_x and – 0.14 kt $PM_{2.5}$. Based on a new study performed in 2018, NO_x emission factors from biomass used in wood processing and chip board industries have been revised downwards from 169 g/GJ to 133 g/GJ and $PM_{2.5}$ emission factors have been revised from 55 g/GJ to 7.6 g/GJ. This results in $PM_{2.5}$ emissions which are about 1 kt lower and in lower NO_x emissions (– 1.2 kt) for 2016.

6.1.6 Road Transport (1.A.3.b)

Using the most recent version of the emission calculation model NEMO of Graz University of Technology, any updates and improvements of the methodology and activity data always result in recalculations of all emission components. This year's emission increase is due to a recalculation of inland diesel consumption:

- Domestic diesel consumption has increased as a result of a methodological update for the use of mobile agricultural machinery (NRMM). In the model GEORG of the Graz University of Technology, the growth indicator "grain harvest" has been reanalysed and an improved method for the time series 2005–2016 has been implemented.
- In domestic road transport, there has been a slight emission increase due to an update of the default probabilities for PC, LDV and HDV based on stock data after the year of their first registration by Statistik Austria, implemented in the NEMO model from 2010 onwards.

According to the bottom-up / top-down methodology for the calculation of domestic fuel consumption and fuel exports, an increased use of domestic diesel always results in a reduction of the quantities handled in fuel export. As fuel export is mainly associated with truck traffic, the emission reduction is strongly reflected in subsector *1.A.3.biii Heavy duty trucks and buses*.

For 2016, the above mentioned improvements lead to the following overall changes to emissions from *1.A.3 Transport* (excluding fuel exports): – 0.2 kt NO_x, – 0.02 kt NMVOC, – 0.05 kt NH_3, – 0.02 kt $PM_{2.5}$. (Changes to emissions from *1.A.3 Transport* including fuel exports: + 0.5 kt NO_x, + 0.23 kt NMVOC, + 0.05 kt NH_3, + 0.02 kt $PM_{2.5}$.)

6.1.7 Mobile Combustion (NRMM) in agriculture (1.A.4.c.2)

In the model GEORG of the Graz University of Technology, the growth indicator "grain harvest" has been re-analysed and an improved method for the time series 2005–2016 has been implemented.

For 2016 the above mentioned improvements lead to the following increase of emissions from *1.A.4.cii*: + 0.37 kt NO_x, + 0.02 kt NMVOC, – 0.03 kt $PM_{2.5}$.

6.1.8 Coal mining and handling (1.B.1.a)

Recalculations of $PM_{2.5}$ and PM_{10} emissions for the years 2005–2016 follow the revisions of the energy balance. This revision leads to a decrease of – 0.0006 kt of PM_{10} emissions and to a decrease of – 0.0002 kt of $PM_{2.5}$ emissions for 2016.

6.2 INDUSTRIAL PROCESSES (2)

6.2.1 Update of activity data

6.2.1.1 Quarrying and mining of minerals other than coal (2.A.5.a)

Due to changes in the data of the Montanhandbuch, particular matter emissions for 2016 have been revised. (– 0.01 kt $PM_{2.5}$ for 2016)

6.2.1.2 Iron and Steel Production (2.C.1)

The electric steel plants production data for 2016 has been revised (by 0.0002 kt SO_2, 0.0002 kt $PM_{2.5}$ and 0.0005 kt NO_x in 2016)

6.2.1.3 Wood processing (2.I)

Due to recalculations of the energy balances, particular matter emissions since 2005 have been changed. (– 0.002 kt $PM_{2.5}$ for 2016)

6.2.2 Methodological changes

6.2.2.1 Cement Production (2.A.1)

The notation key for SO_2 and NO_x has been changed to IE. These emissions are included in *1.A.2.f*.

6.2.2.2 Other chemical industry (2.B.10.a)

The calculations of NMVOC emissions have been revised, as PRTR data for 2016 became available for one facility (+ 0.0025 kt NMVOC in 2016)

6.2.2.3 Lead Production (2.C.5)

The notation key for SO_2 has been changed to IE. These emissions are included in *1.A.2.b*.

6.2.2.4 Road paving with asphalt (2.D.3.b)

This subsector was updated during the evaluation of the solvents model. The default values of the EMEP EEA GB 2016 were used for NMVOC. $PM_{2.5}$ will be estimated after the data on plants and installed abatement technologies has been fully investigated (+ 0.019 kt NMVOC in 2016).

6.2.2.5 Asphalt roofing (2.D.3.c)

This subsector was updated during the evaluation of the solvents model: all of the Austrian production sites are equipped with off-gas treatment systems and emissions have been negligible in the past. Therefore, the notation key has been changed to NE. The time series will be revised when data on installed abatement technologies has been fully investigated.

6.2.2.6 Solvent Use (2.D.3)

A new set-up of the model on Solvent Use has been created. Reports on actual NMVOC emissions based on solvent balances, reported under Directive 1999/13/EC (VOC Solvents Directive) have led to significant improvements of the information on substance flows in the production segment (bottom-up approach), which were incorporated into the model. Newly obtained data was allocated to the relevant SNAPs and grossed up for the relevant economic sectors by including the number of employees per company per sector and the statistical data on the total number of employees per sector. This information was incorporated into the timeline (2015–2000), overlapping with information from the old and the new model.

For the sum obtained from the top down approach, the statistical data used for estimating the overall solvent use in Austria was re-evaluated for the years 2000 onwards: import-export/production statistics were screened for further relevant items that had not been considered before, as well as for irrelevant items. In addition, further non-solvent uses were evaluated by the Institute for Industrial Ecology (IIÖ).

Both changes (combined with other minor methodological changes as explained above) resulted in a decrease of the top-down value for overall solvent consumption. Domestic solvent uses were also amended, using information obtained on paints and varnishes, and products statistics that were cross referenced with average solvent contents obtained from Germany.

This has led to a decrease of NMVOC emissions for the period 2000–2016.

6.2.2.7 Other product use (2.G)

New data became available for the amount of tobacco sold in Austria, which had previously been calculated based on data for the number of smokers, and the average amount of cigarettes smoked.

6.2.2.8 Other Production (2.H)

A recently published national study showed that the NO_x emissions reported under *2.H.1* had been double-counted. All these emissions are included in *1.A.2.d*.

6.3 AGRICULTURE (3)

6.3.1 Update of activity data

6.3.1.1 AWMS data (3.B, 3.D)

The research project 'Animal husbandry and manure management systems in Austria (TIHALO I, AMON et al. 2007)' was followed by a new study (TIHALO II, PÖLLINGER et al. 2018[12]). For this project, as for the previous one, a comprehensive survey on agricultural practices in Austria has been carried out. For the 2019 submission the results of this survey (data on livestock feeding,

[12] PÖLLINGER et al. (2018): Erhebung zum Wirtschaftsdüngermanagement aus der landwirtschaftlichen Tierhaltung in Österreich. Surveys on manure management from agricultural livstock farmings in Austria. Abschlussbericht TIHALO II. Projekt Nr./Wissenschaftliche Tätigkeit Nr. 3662. PÖLLINGER, A.; BRETTSCHUH, S.; LACKNER, L.; STICKLER, Y.; ZENTNER, A.; HBLFA Raumberg Gumpenstein & Bundesanstalt für Agrarwirtschaft, Wien. Bundesministerium für Nachhaltigkeit und Tourismus (BMNT), Wien 2018.

management systems and practices, application techniques) were implemented in Austria's emission inventory resulting in revisions for NH_3 and NO_x emissions in all animal related emission sources.

The following inventory updates have an impact on Austria's ammonia inventory:

- Increased share of loose housing systems (cattle)
- Increased share of liquid systems (cattle & swine)
- Consideration of the "grooved floor" system for cattle housings (liquid system)
- Consideration of the "partly slatted floor" system for pig housings (liquid system)
- Consideration of the "manure belt" system for poultry housings (solid system)
- Consideration of N_2 losses from manure storage
- Consideration of the following low-emission manure spreading techniques: trailing hose, trailing shoe, injector (liquid manure)
- Consideration of liquid manure amounts diluted before spreading (50% dilution)
- Consideration of rapid incorporation of solid manure (within 12h and within 4h)
- Consideration of humid conditions before application (timing)
- Improved calculations for the non-key animals sheep, goats and poultry

6.3.1.2 Livestock data (3.B, 3.D)

In response to a recommendation under the NEC Review 2018, Austria splitted the piglet numbers <20 kg into suckling piglets <8 kg and weaned piglets 8–20 kg. The share of suckling and weaned piglets was calculated on the basis of daily weight gain and official livestock data (STATISTIK AUSTRIA 2018[13]). This approach was accepted under the NEC Review 2018 and applied for all inventory years.

6.3.1.3 Land use data (3.D)

Cropland and grassland areas for the years 2014, 2015 and 2016 have been slightly revised according to the final results of the farm structure survey 2016.

6.3.1.4 Detailed raw material and energy balances (3.D.a.2.c)

Estimates have been updated on the basis of available raw material balances for the years 2015 and 2016 (E-Control 2018). Based on the new AWMS data (PÖLLINGER et al. 2018), NH_3 and NO_x emissions have been slightly revised upwards for all reporting years (+ 0.1 kt NO_x and 0.1 kt NH_3 in 2016).

[13] STATISTIK AUSTRIA (2018): Derivation of suckling and weaned piglet numbers on the basis of daily weight gain and official livestock data for piglets < 20kg. E-mail with expert judgement received on 18 June 2018.

6.3.2 Methodological changes

6.3.2.1 Manure Management (3.B) – NH3

The main reason for the changes to NH_3 emissions was the implementation of new and updated information on Austria's agriculture practices obtained from PÖLLINGER et al. (2018), e.g. an increased share of loose housing systems.

As a consequence, NH_3 emissions from manure management have been revised upwards for the whole time series (+ 1.3 kt NH_3 in 2016).

6.3.2.2 Manure Management (3.B) – NO_x

Calculations of NO_x emissions have been improved by applying the Tier 2 methodology according to the 2016 EMEP/EEA Guidebook. The use of the mass-flow approach based on the concept of a flow of TAN through the manure management system has resulted in higher emissions for the whole time series (+ 0.2 kt NO_x in 2016).

6.3.2.3 Manure Management (3.B) – NMVOC

Following a recommendation under the NEC Review 2018, Austria revised its calculations according to the 2016 EMEP/EEA 2016 Tier 2 methodology for all livestock categories. The improved calculations resulted in higher emissions for the whole time series (+ 5.1 kt NMVOC in 2016).

6.3.2.4 Agricultural Soils (3.D) – NH_3

3.D.a.1 Mineral fertiliser application

The calculation method for NH_3 emissions from mineral fertiliser application has been improved. The EMEP/EEA 2016 Tier 2 methodology based on more detailed activity data (fertiliser types) has been used for the first time. The revision has resulted in higher emissions (+ 0.4 kt in 2016). A review of the historical fertiliser data was carried out as part of the revision, resulting in a correction of the 1990–1995 fertiliser amounts.

3.D.a.2.a Animal manure applied to soils

NH_3 emissions have been revised downwards for the entire time series. The reasons are the improvements carried out in the manure management sector (e.g. updated AWMS data, taking N_2 losses into account for the first time, improved calculations of NO_x emissions, see above) resulting in smaller N amounts available for application, and also taking specific low-emission application techniques (as already described above) into account (– 1.9 kt NH_3 in 2016).

6.3.2.5 Agricultural Soils (3.D) – NO_x

3.D.a.2.a Animal manure applied to soils

Taking N_2 losses and improved NO_x calculations in the manure management sector into account resulted in smaller N amounts available for application. This has resulted in lower NO_x emissions for the whole time series (– 0.3 kt NO_x in 2016).

6.3.2.6 Agricultural Soils (3.D) – NMVOC

3.D.a.2.a Animal manure applied to soils

NMVOC emissions from manure application have been estimated based on the 2016 EMEP/EEA Tier 2 methodology for the first time. The calculations have resulted in a considerable change to the amount of emissions (+ 8.8 kt in 2016).

3.D.a.3 Urine and dung deposited by Grazing Animals

For the first time NMVOC emissions from grazing animals have been estimated. Calculations are based on the 2016 EMEP/EEA Tier 2 methodology (+ 0.1 kt in 2016).

6.3.3 Additional data sources

6.3.3.1 Biological treatment of waste (5.B) – NH_3

NH_3 emissions from anaerobic digestion at biogas facilities (5.B.2) have been submitted for the first time for the current submission. Calculations were carried out according to the Tier 1 methodology of the 2016 EMEP/EEA Guidebook. Emissions were calculated in sector *3 Agriculture* but have been reported under sector *5 Waste*. For 2016, 0.4 kt of NH_3 have been calculated for this source category.

6.4 WASTE (5)

6.4.1 Update of activity data

6.4.1.1 Biological Treatment (5.B)

Under the NEC Review 2017, the TERT encouraged Austria to include NH_3 emissions from *5.B.2* in its next submission. Calculations carried out showed that even assuming a worst case, NH_3 emissions from the anaerobic treatment of waste would amount to about 0.15% of the total national NH_3 emissions and therefore have not been included.

A major change is that the emissions from biogas plants with feedstock from agriculture have been reported for the first time within *5.B*. Up to 2016 these emissions had been reported within the agriculture sector.

6.4.1.2 Other waste (5.E)

Recalculations have been carried out for all years except 2010 and 2016, which is due to an improved method for determining the number of fire incidents per category. Now the total number of fires is determined first, and then the fires in different types of housing or homes.

ANNEX 1: AUSTRIA´S EMISSIONS BASED ON FUEL USED (WITHOUT 'FUEL EXPORTS')

Notation keys:

NE (not estimated)..... for existing emissions by sources and removals by sinks of pollutants which have not been estimated.

IE (included elsewhere) ... for emissions by sources and removals by sinks of pollutants estimated but included elsewhere in the inventory instead of the expected source/sink category.

NO (not occurring) ..... for emissions by sources and removals by sinks of pollutants that do not occur for a particular gas or source/sink category.

NA (not applicable)..... for activities in a given source/sink category that do not result in emissions or removals of a specific pollutant.

C (confidential)..... for emissions which could lead to the disclosure of confidential information if reported at the most disaggregated level. In this case a minimum of aggregation is required to protect business information.

The complete tables in the NFR format are submitted separately in digital form only (excel files).

Table A.I-1: SO_2 emissions [Kilotonnes] 1990–2017 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	70.97	68.97	2.00	1.93	0.00	0.07	NO	72.98	0.26
1991	68.13	66.83	1.30	1.61	0.00	0.06	NO	69.80	0.29
1992	51.85	49.85	2.00	1.36	0.00	0.04	NO	53.25	0.31
1993	50.48	48.38	2.10	1.11	0.00	0.04	NO	51.63	0.33
1994	44.92	43.64	1.28	1.12	0.00	0.05	NO	46.09	0.34
1995	44.68	43.15	1.53	1.07	0.00	0.05	NO	45.80	0.38
1996	42.21	41.01	1.20	0.99	0.00	0.05	NO	43.25	0.43
1997	38.97	38.91	0.07	0.96	0.00	0.05	NO	39.99	0.44
1998	34.04	34.00	0.04	0.87	0.00	0.05	NO	34.97	0.46
1999	32.38	32.34	0.04	0.81	0.00	0.06	NO	33.26	0.45
2000	30.24	30.19	0.04	0.78	0.00	0.06	NO	31.08	0.48
2001	31.10	31.05	0.05	0.71	0.00	0.06	NO	31.87	0.47
2002	30.08	30.04	0.04	0.71	0.00	0.06	NO	30.85	0.43
2003	29.91	29.86	0.05	0.71	0.00	0.06	NO	30.68	0.40
2004	26.17	26.12	0.04	0.72	0.01	0.06	NO	26.95	0.47
2005	24.63	24.59	0.04	0.72	0.00	0.06	NO	25.42	0.55
2006	25.48	25.43	0.05	0.73	0.00	0.05	NO	26.26	0.58
2007	22.20	22.14	0.05	0.75	0.00	0.04	NO	22.98	0.61
2008	19.14	19.10	0.04	0.78	0.00	0.03	NO	19.95	0.61
2009	13.87	13.81	0.06	0.70	0.00	0.02	NO	14.59	0.53
2010	15.11	15.06	0.05	0.70	0.00	0.01	NO	15.83	0.57
2011	14.37	14.32	0.05	0.68	0.00	0.01	NO	15.06	0.60
2012	13.90	13.85	0.05	0.65	0.00	0.01	NO	14.55	0.57
2013	13.84	13.81	0.04	0.59	0.00	0.01	NO	14.44	0.54
2014	14.04	14.00	0.04	0.55	0.00	0.01	NO	14.60	0.54
2015	13.36	13.32	0.04	0.57	0.00	0.01	NO	13.94	0.58
2016	12.92	12.90	0.02	0.57	0.00	0.01	NO	13.50	0.54
2017	12.20	12.16	0.04	0.57	0.00	0.01	NO	12.78	0.52

Table A.I-2: NO_x emissions [Kilotonnes] 1990–2017 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	187.97	187.97	IE	4.27	11.99	0.10	NO	204.33	2.44
1991	188.69	188.69	IE	3.93	11.93	0.09	NO	204.64	2.76
1992	179.15	179.15	IE	4.02	11.67	0.06	NO	194.90	3.00
1993	173.22	173.22	IE	1.46	11.51	0.05	NO	186.23	3.18
1994	169.02	169.02	IE	1.38	11.37	0.05	NO	181.82	3.31
1995	168.22	168.22	IE	0.90	11.56	0.05	NO	180.72	3.73
1996	168.46	168.46	IE	0.86	11.44	0.05	NO	180.81	4.14
1997	168.86	168.86	IE	0.86	11.51	0.05	NO	181.28	4.29
1998	166.67	166.67	IE	0.83	11.57	0.05	NO	179.11	4.43
1999	166.53	166.53	IE	0.82	11.22	0.05	NO	178.62	4.33
2000	165.58	165.58	IE	0.83	11.03	0.05	NO	177.49	6.44
2001	167.49	167.49	IE	0.78	11.00	0.05	NO	179.32	6.32
2002	165.31	165.31	IE	0.78	11.02	0.05	NO	177.16	5.67
2003	167.85	167.85	IE	0.81	10.55	0.05	NO	179.25	5.21
2004	166.72	166.72	IE	0.69	10.01	0.05	NO	177.47	6.09
2005	167.84	167.84	IE	0.70	10.07	0.05	NO	178.66	6.99
2006	167.01	167.01	IE	0.58	10.11	0.04	NO	177.75	7.54
2007	161.54	161.54	IE	0.48	10.26	0.04	NO	172.32	7.99
2008	154.92	154.92	IE	0.56	10.85	0.03	NO	166.35	7.90
2009	141.96	141.96	IE	0.41	10.64	0.02	NO	153.03	6.86
2010	142.21	142.21	IE	0.55	9.73	0.02	NO	152.51	7.60
2011	139.68	139.68	IE	0.51	10.23	0.02	NO	150.44	7.98
2012	135.44	135.44	IE	0.54	10.34	0.02	NO	146.34	7.68
2013	134.08	134.08	IE	0.45	10.24	0.02	NO	144.79	7.46
2014	130.32	130.32	IE	0.46	10.53	0.02	NO	141.34	7.49
2015	127.81	127.81	IE	0.52	10.91	0.02	NO	139.25	8.18
2016	124.70	124.70	IE	0.51	11.10	0.02	NO	136.33	10.28
2017	120.11	120.11	IE	0.47	10.88	0.02	NO	131.48	10.06

Table A.I-3: NMVOC emissions [Kilotonnes] 1990–2017 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	150.68	135.19	15.49	118.53	52.87	0.16	NO	322.24	0.18
1991	145.40	130.28	15.12	112.00	51.87	0.16	NO	309.43	0.20
1992	133.98	118.79	15.19	105.24	49.16	0.15	NO	288.53	0.22
1993	124.31	109.65	14.65	98.54	47.81	0.15	NO	270.80	0.24
1994	111.55	100.44	11.12	91.98	47.35	0.14	NO	251.02	0.25
1995	104.87	95.38	9.49	85.27	46.81	0.14	NO	237.09	0.29
1996	100.87	92.41	8.46	83.71	45.67	0.13	NO	230.38	0.34
1997	92.02	84.07	7.95	82.36	44.84	0.13	NO	219.35	0.37
1998	84.56	78.12	6.43	81.05	44.50	0.13	NO	210.23	0.40
1999	80.13	74.46	5.67	78.31	43.78	0.12	NO	202.35	0.39
2000	74.29	68.60	5.69	62.20	42.83	0.12	NO	179.43	0.42
2001	71.01	67.17	3.84	59.96	42.36	0.11	NO	173.44	0.41
2002	66.44	62.41	4.03	59.09	41.46	0.11	NO	167.10	0.37
2003	64.25	60.29	3.96	58.72	40.95	0.11	NO	164.03	0.34
2004	60.63	57.06	3.57	50.21	40.67	0.11	NO	151.62	0.40
2005	54.16	50.81	3.34	57.90	39.99	0.11	NO	152.16	0.47
2006	51.65	48.29	3.36	64.23	39.68	0.10	NO	155.66	0.50
2007	48.73	45.75	2.98	63.29	39.55	0.10	NO	151.66	0.53
2008	47.63	44.87	2.75	60.45	39.25	0.10	NO	147.42	0.52
2009	45.31	42.72	2.59	49.43	39.44	0.09	NO	134.26	0.45
2010	46.99	44.54	2.45	49.45	39.02	0.09	NO	135.55	0.49
2011	43.49	41.08	2.41	48.13	38.34	0.08	NO	130.04	0.51
2012	42.85	40.45	2.40	46.50	38.02	0.08	NO	127.45	0.49
2013	46.85	44.55	2.30	47.28	37.97	0.07	NO	132.17	0.46
2014	41.08	38.67	2.42	40.32	37.96	0.07	NO	119.43	0.46
2015	42.37	40.05	2.32	42.94	37.71	0.06	NO	123.08	0.50
2016	41.59	39.32	2.27	42.00	37.64	0.06	NO	121.30	0.23
2017	41.51	39.22	2.29	40.19	37.53	0.06	NO	119.30	0.20

Table A.I-4: NH_3 emissions [Kilotonnes] 1990–2017 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	2.23	2.23	IE	0.34	62.23	0.37	NO	65.15	0.00
1991	2.70	2.70	IE	0.57	62.42	0.38	NO	66.08	0.00
1992	3.02	3.02	IE	0.44	60.70	0.43	NO	64.60	0.00
1993	3.39	3.39	IE	0.28	61.54	0.52	NO	65.73	0.00
1994	3.62	3.62	IE	0.23	61.31	0.62	NO	65.79	0.00
1995	3.81	3.81	IE	0.16	62.28	0.64	NO	66.90	0.00
1996	4.07	4.07	IE	0.16	61.31	0.67	NO	66.21	0.00
1997	4.15	4.15	IE	0.16	61.62	0.67	NO	66.60	0.00
1998	4.25	4.25	IE	0.17	61.56	0.70	NO	66.68	0.00
1999	4.39	4.39	IE	0.18	60.17	0.77	NO	65.52	0.00
2000	4.28	4.28	IE	0.16	58.72	0.83	NO	64.00	0.00
2001	4.22	4.22	IE	0.14	58.57	0.93	NO	63.85	0.00
2002	3.91	3.91	IE	0.12	57.66	1.02	NO	62.72	0.00
2003	3.72	3.72	IE	0.14	57.54	1.11	NO	62.51	0.00
2004	3.49	3.49	IE	0.12	57.36	1.35	NO	62.33	0.00
2005	3.35	3.35	IE	0.12	57.25	1.45	NO	62.17	0.00
2006	3.23	3.23	IE	0.13	57.82	1.48	NO	62.66	0.00
2007	3.12	3.12	IE	0.13	59.29	1.52	NO	64.07	0.00
2008	3.00	3.00	IE	0.14	59.17	1.55	NO	63.85	0.00
2009	2.83	2.83	IE	0.14	60.90	1.58	NO	65.46	0.00
2010	2.88	2.88	IE	0.15	60.79	1.58	NO	65.40	0.00
2011	2.69	2.69	IE	0.16	60.54	1.57	NO	64.96	0.00
2012	2.63	2.63	IE	0.15	61.06	1.60	NO	65.44	0.00
2013	2.60	2.60	IE	0.15	61.40	1.55	NO	65.70	0.00
2014	2.45	2.45	IE	0.14	62.30	1.59	NO	66.49	0.00
2015	2.47	2.47	IE	0.13	62.95	1.63	NO	67.18	0.00
2016	2.40	2.40	IE	0.14	63.87	1.63	NO	68.05	0.00
2017	2.45	2.45	IE	0.16	64.62	1.62	NO	68.85	0.00

Table A.I-5: $PM_{2.5}$ emissions [Kilotonnes] 1990–2017 based on fuel used. (Source: Umweltbundesamt)

	NFR Sectors								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	21.43	21.32	0.11	3.81	0.41	0.23	NO	25.87	0.28
1995	21.04	20.95	0.09	3.15	0.40	0.24	NO	24.83	0.42
2000	20.26	20.17	0.09	2.94	0.38	0.23	NO	23.80	0.52
2001	20.41	20.32	0.09	2.84	0.38	0.23	NO	23.86	0.51
2002	19.66	19.56	0.10	2.47	0.38	0.23	NO	22.73	0.46
2003	19.34	19.23	0.10	2.41	0.37	0.24	NO	22.36	0.43
2004	18.87	18.78	0.09	2.38	0.42	0.24	NO	21.91	0.51
2005	17.74	17.65	0.09	2.29	0.37	0.21	NO	20.62	0.59
2006	17.48	17.39	0.09	2.07	0.36	0.21	NO	20.11	0.63
2007	16.75	16.67	0.08	1.87	0.37	0.26	NO	19.25	0.66
2008	16.30	16.22	0.08	1.96	0.36	0.25	NO	18.87	0.66
2009	15.40	15.34	0.06	1.83	0.35	0.25	NO	17.83	0.57
2010	16.00	15.93	0.07	1.84	0.35	0.29	NO	18.49	0.62
2011	15.00	14.93	0.07	1.88	0.33	0.29	NO	17.50	0.65
2012	14.63	14.56	0.07	1.82	0.32	0.30	NO	17.07	0.62
2013	15.26	15.19	0.07	1.81	0.31	0.26	NO	17.65	0.59
2014	13.47	13.41	0.06	1.82	0.32	0.31	NO	15.93	0.59
2015	13.52	13.46	0.07	1.75	0.31	0.33	NO	15.91	0.63
2016	13.23	13.17	0.06	1.75	0.31	0.31	NO	15.60	0.70
2017	13.01	12.95	0.06	1.75	0.31	0.31	NO	15.38	0.67

ANNEX 2: AUSTRIA´S EMISSIONS BASED ON FUEL SOLD (WITH 'FUEL EXPORTS')

Notation keys:

NE (not estimated)..... for existing emissions by sources and removals by sinks of pollutants which have not been estimated.

IE (included elsewhere) ... for emissions by sources and removals by sinks of pollutants estimated but included elsewhere in the inventory instead of the expected source/sink category.

NO (not occurring) ..... for emissions by sources and removals by sinks of pollutants that do not occur for a particular gas or source/sink category.

NA (not applicable)..... for activities in a given source/sink category that do not result in emissions or removals of a specific pollutant.

C (confidential)..... for emissions which could lead to the disclosure of confidential information if reported at the most disaggregated level. In this case a minimum of aggregation is required to protect business information.

Table A.II-1: SO_2 emissions [Kilotonnes] 1990–2017 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	71.76	69.76	2.00	1.93	0.00	0.07	NO	73.76	0.26
1991	69.18	67.88	1.30	1.61	0.00	0.06	NO	70.84	0.29
1992	52.91	50.91	2.00	1.36	0.00	0.04	NO	54.31	0.31
1993	51.68	49.58	2.10	1.11	0.00	0.04	NO	52.83	0.33
1994	46.03	44.75	1.28	1.12	0.00	0.05	NO	47.20	0.34
1995	45.71	44.18	1.53	1.07	0.00	0.05	NO	46.83	0.38
1996	42.99	41.79	1.20	0.99	0.00	0.05	NO	44.03	0.43
1997	39.44	39.37	0.07	0.96	0.00	0.05	NO	40.45	0.44
1998	34.74	34.70	0.04	0.87	0.00	0.05	NO	35.67	0.46
1999	32.90	32.85	0.04	0.81	0.00	0.06	NO	33.77	0.45
2000	30.81	30.77	0.04	0.78	0.00	0.06	NO	31.65	0.48
2001	31.79	31.74	0.05	0.71	0.00	0.06	NO	32.56	0.47
2002	30.82	30.77	0.04	0.71	0.00	0.06	NO	31.59	0.43
2003	30.71	30.66	0.05	0.71	0.00	0.06	NO	31.47	0.40
2004	26.23	26.18	0.04	0.72	0.01	0.06	NO	27.01	0.47
2005	24.68	24.64	0.04	0.72	0.00	0.06	NO	25.47	0.55
2006	25.52	25.47	0.05	0.73	0.00	0.05	NO	26.30	0.58
2007	22.23	22.18	0.05	0.75	0.00	0.04	NO	23.02	0.61
2008	19.17	19.13	0.04	0.78	0.00	0.03	NO	19.98	0.61
2009	13.90	13.84	0.06	0.70	0.00	0.02	NO	14.62	0.53
2010	15.15	15.10	0.05	0.70	0.00	0.01	NO	15.86	0.57
2011	14.40	14.35	0.05	0.68	0.00	0.01	NO	15.09	0.60
2012	13.93	13.88	0.05	0.65	0.00	0.01	NO	14.58	0.57
2013	13.88	13.84	0.04	0.59	0.00	0.01	NO	14.48	0.54
2014	14.07	14.03	0.04	0.55	0.00	0.01	NO	14.63	0.54
2015	13.39	13.35	0.04	0.57	0.00	0.01	NO	13.97	0.58
2016	12.95	12.93	0.02	0.57	0.00	0.01	NO	13.53	0.54
2017	12.23	12.19	0.04	0.57	0.00	0.01	NO	12.81	0.52

Table A.II-2: NO_x emissions [Kilotonnes] 1990–2017 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	202.96	202.96	IE	4.27	11.99	0.10	NO	219.33	2.44
1991	211.10	211.10	IE	3.93	11.93	0.09	NO	227.05	2.76
1992	199.02	199.02	IE	4.02	11.67	0.06	NO	214.77	3.00
1993	193.57	193.57	IE	1.46	11.51	0.05	NO	206.58	3.18
1994	186.20	186.20	IE	1.38	11.37	0.05	NO	198.99	3.31
1995	186.42	186.42	IE	0.90	11.56	0.05	NO	198.92	3.73
1996	205.69	205.69	IE	0.86	11.44	0.05	NO	218.05	4.14
1997	192.16	192.16	IE	0.86	11.51	0.05	NO	204.58	4.29
1998	204.68	204.68	IE	0.83	11.57	0.05	NO	217.13	4.43
1999	196.50	196.50	IE	0.82	11.22	0.05	NO	208.59	4.33
2000	202.27	202.27	IE	0.83	11.03	0.05	NO	214.18	6.44
2001	212.31	212.31	IE	0.78	11.00	0.05	NO	224.13	6.32
2002	218.43	218.43	IE	0.78	11.02	0.05	NO	230.28	5.67
2003	227.58	227.58	IE	0.81	10.55	0.05	NO	238.99	5.21
2004	225.52	225.52	IE	0.69	10.01	0.05	NO	236.28	6.09
2005	227.05	227.05	IE	0.70	10.07	0.05	NO	237.87	6.99
2006	213.80	213.80	IE	0.58	10.11	0.04	NO	224.54	7.54
2007	203.62	203.62	IE	0.48	10.26	0.04	NO	214.39	7.99
2008	187.06	187.06	IE	0.56	10.85	0.03	NO	198.50	7.90
2009	172.44	172.44	IE	0.41	10.64	0.02	NO	183.52	6.86
2010	172.84	172.84	IE	0.55	9.73	0.02	NO	183.14	7.60
2011	162.67	162.67	IE	0.51	10.23	0.02	NO	173.43	7.98
2012	157.11	157.11	IE	0.54	10.34	0.02	NO	168.01	7.68
2013	158.06	158.06	IE	0.45	10.24	0.02	NO	168.76	7.46
2014	149.13	149.13	IE	0.46	10.53	0.02	NO	160.14	7.49
2015	144.83	144.83	IE	0.52	10.91	0.02	NO	156.28	8.18
2016	139.73	139.73	IE	0.51	11.10	0.02	NO	151.36	10.28
2017	133.35	133.35	IE	0.47	10.88	0.02	NO	144.71	10.06

Table A.II-3: NMVOC emissions [Kilotonnes] 1990–2017 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	152.84	137.36	15.49	118.53	52.87	0.16	NO	324.40	0.18
1991	151.97	136.85	15.12	112.00	51.87	0.16	NO	316.00	0.20
1992	137.11	121.92	15.19	105.24	49.16	0.15	NO	291.66	0.22
1993	125.82	111.17	14.65	98.54	47.81	0.15	NO	272.32	0.24
1994	111.52	100.41	11.12	91.98	47.35	0.14	NO	250.99	0.25
1995	104.77	95.28	9.49	85.27	46.81	0.14	NO	236.98	0.29
1996	100.47	92.01	8.46	83.71	45.67	0.13	NO	229.98	0.34
1997	90.76	82.81	7.95	82.36	44.84	0.13	NO	218.09	0.37
1998	85.35	78.92	6.43	81.05	44.50	0.13	NO	211.03	0.40
1999	79.78	74.11	5.67	78.31	43.78	0.12	NO	201.99	0.39
2000	74.41	68.72	5.69	62.20	42.83	0.12	NO	179.56	0.42
2001	72.24	68.40	3.84	59.96	42.36	0.11	NO	174.67	0.41
2002	69.42	65.39	4.03	59.09	41.46	0.11	NO	170.08	0.37
2003	68.22	64.26	3.96	58.72	40.95	0.11	NO	168.01	0.34
2004	64.67	61.10	3.57	50.21	40.67	0.11	NO	155.66	0.40
2005	58.10	54.75	3.34	57.90	39.99	0.11	NO	156.10	0.47
2006	54.71	51.35	3.36	64.23	39.68	0.10	NO	158.72	0.50
2007	51.44	48.46	2.98	63.29	39.55	0.10	NO	154.37	0.53
2008	49.50	46.75	2.75	60.45	39.25	0.10	NO	149.29	0.52
2009	47.02	44.43	2.59	49.43	39.44	0.09	NO	135.97	0.45
2010	48.62	46.16	2.45	49.45	39.02	0.09	NO	137.17	0.49
2011	44.79	42.38	2.41	48.13	38.34	0.08	NO	131.34	0.51
2012	44.04	41.63	2.40	46.50	38.02	0.08	NO	128.63	0.49
2013	47.98	45.67	2.30	47.28	37.97	0.07	NO	133.29	0.46
2014	42.05	39.63	2.42	40.32	37.96	0.07	NO	120.40	0.46
2015	43.39	41.07	2.32	42.94	37.71	0.06	NO	124.10	0.50
2016	42.60	40.33	2.27	42.00	37.64	0.06	NO	122.31	0.23
2017	42.41	40.12	2.29	40.19	37.53	0.06	NO	120.19	0.20

Table A.II-4: NH_3 emissions [Kilotonnes] 1990–2017 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	2.26	2.26	IE	0.34	62.23	0.37	NO	65.19	0.00
1991	2.87	2.87	IE	0.57	62.42	0.38	NO	66.25	0.00
1992	3.13	3.13	IE	0.44	60.70	0.43	NO	64.70	0.00
1993	3.43	3.43	IE	0.28	61.54	0.52	NO	65.78	0.00
1994	3.57	3.57	IE	0.23	61.31	0.62	NO	65.74	0.00
1995	3.73	3.73	IE	0.16	62.28	0.64	NO	66.82	0.00
1996	3.85	3.85	IE	0.16	61.31	0.67	NO	65.99	0.00
1997	3.85	3.85	IE	0.16	61.62	0.67	NO	66.30	0.00
1998	4.14	4.14	IE	0.17	61.56	0.70	NO	66.56	0.00
1999	4.11	4.11	IE	0.18	60.17	0.77	NO	65.24	0.00
2000	4.02	4.02	IE	0.16	58.72	0.83	NO	63.73	0.00
2001	4.12	4.12	IE	0.14	58.57	0.93	NO	63.76	0.00
2002	4.19	4.19	IE	0.12	57.66	1.02	NO	63.00	0.00
2003	4.22	4.22	IE	0.14	57.54	1.11	NO	63.00	0.00
2004	4.02	4.02	IE	0.12	57.36	1.35	NO	62.86	0.00
2005	3.87	3.87	IE	0.12	57.25	1.45	NO	62.70	0.00
2006	3.72	3.72	IE	0.13	57.82	1.48	NO	63.15	0.00
2007	3.58	3.58	IE	0.13	59.29	1.52	NO	64.53	0.00
2008	3.31	3.31	IE	0.14	59.17	1.55	NO	64.17	0.00
2009	3.14	3.14	IE	0.14	60.90	1.58	NO	65.77	0.00
2010	3.19	3.19	IE	0.15	60.79	1.58	NO	65.70	0.00
2011	2.96	2.96	IE	0.16	60.54	1.57	NO	65.23	0.00
2012	2.90	2.90	IE	0.15	61.06	1.60	NO	65.70	0.00
2013	2.84	2.84	IE	0.15	61.40	1.55	NO	65.93	0.00
2014	2.67	2.67	IE	0.14	62.30	1.59	NO	66.71	0.00
2015	2.73	2.73	IE	0.13	62.95	1.63	NO	67.44	0.00
2016	2.67	2.67	IE	0.14	63.87	1.63	NO	68.32	0.00
2017	2.69	2.69	IE	0.16	64.62	1.62	NO	69.09	0.00

Table A.II-5: $PM_{2.5}$ emissions [Kilotonnes] 1990–2017 based on fuel sold. (Source: Umweltbundesamt)

	NFR								
	1	1 A	1 B	2	3	5	6		
	ENERGY	FUEL COMBUSTION ACTIVITIES	FUGITIVE EMISSIONS FROM FUELS	INDUSTRIAL PROCESSES	AGRICULTURE	WASTE	OTHER	NATIONAL TOTAL	International Bunkers
1990	21.93	21.82	0.11	3.81	0.41	0.23	NO	26.37	0.28
1995	21.73	21.64	0.09	3.15	0.40	0.24	NO	25.51	0.42
2000	21.11	21.02	0.09	2.94	0.38	0.23	NO	24.65	0.52
2001	21.48	21.39	0.09	2.84	0.38	0.23	NO	24.94	0.51
2002	21.06	20.96	0.10	2.47	0.38	0.23	NO	24.13	0.46
2003	20.97	20.86	0.10	2.41	0.37	0.24	NO	23.98	0.43
2004	20.48	20.39	0.09	2.38	0.42	0.24	NO	23.52	0.51
2005	19.33	19.24	0.09	2.29	0.37	0.21	NO	22.21	0.59
2006	18.76	18.67	0.09	2.07	0.36	0.21	NO	21.40	0.63
2007	17.88	17.80	0.08	1.87	0.37	0.26	NO	20.37	0.66
2008	17.09	17.02	0.08	1.96	0.36	0.25	NO	19.67	0.66
2009	16.11	16.06	0.06	1.83	0.35	0.25	NO	18.54	0.57
2010	16.71	16.64	0.07	1.84	0.35	0.29	NO	19.19	0.62
2011	15.53	15.46	0.07	1.88	0.33	0.29	NO	18.03	0.65
2012	15.10	15.03	0.07	1.82	0.32	0.30	NO	17.53	0.62
2013	15.74	15.67	0.07	1.81	0.31	0.26	NO	18.12	0.59
2014	13.83	13.77	0.06	1.82	0.32	0.31	NO	16.29	0.59
2015	13.84	13.77	0.07	1.75	0.31	0.33	NO	16.22	0.63
2016	13.50	13.44	0.06	1.75	0.31	0.31	NO	15.88	0.70
2017	13.24	13.17	0.06	1.75	0.31	0.31	NO	15.61	0.67

ENVIRONMENT AGENCY AUSTRIA **umweltbundesamt**

Umweltbundesamt GmbH
Spittelauer Lände 5
1090 Vienna/Austria

Tel.: +43-(0)1-313 04
Fax: +43-(0)1-313 04/5400

office@umweltbundesamt.at
www.umweltbundesamt.at

The report on Austria's Annual Air Emission Inventory 1990–2017, compiled by the Umweltbundesamt (Environment Agency Austria), provides a summary of Austria's SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ emissions for the years 1990 to 2017.

The report includes first information on emission trends and performed recalculations for the years 1990 and 2017. More detailed descriptions will be provided in Austria's Informative Inventory Report (IIR) 2019, which is to be submitted under the NEC Directive on 15 March 2019.

The results of the calculations compiled in the report show that between 2016 and 2017, emissions of sulphur dioxide (SO_2) decreased by 5.3%, nitrogen oxide emissions (NO_x) decreased by 3.6%, non-methane volatile organic compounds (NMVOCs) decreased by 1.7%, ammonia emissions (NH_3) increased by 1.2% and particulate matter ($PM_{2.5}$) decreased by 1.4%.

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