PERSPEKTIVEN FÜR UMWELT & GESELLSCHAFT

umweltbundesamt

Austria's Annual Air Emission Inventory 1990–2016

Emissions of SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

AUSTRIA'S ANNUAL AIR EMISSION INVENTORY 1990–2016

Emissions of SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$

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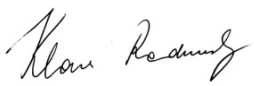

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1 EINLEITUNG

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 2018 an die Europäische Kommission übermittelt wurde, die wichtigsten Trends sowie die wesentlichen methodischen Änderungen 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 NFR-Nomenklatur der 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 Berichtes.

Inventur	Datenstand	Berichtsformat
OLI 2017	26. Jänner 2018	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 (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

Die folgende Tabelle sowie Abbildung 1 zeigt 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, 1990-2016

	Emissionen ohne Kraftstoffexport in Kilotonnen				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	73.01	204.77	302.05	66.14	25.74
1995	45.90	182.08	219.20	69.53	24.79
2000	31.08	177.71	175.98	66.35	23.77
2001	31.88	179.92	171.92	66.37	23.86
2002	30.86	177.59	166.56	65.37	22.72
2003	30.70	179.25	163.72	65.06	22.37
2004	26.95	177.75	159.00	64.65	21.97
2005	25.59	179.66	155.94	64.74	21.83
2006	26.35	178.83	151.74	65.03	21.34
2007	22.98	173.38	147.26	66.32	20.40
2008	20.22	167.46	145.23	66.06	20.10
2009	14.61	153.84	141.30	67.16	18.84
2010	16.28	153.98	142.06	66.48	19.59
2011	15.31	152.88	138.08	65.97	18.98
2012	15.07	149.23	138.26	66.11	18.92
2013	15.10	148.01	139.93	66.05	19.37
2014	14.84	143.02	134.48	66.50	17.33
2015	14.62	142.56	136.86	66.99	17.61
2016	13.81	139.57	136.74	67.64	17.34

Während für die Emissionen von SO_2, NO_x, NMVOC und $PM_{2.5}$ von 2015 auf 2016 leichte Rückgange 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 Emissionshöchstmengengesetz-Luft (EG-L, BGBl. I Nr. 34/2003), 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.

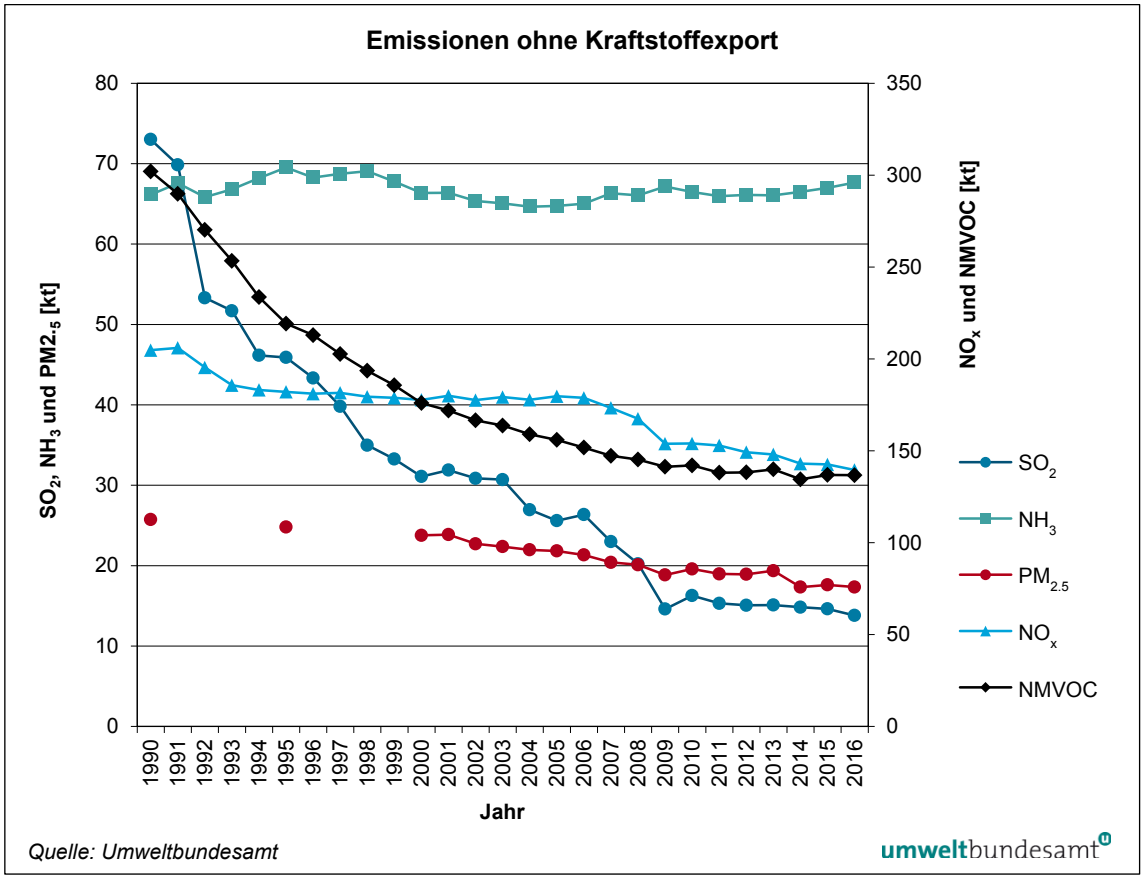

Abbildung 1: SO_2, NO_x, NMVOC, NH_3 und $PM_{2.5}$-Emissionen ohne Kraftstoffexport

[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.

Einreichung von Inventur-Anpassungsvorschlägen

Österreich hat im Jahr 2017 Vorschläge zur Anpassung spezifischer Inventurdaten für die NO_x- und NH_3-Zielerreichung bei der Europäischen Kommission eingereicht[2]. Ausschlaggebend dafür sind bei NO_x die mangelnde Wirksamkeit der auf EU-Ebene erlassenen Kfz-Abgasvorschriften und bei NH_3 methodische Änderungen in der Inventur im Vergleich zur der beim Beschluss der Emissionshöchstmengen geltenden Inventur.

Die Vorschläge wurden von der Europäischen Kommission bewilligt[3]. Damit ist es legitim, die Anpassungswerte für den NEC-Zielvergleich von der nationalen Emissionsmenge abzuziehen.

Am 15. Februar 2018 wurden von Österreich die neue Inventur-Zeitreihe 1990-2016 sowie eine Aktualisierung der im Jahr 2017 bewilligten Anpassungswerte an die Europäische Kommission übermittelt.

In Tabelle 3 sind die bewilligten Anpassungswerte (aktualisiert für die Jahre 2010-2016), die angepassten nationalen Emissionswerte sowie die nationalen Emissionshöchstwerte zusammengefasst dargestellt[4]:

Tabelle 3: Bewilligte Anpassungswerte, angepasste Inventurdaten und Emissionshöchstmengen 2010-2016

	Bewilligte Anpassungswerte („approved adjustments“)		**Angepasste Inventurdaten (Submission 2017)**		**Zulässige Emissionshöchstmengen (ab 2010)**	
	NO_x	**NH_3**	**NO_x**	**NH_3**	**NO_x**	**NH_3**
2010	-29.19 kt	-0.90 kt	124.79 kt	65.58 kt	103 kt	66 kt
2011	-31.72 kt	-0.87 kt	121.16 kt	65.10 kt	103 kt	66 kt
2012	-32.99 kt	-0.90 kt	116.24 kt	65.21 kt	103 kt	66 kt
2013	-34.18 kt	-0.91 kt	113.84 kt	65.14 kt	103 kt	66 kt
2014	-35.67 kt	-0.95 kt	107.35 kt	65.55 kt	103 kt	66 kt
2015	-35.23 kt	-1.00 kt	107.33 kt	65.99 kt	103 kt	66 kt
2016	-33.95 kt	-1.01 kt	105.62 kt	66.64 kt	103 kt	66 kt

Auf Basis der NEC-Emissionsberichterstattung 2018 (Zeitreihe 1990-2016) stellt sich der Zielvergleich wie folgt dar:

- Die festgesetzte Emissionshöchstmenge für NO_x (103 kt) wird in den Jahren 2010-2016 unter Berücksichtigung der bewilligten Anpassungen überschritten. Die Überschreitung im Jahr 2016 beträgt 2,62 kt NO_x.

[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] EEA (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). Final Review Report 2017.

[4] Zusätzliche Anpassungen für NO_x Emissionen wurden im Jahr 2018 eingereicht und sind zurzeit noch nicht bewilligt. Daher werden diese Anpassungen in diesem Bericht noch nicht berücksichtigt.

- Die festgesetzte Emissionshöchstmenge für NH_3 wird unter Berücksichtigung der bewilligten Anpassungen in den Jahren 2010-2015 unterschritten, und im Jahr 2016 um 0,64 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.

Im Rahmen der NEC-Emissionsberichterstattung im Jahr 2018 reicht Österreich zudem einen neuen Vorschlag zur Anpassung spezifischer Inventurdaten zu NO_x-Emissionen aus dem Sektor Landwirtschaft ein.

Das Ergebnis der Prüfung durch die Europäische Kommission liegt voraussichtlich Ende 2018 vor.

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 im Inland getankt, jedoch im Ausland verfahren wurde (Kraftstoffexport in Fahrzeugtanks, oft auch als „Tanktourismus“ bezeichnet).

Tabelle 4: Gesamtemissionen Österreichs inklusive Kraftstoffexport, 1990–2016

	Gesamtemissionen Österreichs inklusive Kraftstoffexport [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	73.90	220.18	302.58	66.14	26.27
1995	47.01	201.04	218.38	69.38	25.51
2000	31.68	215.26	175.81	66.01	24.62
2001	32.59	225.55	172.89	66.21	24.92
2002	31.62	231.53	169.33	65.59	24.10
2003	31.51	239.82	167.50	65.50	23.99
2004	27.01	237.43	162.88	65.13	23.57
2005	25.65	239.76	159.73	65.21	23.41
2006	26.39	226.41	154.70	65.47	22.61
2007	23.02	215.98	149.88	66.75	21.51
2008	20.25	200.38	147.05	66.35	20.90
2009	14.64	184.88	142.97	67.45	19.56
2010	16.31	184.77	143.63	66.77	20.29
2011	15.34	176.23	139.35	66.23	19.51
2012	15.10	171.09	139.40	66.36	19.39
2013	15.13	171.84	140.92	66.23	19.83
2014	14.87	161.72	135.33	66.68	17.68
2015	14.65	159.18	137.75	67.20	17.91
2016	13.84	154.26	137.62	67.86	17.60

2.4 Beschreibung der Trends

2.4.1 SO_2-Emissionen

2016 betrugen die SO_2-Emissionen 13,8 kt (ohne Kraftstoffexport). Seit 1990 (73,0 kt) nahmen die Emissionen stetig ab.

Seit 1990 konnten die SO_2-Emissionen (ohne Kraftstoffexport) um 81,1 % 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 2015 auf 2016 sind die SO_2-Emissionen (ohne Kraftstoffexport) um 0,8 kt (-5,6 %) weiter gesunken; dies geschah hauptsächlich aufgrund der Stilllegung eines großen Kohlekraftwerkskessels (1.A.1.a), aber auch wegen Reduktionen der SO_2-Emissionen in der Raffinerie (1.A.1.b), Eisen- und Stahlindustrie (1.A.2.a) und Nichtmetallischen Mineralindustrie (1.A.2.f).

Die SO_2-Emissionen inklusive Kraftstoffexport beliefen sich im Jahr 1990 auf 73,9 kt. Bis zum Jahr 2016 nahmen sie um 81,3 % auf 13,8 kt ab. Zwischen 2015 und 2016 sanken die Emissionen um 5,6 %.

2.4.2 NO_X-Emissionen

Für das Jahr 2016 wurde ein Ausstoß von rund 139,6 kt NO_x berechnet (ohne Kraftstoffexport). Im Jahr 1990 betrugen die NO_x-Emissionen ohne Kraftstoffexport 204,8 kt.

Seit 1990 nahmen die NO_x-Emissionen (ohne Kraftstoffexport) um 31,8 % 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 2015 auf 2016 setzte sich der rückläufige Trend der NO_x-Emissionen (ohne Kraftstoffexport) mit einer Reduktion um 3,0 kt (-2,1 %) 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 2016 auf den Straßenverkehr mit 43,6 % (exklusive Kraftstoffexport) entfiel.

Die NO_x-Emissionen inklusive Kraftstoffexport sind im Zeitraum 1990 bis 2016 um 29,9 % von 220,2 kt auf rd. 154,3 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 2015 beträgt der Rückgang im Jahr 2016 3,1 %. Der größte Anteil an den NO_x-Gesamtemissionen im Jahr 2016 fiel auf den Straßenverkehr mit 51,2 %.

2.4.3 NMVOC Emissionen

Die NMVOC-Emissionen ohne Kraftstoffexport betrugen im Jahr 2016 136,7 kt und im Jahr 1990 302,0 kt.

Die NMVOC-Emissionen (ohne Kraftstoffexport) sind seit 1990 um 54,7 % 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 2015 auf 2016 sind die NMVOC Emissionen (ohne Kraftstoffexport) um 0,1 kt (-0.1 %) gesunken.

Die NMVOC Emissionen inklusive Kraftstoffexport beliefen sich im Jahr 1990 auf 302,6 kt. Bis zum Jahr 2016 nahmen sie um 54,5 % auf 137,6 kt ab. Zwischen 2015 und 2016 sanken die Emissionen um 0,1 %.

2.4.4 NH_3-Emissionen

Für das Jahr 2016 wurde ein Ausstoß von rund 67,6 kt NH_3 berechnet (ohne Kraftstoffexport). Im Jahr 1990 betrugen die NH_3-Emissionen ohne Kraftstoffexport 66,1 kt.

Von 1990 bis 2016 nahmen die NH_3-Emissionen (ohne Kraftstoffexport) um 2,3 % zu. Die österreichischen NH_3-Emissionen stammen nahezu ausschließlich vom Sektor Landwirtschaft (94,3 %). 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 2015 nahmen die NH_3-Emissionen (ohne Kraftstoffexport) im letzten Berichtsjahr um 0,7 kt (+1,0 %) zu. Der Grund für den Anstieg im letzten Jahr ist vor allem der vermehrte Einsatz von Mineraldüngern auf landwirtschaftlichen Böden, insbesondere von Harnstoff. Zusätzlich trug die etwas höhere Anzahl an Milchkühen bei steigender durchschnittlicher Milchleistung zum Anstieg der sektoralen NH_3-Emissionen im Jahr 2016 bei.

Die NH_3 Emissionen inklusive Kraftstoffexport beliefen sich im Jahr 1990 auf 66,1 kt. Bis zum Jahr 2016 nahmen sie um 2,6 % auf 67,9 kt zu. Zwischen 2015 und 2016 stiegen die Emissionen um 1,0 %.

2.4.5 $PM_{2.5}$-Emissionen

Die $PM_{2.5}$-Emissionen ohne Kraftstoffexport betrugen im Jahr 2016 17,3 kt und im Jahr 1990 25,7 kt.

Seit 1990 nahmen die $PM_{2.5}$ Emissionen (ohne Kraftstoffexport) um 32,6 % 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 2015 auf 2016 sind die $PM_{2.5}$ Emissionen (ohne Kraftstoffexport) um 0,3 kt (-1,5 %) gesunken; hauptsächlich aufgrund von Reduktionen im Sektor Energie und Verkehr.

Die $PM_{2.5}$-Emissionen inklusive Kraftstoffexport sind im Zeitraum 1990 bis 2016 um 33,0 % von 26,3 kt auf rd. 17,6 kt gesunken. Verglichen mit 2015 beträgt der Rückgang im Jahr 2016 1,7 %. Der mit 40,8 % Anteil größte Verursacher an den $PM_{2.5}$-Gesamtemissionen im Jahr 2016 fiel auf die Haushalte (1.A.4.b.1), deren Emissionen hauptsächlich durch Holzheizungen (v. a. Allesbrenner-Kessel für feste Brennstoffe, Stückholz-Einzelöfen und Kachelöfen, sowie Putzgrundöfen) verursacht werden.

2.5 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[5], 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[6] bestätigte das Ausmaß des Kraftstoffexportes. 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 2016 sind etwa 15 kt, das sind rd. 11 % der NO_x-Gesamtemissionen Österreichs, auf diesen Effekt zurückzuführen. Besonders ab Ende der 90er Jahre kam es zu einem verstärkten Anstieg der NO_x-Emissionen, bedingt durch den zunehmenden Kraftstoffexport, vor allem im Schwerverkehr. Im Jahr 2003 wurde ein Höchstwert erreicht; seither nimmt der Kraftstoffexport kontinuierlich ab.

[5] 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.

[6] 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.

Tabelle 5: Emissionen aus Kraftstoffexport in Fahrzeugtanks

	Emissionen in tausend Tonnen [Kilotonnen]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	0,89	15,41	0,53	0,00	0.54
1995	1,11	18,96	-0,82	-0,15	0.72
2000	0,59	37,55	-0,18	-0,34	0.84
2001	0,71	45,62	0,98	-0,16	1.06
2002	0,76	53,95	2,76	0,22	1.39
2003	0,81	60,57	3,78	0,44	1.62
2004	0,06	59,68	3,88	0,48	1.60
2005	0,05	60,09	3,80	0,48	1.58
2006	0,04	47,59	2,96	0,45	1.27
2007	0,04	42,59	2,62	0,43	1.11
2008	0,03	32,92	1,82	0,29	0.79
2009	0,03	31,04	1,67	0,29	0.72
2010	0,04	30,79	1,58	0,29	0.70
2011	0,03	23,35	1,27	0,26	0.53
2012	0,03	21,86	1,15	0,25	0.47
2013	0,03	23,82	0,98	0,18	0.46
2014	0,03	18,71	0,86	0,18	0.35
2015	0,03	16,62	0,89	0,21	0.30
2016	0,03	14,68	0,88	0,22	0.26

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 2016. Trend tables 1990–2016 (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)[7] of EIONET in digital form (excel files).

[7] 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 1990–2016 not including fuel exports

	Austria's Air Emissions not including 'fuel exports' [Kilotonnes]				
	SO_2	**NO_x**	**NMVOC**	**NH_3**	**$PM_{2.5}$**
1990	73.01	204.77	302.05	66.14	25.74
1995	45.90	182.08	219.20	69.53	24.79
2000	31.08	177.71	175.98	66.35	23.77
2001	31.88	179.92	171.92	66.37	23.86
2002	30.86	177.59	166.56	65.37	22.72
2003	30.70	179.25	163.72	65.06	22.37
2004	26.95	177.75	159.00	64.65	21.97
2005	25.59	179.66	155.94	64.74	21.83
2006	26.35	178.83	151.74	65.03	21.34
2007	22.98	173.38	147.26	66.32	20.40
2008	20.22	167.46	145.23	66.06	20.10
2009	14.61	153.84	141.30	67.16	18.84
2010	16.28	153.98	142.06	66.48	19.59
2011	15.31	152.88	138.08	65.97	18.98
2012	15.07	149.23	138.26	66.11	18.92
2013	15.10	148.01	139.93	66.05	19.37
2014	14.84	143.02	134.48	66.50	17.33
2015	14.62	142.56	136.86	66.99	17.61
2016	13.81	139.57	136.74	67.64	17.34

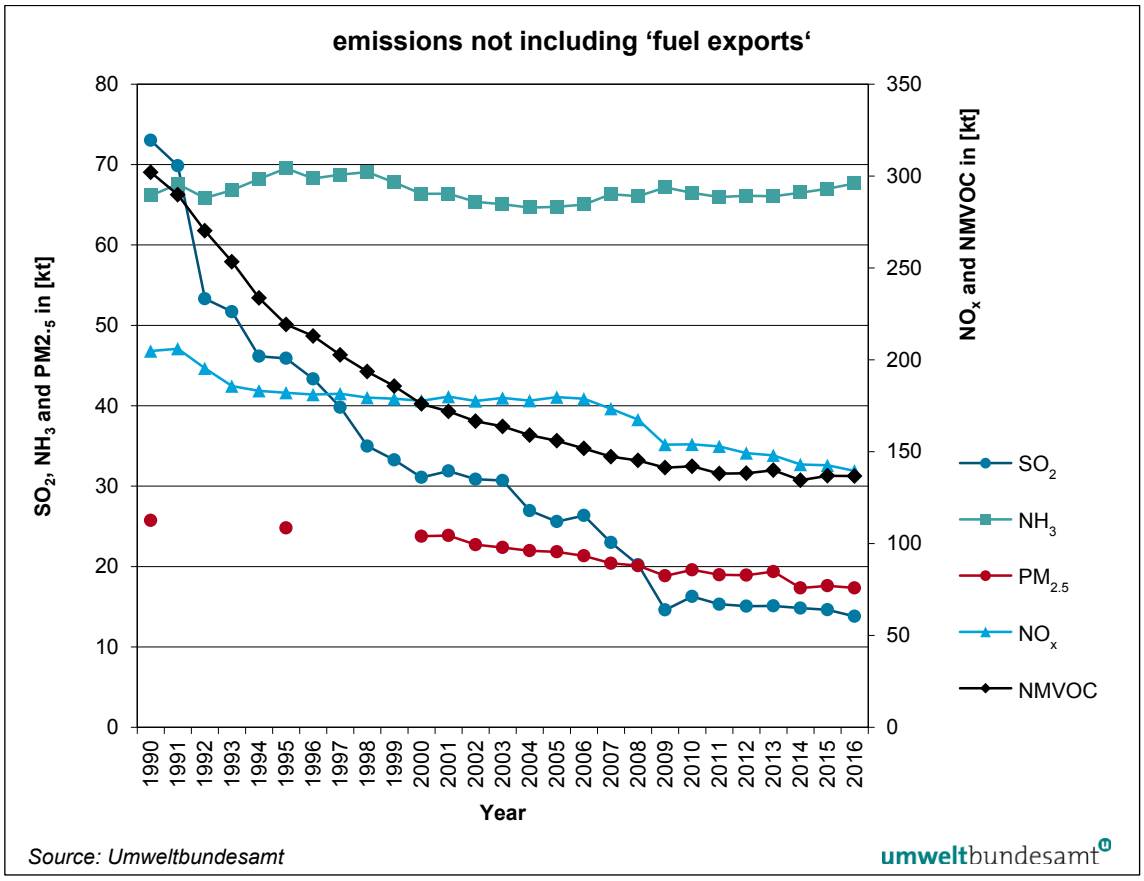

Figure 1: SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$ emissions not including 'fuel exports'

4.2 Emissions including 'fuel exports'

According to the 2013 Reporting Guidelines, Parties within the EMEP[8] 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.

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

Table 2: Austria's total emissions 1990–2016 including fuel exports

	Austria's Total Emissions [Kilotonnes]				
	SO_2	NO_x	NMVOC	NH_3	$PM_{2.5}$
1990	73.90	220.18	302.58	66.14	26.27
1995	47.01	201.04	218.38	69.38	25.51
2000	31.68	215.26	175.81	66.01	24.62
2001	32.59	225.55	172.89	66.21	24.92
2002	31.62	231.53	169.33	65.59	24.10
2003	31.51	239.82	167.50	65.50	23.99
2004	27.01	237.43	162.88	65.13	23.57
2005	25.65	239.76	159.73	65.21	23.41
2006	26.39	226.41	154.70	65.47	22.61
2007	23.02	215.98	149.88	66.75	21.51
2008	20.25	200.38	147.05	66.35	20.90
2009	14.64	184.88	142.97	67.45	19.56
2010	16.31	184.77	143.63	66.77	20.29
2011	15.34	176.23	139.35	66.23	19.51
2012	15.10	171.09	139.40	66.36	19.39
2013	15.13	171.84	140.92	66.23	19.83
2014	14.87	161.72	135.33	66.68	17.68
2015	14.65	159.18	137.75	67.20	17.91
2016	13.84	154.26	137.62	67.86	17.60

4.3 Emissions from 'fuel exports'

In the year 2004, a study[9] 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[10].

The following Table 3 provides information on the quantities of emissions that can be attributed to fuel exports in vehicle tanks. In 2016, about 11% of the reported NO_x emissions were due to 'fuel exports'.

[9] 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 by order of the Austrian Ministry of Life, not published. Graz, 2004.

[10] 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 by order 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	0,89	15,41	0,53	0,00	0.54
1995	1,11	18,96	-0,82	-0,15	0.72
2000	0,59	37,55	-0,18	-0,34	0.84
2001	0,71	45,62	0,98	-0,16	1.06
2002	0,76	53,95	2,76	0,22	1.39
2003	0,81	60,57	3,78	0,44	1.62
2004	0,06	59,68	3,88	0,48	1.60
2005	0,05	60,09	3,80	0,48	1.58
2006	0,04	47,59	2,96	0,45	1.27
2007	0,04	42,59	2,62	0,43	1.11
2008	0,03	32,92	1,82	0,29	0.79
2009	0,03	31,04	1,67	0,29	0.72
2010	0,04	30,79	1,58	0,29	0.70
2011	0,03	23,35	1,27	0,26	0.53
2012	0,03	21,86	1,15	0,25	0.47
2013	0,03	23,82	0,98	0,18	0.46
2014	0,03	18,71	0,86	0,18	0.35
2015	0,03	16,62	0,89	0,21	0.30
2016	0,03	14,68	0,88	0,22	0.26

4.4 Description of trends

4.4.1 SO_2 emissions

In 2016, SO_2 emissions amounted to 13.8 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 81.1%. 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), and from iron and steel (1.A.2.a) and pulp and paper (1.A.2.d) production.

From 2015 to 2016 SO_2 emissions (not including 'fuel exports') decreased by 0.8 kt (-5.6%). This was mainly caused by the decommissioning of a large coal boiler (1.A.1.a) as well as by reductions in emissions from oil refineries (1.A.1.b), and from iron and steel (1.A.2.a) and non-metallic minerals (1.A.2.f) industries.

SO_2 emissions including 'fuel exports' amounted to 73.9 kt in the year 1990 and decreased by 81.3% by 2016 (13.8 kt). Between 2015 and 2016 SO_2 emissions decreased by 5.6%.

4.4.2 NO_X emissions

In 1990, NO_x emissions without ‘fuel exports’ amounted to 204.8 kt, and in 2016 to 139.6 kt.

Since 1990, NO_x emissions (not including ‘fuel exports‘) have decreased by 31.8%. 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 2015 to 2016 the downward trend in NO_x emissions (not including ‘fuel exports‘) continued with a decrease of 3.0 kt (-2.1%). 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 the incineration of fuels. Road transport accounted for the biggest part of Austria's total NO_x emissions in the year 2016 with a contribution of 43,6%, not including ‘fuel exports’.

NO_x emissions including 'fuel exports' decreased from 1990 to 2016 by 29.9% from 220.2 kt to 154.3 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 2015, emissions were 3.1% lower in the year 2016. Road transport accounts for the biggest part of Austria's total NO_x emissions in the year 2016 contributing 51.2%.

4.4.3 NMVOC emissions in 2016 and trends 1990-2016

NMVOC emissions without ‘fuel exports’ amounted to 302.0 kt in 1990, and to 136.7 kt in 2016.

Since 1990, NMVOC emissions (not including ‘fuel exports‘) decreased by 54.7%. 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 2015 to 2016 NMVOC emissions (not including ‘fuel exports‘) decreased by 0.1 kt (-0.1%).

NMVOC emissions including ‘fuel exports‘ amounted to 302.6 kt in the year 1990 and decreased by 54.5% by 2016 (137.6 kt). Between 2015 and 2016 NMVOC emissions decreased by 0.1%.

4.4.4 NH_3 emissions

NH_3 emissions without ‘fuel exports’ amounted to 66.1 kt in 1990, and to 67.6 kt in 2016.

Since 1990, NH_3 emissions (not including ‘fuel exports‘) increased by 2.3%. Austria's NH_3 emissions are almost entirely emitted from the agriculture sector (94.3%). There have been only slight changes in the emissions since 1990. The light 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 less efficient fertiliser).

From 2015 to 2016 NH_3 emissions (not including ‘fuel exports‘) increased by 0.7 kt (+1.0%). The increase was caused by an increased use of mineral fertilisers on agricultural soils, especially the use of urea. Additionally, the slightly higher number of dairy cows with a higher average milk yield was responsible for the increase in the sectoral NH_3 emissions in the year 2016.

NH_3 emissions including ‘fuel exports‘ amounted to 66.1 kt in the year 1990 and increased by 2.6% by 2016 (67.9 kt). Between 2015 and 2016 NH_3 emissions increased by 1.0%.

4.4.5 $PM_{2.5}$ emissions

$PM_{2.5}$ emissions without ‘fuel exports’ amounted to 25.7 kt in 1990, and to 17.3 kt in 2016.

Since 1990, the $PM_{2.5}$ emissions (not including ‘fuel exports‘) decreased by 32.6%. 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 lower 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 2015 to 2016 $PM_{2.5}$ emissions (not including ‘fuel exports‘) decreased by 0.3 kt (-1.5%), mainly due to reductions in the energy and transport sectors.

$PM_{2.5}$ emissions including ‘fuel exports‘ amounted to 26.3 kt in the year 1990 and decreased by 33.0% by 2016 (17.6 kt). Between 2015 and 2016 $PM_{2.5}$ emissions decreased by 1.7%.

The sector residential-stationary (1.A.4.b.i) contributed with 40.8% the largest share to Austria's total $PM_{2.5}$ emissions in the year 2016, which is mainly due to biomass boilers/stoves used for space heating.

5 METHOD OF REPORTING

5.1 Methodology

The Austrian air emission inventory for the period 1990 to 2015 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 summarises the status of the present report:

Table 4: Status of the present report.

Format	Inventory	Version
NFR Format (UNECE)	OLI 2017	February 15th 2018

Data presented in this report are based on the Austrian Air Emission Inventory 2017 (Österreichische Luftschadstoff-Inventur, OLI 2017) prepared by the Umweltbundesamt for the years 1990 to 2016. 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
IPPU	National production statistics, import/export statistics; EU-ETS; direct information from industry or associations of industry
	Surveys conducted at companies and associations
	Reports submitted under the Industrial Emissions Directive

Sector	Data Sources for Activity Data
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.

In cases in which 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 where required (e.g. revision of methodologies for a complex emission source). Such subcontracts have so far be entered into with:

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

The final QC to assess whether the requirements have been fulfilled is made 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) 2018, which is to be submitted under the UNECE Convention on Long-range Transboundary Air Pollution and NECD 2016/2284 on 15 March 2018.

6 RECALCULATIONS

Following the continuous improvements made to the Austria's Annual Air Emission Inventory emissions, 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 the data reported earlier 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.

	Recalculation Difference [%]			
	NEC		**LRTAP**	
	1990	**2015**	**1990**	**2015**
SO_2	-0.89%	-1.65%	-0.91%	-1.66%
NO_x	0.81%	8.22%	-0.32%	6.74%
NMVOC	8.94%	21.80%	7.82%	22.02%
NH_3	0.07%	0.27%	-0.01%	0.49%
$PM_{2.5}$	4.33%	7.86%	4.06%	7.76%

The changes to NO_x emissions for the year 2015 are mainly due to methodological updates in the road transport category (1.A.3.b.i passenger cars).

Recalculations of NMVOC for the years 1990 and 2015 are mainly due to the inclusion of a new source in the agriculture sector: In the inventory submitted in 2017 NMVOC emissions from manure management were reported for the first time. Some major changes for the year 1990 are due to emission reductions in the residential/stationary category (1.A.4.b.i) due to the application of a new space heating energy demand model. Some emissions increased due to methodology changes in the road transport category (1.A.3.b.v – Road Transport, Gasoline evaporation).

Recalculations for $PM_{2.5}$ are mainly due to the application of a new space heating energy demand model in the residential/stationary category (1.A.4.b.i).

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

In previous versions of the energy balance, category 1.A.4.a was used as a 'residual' sector for the amount of fuels which could not be attributed to sectors by default. For the years 2012 onwards a new systematic approach has been applied by Statistik Austria for gasoil, residual fuel oil, LPG, natural gas, wood pellets and briquettes. Under this new approach amounts of fuel which are not covered by bottom up statistics or census data are considered in a different way. These amounts of fuels are now listed under final energy consumption in the subcategories 1.A.2 Manufacturing industries and 1.A.4 'other sectors', depending on the estimated incompleteness (e.g. small companies which are not obliged to report energy consumption) or uncertainty (census data) of fuel consumption in these sectors. These methodological changes do not affect the total final consumption data for these fuels but lead to shifts between 1.A.2 and 1.A.4 subcategories.

The energy balance was revised by Statistik Austria for the years 2003 to 2015 with the following main changes for energy consumption and CO_2 emissions:

- Natural gas for the years 2011−2015 has been shifted between 'final energy consumption', 'other energy industries' and 'transformation input to power plants' (−0.1 to 3.1 PJ). Total natural gas consumption has not been affected in any year.
- For liquid fuels, minor revisions have been made for the period 2005-2015 (mainly shifts between 1.A.2 and 1.A.4 subcategories). E.g. for the year 2015 about 3.4 PJ have been shifted from 1.A.4.a.i to 1.A.4.b.i.
- For solid fuels, minor revisions (of about +0.05 PJ) have been made for the years 2002−2004 and category '1.A.1.a public electricity and heat production'. For 2005–2015, minor revisions have been made for category '1A2 manufacturing industries' (-0.16 PJ in 2015) and category '1.A.4 Other sectors' (-0.17 PJ in 2015).
- For 'other fuels', a major revision of the energy balance took place for the years 2005-2013, which resulted in +0.5 PJ for '1.A.1.a public electricity and heat production' in 2013. Other revisions of the energy balance resulted in +1.5 PJ for '1A2c Chemicals Industries' for the year 2015 and -2.5 PJ for the year 2009.

6.1.2 Changes according to recommendations of the NECD Review 2017

Following a recommendation from the NECD review 2017, SO_2 emissions from natural gas combustion have been estimated using the methodologies from the EMEP/EEA 2016 Guidebook. In previous versions of the inventory, SO_2 emissions from natural gas combustion were judged as negligible and not estimated. The revision leads to about +0.07 kt of SO_2 emissions in 2015.

6.1.3 Public Electricity and Heat Production (1.A.1.a)

Updates of large combustion plants emissions declarations have resulted in +0.17 kt NO_x emissions for 2015. Other revisions follow the revisions of the energy balance (in total +0.31 kt NO_X, -0.02 kt SO_2 and +0.01 kt NMVOC for the year 2015).

6.1.4 Manufacture of Solid fuels and Other Energy Industries (1.A.1.c)

Recalculations follow the revisions of the energy balance, resulting in lower NO_x emissions in the range from -0.14 kt to -0.22 kt for the years 1999-2004 and -0.38 kt NO_x for the year 2015.

6.1.5 Manufacturing Industries and Construction (1.A.2)

The changes in this category mainly result from the revisions of the energy balance. The largest recalculations for the year 2015 took place for category 1.A.2.g.7 with higher NO_x emissions (+0.8 kt), lower NMVOC emissions (-0.39 kt) and lower $PM_{2.5}$ emissions (-0.05 kt), and for category 1.A.2.g.8 with higher NO_x emissions (+0.69 kt), higher SO_2 emissions (+0.1 kt), and higher $PM_{2.5}$ emissions (+0.12 kt)

6.1.6 Households, Institutional/Commercial and Agriculture sector (1.A.4.a.i, 1.A.4.b.i and 1.A.4.c.i)

The following table (Table 7) shows recalculations totals for categories 1.A.4.a.i, 1.A.4.b.i and 1.A.4.c.i for selected years.

Table 7: Recalculation totals for categories 1.A.4.a.i, 1.A.4.b.i and 1.A.4.c.i.

Recalculations (kt)		1990	1995	2000	2005	2010	2011	2012	2013	2014	2015
1A4ai	NO_x	-0.27	-0.09	-0.06	0.71	0.53	0.48	0.22	0.23	0.11	0.27
1A4ai	SO_2	-0.29	-0.15	-0.10	0.12	0.01	0.02	0.03	0.02	-0.02	-0.09
1A4ai	NMVOC	0.67	0.52	-0.68	0.14	0.66	0.46	0.65	0.67	0.55	1.02
1A4ai	$PM_{2.5}$	0.08	0.08	0.05	0.14	0.14	0.10	0.12	0.12	0.11	0.20
1A4bi	NO_x	1.84	2.11	0.51	0.66	1.05	1.08	1.35	1.29	1.30	1.13
1A4bi	SO_2	0.01	0.01	0.53	-0.14	0.05	0.08	0.13	0.07	0.06	-0.05
1A4bi	NMVOC	-16.68	-13.72	-2.95	-0.36	1.21	1.60	1.77	1.94	2.14	1.59
1A4bi	$PM_{2.5}$	1.22	1.38	1.30	1.71	1.73	1.63	1.69	1.76	1.48	1.42
1A4ci	NO_x	0.03	0.04	-0.06	-0.31	-0.20	-0.16	-0.11	-0.26	-0.22	-0.29
1A4ci	SO_2	0.00	0.00	0.00	0.00	-0.02	0.00	-0.01	-0.02	-0.01	-0.02
1A4ci	NMVOC	1.54	1.56	-0.33	-0.20	0.44	0.48	0.94	0.94	0.68	0.57
1A4ci	$PM_{2.5}$	0.12	0.10	0.07	-0.01	0.06	0.06	0.13	0.09	0.06	0.03

Emission calculations for 1.A.4.a.i, 1.A.4.b.i and 1.A.4.c.i are now calculated on the basis of a new energy demand model for space heating. The model considers more detailed technologies (boilers, stoves) and provides an improved time series consistency.

Emissions from industrial waste incineration for the years 1990 to 2000 have been shifted from category 1.A.4.a.i to category 1.A.1.a in order to increase time series consistency of those sectors. The shift results in lower NO_x emissions (-0.23 kt) and lower SO_2 emissions (-0.29 kt) for the year 1990.

6.1.7 Aviation (1.A.3.a)

An update of the aviation emission model for calculating emissions of 2016 has been performed which includes the newest EMEP/EEA 2016 (Annex 5) emission factors. Flight movement data and the calculation of distances between airports have been improved.

As a recalculation of the whole time series (1990-2015) with the updated emission model is not possible due to a lack of detailed data (which are needed from now on) and budgetary resources, the result for 2016 cannot be compared with the result for 2015 in the submission for 2017. An application of the updated emission model to all inventory years, or a calibration to ensure a consistent time series is planned for the next submission in 2019.

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

In road transport several improvements have been implemented. The most important are:

- Update of NO_x emission factors for diesel passenger cars (PC) in the model NEMO according to the latest HBEFA Version V3.3 (March 2017).

The latest measurements of EURO 4, 5 and 6a/b for diesel PC have shown higher real-drive NO_x emissions compared to the previous version. These findings were implemented in HBEFA V3.3 including the effect of different ambient temperatures on the behaviour of exhaust gas after-treatment systems.

NO_x	NEMO HBEFA3.2	NEMO HBEFA3.3
PRE ECE	1,01	1,01
ECE15/01	1,01	1,01
ECE15/02	1,01	1,01
ECE15/03	1,01	1,01
ECE15/04	1,01	1,01
US 83	0,75	0,75
Gesetz A	0,77	0,77
EURO 2	0,82	0,82
EURO 3	0,86	0,86
EURO 4	0,57	0,64
EU4+DPF	0,57	0,64
EURO 5	0,69	0,85
EURO 6a/b	0,27	0,50
EURO 6d temp	0,14	0,17
EURO 6d	-	0,11

Table 8: Comparison of NO_x emission factors for diesel PC of HBEFA v3.2 and v3.3

As the first EURO 4 diesel PC entered the fleet in the model NEMO in the year 2004, higher NO_x emissions can be seen for PC (excluding fuel exports) from the year 2004 onwards. This effect cannot be seen when looking at the total NO_x emissions from PC including fuel exports. Up to 2010, NO_x emissions from PC which include fuel exports are lower for the whole time series compared to the last submission. This can be explained by this year's higher estimated fuel consumption by PC in Austria (excl. fuel exports) caused by:

- Refined calibration of specific CO_2 emissions from newly registered PCs and LDVs for all years, taking into account the special characteristics of the fuels used in the type approval process.

In the model NEMO this revision leads to a shift between fuel consumption in Austria and fuel exports. In total, fuel consumption by PC is lower until 2009 and shows a strong upward trend for the years after 2010, which can be explained by another improvement compared to last year's submission:

- Increase in the specific yearly mileage for diesel PC from 2010 onwards.

The upward revision of NO_x emissions from PC from 2010 onwards shows the same development as fuel consumption and is reinforced by the higher NOx emission factors for diesel PC from EURO 4 onwards.

The changes in the NO_x emissions from HDV are caused by shifts between fuel consumption in Austria and fuel exports. In the newest NEMO version (4.0.3 from Dec. 2017) activity data for inland road transport has been increased due to new findings for the yearly mileage for passenger cars and mopeds and higher specific CO_2 emissions from newly registered cars. In the emission model, higher fuel consumption in Austria leads to lower fuel export activities. Because of the specific fleet composition for fuel exports (mainly HDV EURO 6), the decrease can be fully observed in category 1A3b3.

Further improvements:

- Calculation of $PM_{2.5}$ emissions for 1A3b4 (mopeds and motorcycles) based on the Tier 2 methodology and emission factors according to the EMEP/EEA Guidebook 2016.
- Separate calculation of $PM_{2.5}$ emissions for 1.A.3.b.6 (tyre and brake ware) and 1.A.3.b.v.7 (road wear). According to the EMEP/EEA Guidebook 2016, road resuspension is no longer reported under 1.A.3.b.6 or 1.A.3.b.7.
- Separate calculation of the different evaporation emissions (diurnal, running losses and hot soak emissions).
- For the year 2015 there are marginal changes in emissions, caused by downward revisions of the levels for liquefied petroleum gas (LPG) in the national energy balance.

For 2015, the mentioned improvements lead to the following overall changes in emissions for 1.A.3 Transport (excluding fuel exports): +7.3 kt NO_x, +1.2 kt NMVOC, -0.2 kt NH_3. (Changes in emissions for 1A3 Transport including fuel exports: +6.6 kt NO_x, +1.6 kt NMVOC, -0.07 kt NH_3, +0.3 kt $PM_{2.5}$.)

6.1.9 Rail transport (1.A.3.c)

Changes in emissions for the year 2015 are caused by revised levels for diesel consumption in the national energy balance. Recalculations for the whole time series can be explained by a transcription error in the overview table of the emission model showing the results per sector, which was resolved in this submission. The main emission changes for 2015 are: -0.1 kt NO_x, -0.01 kt SO_2, -0.01 kt NMVOC, -0.01 kt $PM_{2.5}$.

6.1.10 NRMM for Industry (1.A.3.g.7) and Agriculture (1.A.4.c.2)

Emission factors for NO_x, and $PM_{2.5}$ in the model GEORG have been updated for non-road mobile machinery (NRMM) in industry and agriculture of the emission standards (stages) IIIA, IIIB and IV. The update is based on new emission measurements commissioned by the Federal Ministry of Sustainability and Tourism (the former Federal Ministry of Agriculture, Forestry, Environment and Water Management).

NO_x emission factors for stage IIIA, IIIB and IV have been increased considerably and are now way above the limit values. Measurements showed that NO_x emission levels of stage IIIA machinery were consistently above those of stage II machinery. Only stage IIIB shows lower emissions compared to stage II.

For 2015 the mentioned improvements lead to the following overall changes in emissions:

- 1.A.2.g.7 Mobile Combustion in Manufacturing Industries and Construction:
  +0.8 kt NO_x, -0.4 kt NMVOC, -0.05 kt $PM_{2.5}$.
- 1.A.4.c.2 Mobile Combustion in Manufacturing Industries and Construction:
  +1.03 kt NO_x, -0.6 kt NMVOC, -0.05 kt $PM_{2.5}$.

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

Recalculations of $PM_{2.5}$ emissions for the years 2005 (-0.001 kt), 2006 (-0.001 kt), 2007 (-0.001 kt), 2008 (-0.0001 kt), 2014 (-0.0004 kt) and 2015 (-0.0003 kt) follow the revisions of the energy balance.

6.1.12 Distribution of oil products (1.B.2.a.5)

NMVOC emissions from this source were revised for 2015 to correct a transcription error (-0.03 kt NMVOC)

6.2 INDUSTRIAL PROCESSES (2)

6.2.1 Update of activity data

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

Due to an update of the activity data for one cast iron facility in 2015, SO_2 and NMVOC emissions for 2015 have been revised.

6.2.1.2 Non Energy Products from Fuel and Solvent Use (2.D)

Due to a transcription error, activity data and emission data for 2015 had to be updated, which led to an increase of 0.21 kt of NMVOC for '2.D.3.a Domestic solvent use including fungizides' and '2.D.3.g Chemical products'

6.2.2 Methodological changes

6.2.2.1 Other Production (2.H)

NMVOC emissions from chipboard production had been double counted. These emissions were reported under 2.H and in 2.D. In order to avoid any further double counting, these emissions are now reported only under 2.D.

6.2.2.2 Chemical Industry (2.B.10)

Calculations of NMVOC emissions have been revised, now only emissions on facility level are used. Emissions from smaller plants are included in the solvents model and reported under 2.D.

6.2.2.3 Non-ferrous metals industries (2.C.7)

Calculations of non-ferrous metals have been improved, based on available facility data and the 2016 guidelines. PM emissions occurring in secondary copper, aluminum and lead production have been included in this year's submission. Emissions occurring during secondary copper production were previously partly reported in the energy sector.

6.2.2.4 Other product use (2.G)

New emission factors became available with the EMEP Guidebook 2016 and were applied to emissions from Tobacco Smoking and Fireworks. The amount of tobacco smoked is based on two statistical surveys on smoking carried out by Statistik Austria in the years 2014 and 2006/7. Additional data was taken from the OECD health statistics 2017 for 1997 and 1986, and data on the number of smokers in relation to the total population was interpolated. The number of cigarettes smoked per smoker was taken from the Austrian surveys on smokers, and the number of cigarettes smoked per capita was extra/interpolated from 2006/7 and 2014 data. According to the 2016 EMEP guidebook, the amount of tobacco per cigarette smoked was assumed to be 1g.

As for fireworks, the amount of fireworks in kg was taken from statistics. The amount placed on the market in Austria was calculated in the following way: 'import – export + production'.

6.3 AGRICULTURE (3)

6.3.1 Update of activity data

Milk yield data (3.B, 3.D)

Milk yield data on dairy cows for the years 1991-1993 and 2001 was updated on the basis of official data from the Ministry of Agriculture (BMLFUW 2017). The revision resulted in slightly higher emissions for the years 1991-1993 and slightly lower emissions for 2001.

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

In 2017 new information on input materials for Austria's biogas plants became available (raw material balances for 2014 and 2015). The updated data were taken from (E-Control 2017) and resulted in revised amounts of digested manure and energy crops for 2012-2015 (the latest available raw material balance used in the previous inventory was for 2011).

Urea consumption (3.D.a.1)

The amount of urea consumption for 2015 was revised, which resulted in higher NH_3 emissions for the respective year (244 t).

Cropland and grassland (3.D.e)

The cropland and grassland areas for the years 2014 and 2015 were revised according to the results of the farm structure survey 2016.

6.3.2 Methodological changes

6.3.2.1 Agricultural Soils (3.D) – NMVOC

Cultivated Crops (3.D.e)

In previous submissions NMVOC emissions from cropland had been calculated by applying the EMEP/EEA 2016 default NMVOC EF of wheat for the total cropland area. As recommended in the NEC Review 2017, estimates have now been provided for all relevant crop type areas for which EFs are available in the 2016 EMEP/EEA Guidebook (Table 3.3). For the remaining cropland area an average of the highest and lowest EF (wheat and oilseed rape) was applied. The revision resulted in increased emissions (+563 t of NMVOC in 2015).

6.3.2.2 Agricultural Soils (3.D) – Particulate matter (TSP, PM_{10}, $PM_{2.5}$)

Farm-level agricultural operations including storage, handling and transport of agricultural products (3.D.c)

In previous submissions, PM emissions from field operations had been calculated following a country-specific methodology. As recommended in the NEC Review 2017, Austria has revised its methodology by applying the Tier 1 approach according to the 2016 EMEP/EEA Guidebook. The revision has resulted in lower PM emissions for the whole time series (-836 t of $PM_{2.5}$). As recommended in the NEC Review 2017, emissions were reallocated from the NFR category 3.D.a.1 Inorganic N fertilisers to the NFR category 3.D.c Farm-level agricultural operations.

6.3.3 Additional data sources

6.3.3.1 Manure management (3.B) – NMVOC

Following a recommendation of the NEC Review 2017, Austria has included NMVOC emissions from sector 3.B Manure Management in its inventory submission for the first time. Estimates are based on the Tier 1 methodology according to the 2016 EMEP/EEA Guidebook. NMVOC emissions for 2015 amount to about 22 kt.

6.4 WASTE (5)

6.4.1 Update of activity data

6.4.1.1 Wastewater Treatment and Discharge (5.D)

During the NEC review in 2017, the ERT recommended excluding activity data from individual septic tanks, and taking into account only wastewater handled in centralised wastewater treatment plants. The used default emission factor applies only to wastewater handled in centralised wastewater treatment plants. NMVOC is only emitted in very small quantities from individual septic tanks, so the emission factor is much smaller.

This resulted in recalculations for NMVOC for the whole time series, with a decrease in emissions from 1990 to 2016 as the use of septic tanks has been steadily decreasing. According to the recalculation, the decrease for 2015 amounts to -0.02 t of NMVOC.

6.4.1.2 Other waste (5.E)

During the stage 3 CLRTAP review, Austria was encouraged to report on car fires and building fires and to use the default emission factors. Activity data have been collected from fire statistics. $PM_{2.5}$ emissions are now reported for 1990-2016.

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 greenhouse gases which have not been estimated.

IE (included elsewhere) ... for emissions by sources and removals by sinks of greenhouse gases 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 greenhouse gases 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 gas.

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] 1990–2016 based on fuel used

	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	71.00	69.00	2.00	1.93	0.00	0.07	NO	73.01	0.26
1991	68.18	66.88	1.30	1.61	0.00	0.06	NO	69.85	0.29
1992	51.91	49.91	2.00	1.36	0.00	0.04	NO	53.32	0.31
1993	50.55	48.45	2.10	1.11	0.00	0.04	NO	51.70	0.33
1994	44.99	43.71	1.28	1.12	0.00	0.05	NO	46.16	0.34
1995	44.78	43.25	1.53	1.07	0.00	0.05	NO	45.90	0.38
1996	42.30	41.10	1.20	0.99	0.00	0.05	NO	43.34	0.43
1997	38.80	38.73	0.07	0.96	0.00	0.05	NO	39.82	0.44
1998	34.05	34.01	0.04	0.87	0.00	0.05	NO	34.98	0.46
1999	32.38	32.34	0.04	0.81	0.00	0.06	NO	33.26	0.45
2000	30.24	30.20	0.04	0.78	0.00	0.06	NO	31.08	0.48
2001	31.11	31.07	0.05	0.71	0.00	0.06	NO	31.88	0.47
2002	30.09	30.05	0.04	0.71	0.00	0.06	NO	30.86	0.43
2003	29.93	29.88	0.05	0.71	0.00	0.06	NO	30.70	0.40
2004	26.17	26.12	0.04	0.72	0.01	0.06	NO	26.95	0.47
2005	24.81	24.77	0.04	0.72	0.00	0.06	NO	25.59	0.55
2006	25.57	25.52	0.05	0.73	0.00	0.05	NO	26.35	0.58
2007	22.19	22.14	0.05	0.75	0.00	0.04	NO	22.98	0.61
2008	19.41	19.37	0.04	0.78	0.00	0.03	NO	20.22	0.61
2009	13.89	13.83	0.06	0.70	0.00	0.02	NO	14.61	0.53
2010	15.56	15.51	0.05	0.70	0.00	0.01	NO	16.28	0.57
2011	14.62	14.58	0.05	0.68	0.00	0.01	NO	15.31	0.60
2012	14.41	14.37	0.05	0.65	0.00	0.01	NO	15.07	0.57
2013	14.50	14.46	0.04	0.59	0.00	0.01	NO	15.10	0.54
2014	14.28	14.24	0.04	0.55	0.00	0.01	NO	14.84	0.54
2015	14.05	14.01	0.04	0.57	0.00	0.01	NO	14.62	0.58
2016	13.23	13.20	0.02	0.57	0.00	0.01	NO	13.81	0.54

Table A.I-2: NO_x emissions [Kilotonnes] 1990–2016 based on fuel used

	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	187.96	187.96	IE	4.82	11.89	0.10	NO	204.77	2.44
1991	188.67	188.67	IE	4.50	12.78	0.09	NO	206.04	2.76
1992	179.12	179.12	IE	4.57	11.62	0.06	NO	195.37	3.00
1993	173.06	173.06	IE	2.00	10.59	0.05	NO	185.70	3.18
1994	168.82	168.82	IE	1.94	12.33	0.05	NO	183.14	3.31
1995	168.02	168.02	IE	1.48	12.54	0.05	NO	182.08	3.73
1996	168.20	168.20	IE	1.44	11.40	0.05	NO	181.09	4.14
1997	168.54	168.54	IE	1.52	11.46	0.05	NO	181.57	4.29
1998	166.37	166.37	IE	1.48	11.52	0.05	NO	179.41	4.43
1999	166.11	166.11	IE	1.46	11.16	0.05	NO	178.79	4.33
2000	165.13	165.13	IE	1.56	10.97	0.05	NO	177.71	6.44
2001	167.35	167.35	IE	1.59	10.93	0.05	NO	179.92	6.32
2002	164.93	164.93	IE	1.65	10.95	0.05	NO	177.59	5.67
2003	167.37	167.37	IE	1.36	10.48	0.05	NO	179.25	5.21
2004	166.47	166.47	IE	1.29	9.93	0.05	NO	177.75	6.09
2005	167.85	167.85	IE	1.77	9.99	0.05	NO	179.66	6.99
2006	166.90	166.90	IE	1.84	10.05	0.04	NO	178.83	7.54
2007	161.40	161.40	IE	1.73	10.22	0.04	NO	173.38	7.99
2008	154.68	154.68	IE	1.93	10.82	0.03	NO	167.46	7.90
2009	141.65	141.65	IE	1.56	10.61	0.02	NO	153.84	6.86
2010	142.42	142.42	IE	1.83	9.71	0.02	NO	153.98	7.60
2011	140.79	140.79	IE	1.84	10.23	0.02	NO	152.88	7.98
2012	137.22	137.22	IE	1.64	10.35	0.02	NO	149.23	7.68
2013	136.26	136.26	IE	1.47	10.27	0.02	NO	148.01	7.46
2014	130.90	130.90	IE	1.52	10.58	0.02	NO	143.02	7.49
2015	129.85	129.85	IE	1.74	10.96	0.02	NO	142.56	8.18
2016	126.68	126.68	IE	1.69	11.19	0.02	NO	139.57	10.29

Table A.I-3: NMVOC emissions [Kilotonnes] 1990–2016 based on fuel used

	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	152.19	136.70	15.49	118.50	31.20	0.16	NO	302.05	0.18
1991	146.83	131.72	15.12	111.97	30.82	0.16	NO	289.78	0.20
1992	135.25	120.06	15.19	105.21	29.59	0.15	NO	270.20	0.22
1993	125.42	110.76	14.65	98.51	29.28	0.15	NO	253.36	0.24
1994	112.52	101.40	11.12	91.94	29.03	0.14	NO	233.64	0.25
1995	105.70	96.21	9.49	85.24	28.13	0.14	NO	219.20	0.29
1996	101.61	93.15	8.46	83.68	27.53	0.13	NO	212.95	0.34
1997	92.67	84.72	7.95	82.34	27.48	0.13	NO	202.62	0.37
1998	85.11	78.68	6.43	81.02	27.30	0.13	NO	193.56	0.40
1999	80.59	74.91	5.67	78.27	26.65	0.12	NO	185.63	0.39
2000	74.74	69.05	5.69	75.47	25.65	0.12	NO	175.98	0.42
2001	71.42	67.59	3.84	74.98	25.40	0.11	NO	171.92	0.41
2002	66.69	62.66	4.03	74.86	24.90	0.11	NO	166.56	0.37
2003	64.38	60.43	3.96	74.68	24.55	0.11	NO	163.72	0.34
2004	60.75	57.18	3.57	73.77	24.37	0.11	NO	159.00	0.40
2005	58.92	55.58	3.34	72.80	24.11	0.11	NO	155.94	0.47
2006	55.79	52.43	3.36	71.84	24.01	0.10	NO	151.74	0.50
2007	52.23	49.25	2.98	70.84	24.09	0.10	NO	147.26	0.53
2008	51.33	48.57	2.75	69.81	23.99	0.10	NO	145.23	0.52
2009	48.04	45.45	2.59	68.90	24.27	0.09	NO	141.30	0.45
2010	49.77	47.31	2.45	67.99	24.21	0.09	NO	142.06	0.49
2011	46.57	44.16	2.41	67.54	23.89	0.08	NO	138.08	0.51
2012	47.51	45.11	2.40	66.93	23.74	0.08	NO	138.26	0.49
2013	49.10	46.79	2.30	66.96	23.81	0.07	NO	139.93	0.46
2014	42.98	40.56	2.42	67.56	23.87	0.07	NO	134.48	0.46
2015	44.87	42.55	2.32	68.12	23.81	0.07	NO	136.86	0.50
2016	44.19	41.91	2.27	68.70	23.78	0.06	NO	136.74	0.23

Table A.I-4: NH_3 emissions [Kilotonnes] 1990–2016 based on fuel used

	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	2.24	2.24	IE	0.32	63.23	0.36	NO	66.14	0.00
1991	2.71	2.71	IE	0.55	63.93	0.37	NO	67.56	0.00
1992	3.04	3.04	IE	0.42	61.96	0.42	NO	65.83	0.00
1993	3.41	3.41	IE	0.27	62.64	0.50	NO	66.81	0.00
1994	3.65	3.65	IE	0.21	63.76	0.57	NO	68.20	0.00
1995	3.84	3.84	IE	0.14	64.96	0.58	NO	69.53	0.00
1996	4.10	4.10	IE	0.14	63.42	0.60	NO	68.27	0.00
1997	4.18	4.18	IE	0.15	63.82	0.59	NO	68.73	0.00
1998	4.29	4.29	IE	0.15	64.03	0.60	NO	69.07	0.00
1999	4.42	4.42	IE	0.16	62.55	0.64	NO	67.77	0.00
2000	4.32	4.32	IE	0.14	61.23	0.67	NO	66.35	0.00
2001	4.25	4.25	IE	0.12	61.25	0.75	NO	66.37	0.00
2002	3.94	3.94	IE	0.10	60.50	0.82	NO	65.37	0.00
2003	3.75	3.75	IE	0.12	60.30	0.89	NO	65.06	0.00
2004	3.52	3.52	IE	0.10	59.90	1.12	NO	64.65	0.00
2005	3.39	3.39	IE	0.11	60.02	1.21	NO	64.74	0.00
2006	3.25	3.25	IE	0.12	60.44	1.22	NO	65.03	0.00
2007	3.13	3.13	IE	0.12	61.83	1.24	NO	66.32	0.00
2008	3.03	3.03	IE	0.12	61.69	1.22	NO	66.06	0.00
2009	2.85	2.85	IE	0.13	62.98	1.20	NO	67.16	0.00
2010	2.88	2.88	IE	0.13	62.25	1.22	NO	66.48	0.00
2011	2.74	2.74	IE	0.14	61.86	1.23	NO	65.97	0.00
2012	2.68	2.68	IE	0.14	62.06	1.23	NO	66.11	0.00
2013	2.67	2.67	IE	0.14	62.08	1.16	NO	66.05	0.00
2014	2.47	2.47	IE	0.13	62.70	1.20	NO	66.50	0.00
2015	2.53	2.53	IE	0.12	63.12	1.22	NO	66.99	0.00
2016	2.46	2.46	IE	0.13	63.79	1.26	NO	67.64	0.00

Table A.I-5: $PM_{2.5}$ emissions [Kilotonnes] 1990–2016 based on fuel used

	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	21.39	21.29	0.11	3.68	0.40	0.26	NO	25.74	0.28
1995	21.10	21.01	0.09	3.03	0.40	0.27	NO	24.79	0.42
2000	20.34	20.25	0.09	2.81	0.37	0.26	NO	23.77	0.52
2001	20.51	20.42	0.09	2.71	0.38	0.26	NO	23.86	0.51
2002	19.75	19.65	0.10	2.33	0.37	0.27	NO	22.72	0.46
2003	19.45	19.34	0.10	2.29	0.37	0.27	NO	22.37	0.43
2004	19.02	18.93	0.09	2.26	0.42	0.28	NO	21.97	0.51
2005	18.98	18.89	0.09	2.20	0.37	0.27	NO	21.83	0.59
2006	18.75	18.66	0.09	1.96	0.36	0.28	NO	21.34	0.63
2007	17.99	17.91	0.08	1.76	0.36	0.29	NO	20.40	0.66
2008	17.60	17.52	0.08	1.87	0.36	0.28	NO	20.10	0.66
2009	16.48	16.43	0.06	1.73	0.35	0.28	NO	18.84	0.57
2010	17.22	17.15	0.07	1.73	0.35	0.29	NO	19.59	0.62
2011	16.56	16.49	0.07	1.80	0.33	0.29	NO	18.98	0.65
2012	16.57	16.50	0.07	1.74	0.32	0.30	NO	18.92	0.62
2013	17.03	16.97	0.07	1.73	0.31	0.30	NO	19.37	0.59
2014	14.95	14.89	0.06	1.74	0.32	0.32	NO	17.33	0.59
2015	15.31	15.25	0.07	1.66	0.31	0.33	NO	17.61	0.63
2016	15.02	14.96	0.06	1.68	0.31	0.33	NO	17.34	0.70

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 greenhouse gases which have not been estimated.

IE (included elsewhere) ... for emissions by sources and removals by sinks of greenhouse gases 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 greenhouse gases 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 gas.

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] 1990–2016 based on fuel sold

	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	71.89	69.89	2.00	1.93	0.00	0.07	NO	73.90	0.26
1991	69.33	68.03	1.30	1.61	0.00	0.06	NO	71.00	0.29
1992	53.08	51.08	2.00	1.36	0.00	0.04	NO	54.48	0.31
1993	51.85	49.75	2.10	1.11	0.00	0.04	NO	53.00	0.33
1994	46.20	44.92	1.28	1.12	0.00	0.05	NO	47.37	0.34
1995	45.89	44.36	1.53	1.07	0.00	0.05	NO	47.01	0.38
1996	43.10	41.90	1.20	0.99	0.00	0.05	NO	44.15	0.43
1997	39.29	39.22	0.07	0.96	0.00	0.05	NO	40.30	0.44
1998	34.77	34.73	0.04	0.87	0.00	0.05	NO	35.70	0.46
1999	32.91	32.87	0.04	0.81	0.00	0.06	NO	33.79	0.45
2000	30.84	30.80	0.04	0.78	0.00	0.06	NO	31.68	0.48
2001	31.82	31.77	0.05	0.71	0.00	0.06	NO	32.59	0.47
2002	30.85	30.80	0.04	0.71	0.00	0.06	NO	31.62	0.43
2003	30.74	30.70	0.05	0.71	0.00	0.06	NO	31.51	0.40
2004	26.23	26.18	0.04	0.72	0.01	0.06	NO	27.01	0.47
2005	24.86	24.82	0.04	0.72	0.00	0.06	NO	25.65	0.55
2006	25.61	25.56	0.05	0.73	0.00	0.05	NO	26.39	0.58
2007	22.23	22.18	0.05	0.75	0.00	0.04	NO	23.02	0.61
2008	19.44	19.40	0.04	0.78	0.00	0.03	NO	20.25	0.61
2009	13.92	13.87	0.06	0.70	0.00	0.02	NO	14.64	0.53
2010	15.60	15.55	0.05	0.70	0.00	0.01	NO	16.31	0.57
2011	14.65	14.61	0.05	0.68	0.00	0.01	NO	15.34	0.60
2012	14.44	14.40	0.05	0.65	0.00	0.01	NO	15.10	0.57
2013	14.54	14.50	0.04	0.59	0.00	0.01	NO	15.13	0.54
2014	14.31	14.27	0.04	0.55	0.00	0.01	NO	14.87	0.54
2015	14.08	14.04	0.04	0.57	0.00	0.01	NO	14.65	0.58
2016	13.26	13.24	0.02	0.57	0.00	0.01	NO	13.84	0.54

Table A.II-2: NO_x emissions [Kilotonnes] 1990–2016 based on fuel sold

	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	203.37	203.37	IE	4.82	11.89	0.10	NO	220.18	2.44
1991	211.61	211.61	IE	4.50	12.78	0.09	NO	228.98	2.76
1992	199.62	199.62	IE	4.57	11.62	0.06	NO	215.87	3.00
1993	194.08	194.08	IE	2.00	10.59	0.05	NO	206.72	3.18
1994	186.75	186.75	IE	1.94	12.33	0.05	NO	201.07	3.31
1995	186.98	186.98	IE	1.48	12.54	0.05	NO	201.04	3.73
1996	205.99	205.99	IE	1.44	11.40	0.05	NO	218.88	4.14
1997	192.67	192.67	IE	1.52	11.46	0.05	NO	205.70	4.29
1998	205.12	205.12	IE	1.48	11.52	0.05	NO	218.17	4.43
1999	196.95	196.95	IE	1.46	11.16	0.05	NO	209.63	4.33
2000	202.68	202.68	IE	1.56	10.97	0.05	NO	215.26	6.44
2001	212.97	212.97	IE	1.59	10.93	0.05	NO	225.55	6.32
2002	218.88	218.88	IE	1.65	10.95	0.05	NO	231.53	5.67
2003	227.93	227.93	IE	1.36	10.48	0.05	NO	239.82	5.21
2004	226.16	226.16	IE	1.29	9.93	0.05	NO	237.43	6.09
2005	227.95	227.95	IE	1.77	9.99	0.05	NO	239.76	6.99
2006	214.48	214.48	IE	1.84	10.05	0.04	NO	226.41	7.54
2007	203.99	203.99	IE	1.73	10.22	0.04	NO	215.98	7.99
2008	187.61	187.61	IE	1.93	10.82	0.03	NO	200.38	7.90
2009	172.69	172.69	IE	1.56	10.61	0.02	NO	184.88	6.86
2010	173.21	173.21	IE	1.83	9.71	0.02	NO	184.77	7.60
2011	164.15	164.15	IE	1.84	10.23	0.02	NO	176.23	7.98
2012	159.08	159.08	IE	1.64	10.35	0.02	NO	171.09	7.68
2013	160.09	160.09	IE	1.47	10.27	0.02	NO	171.84	7.46
2014	149.61	149.61	IE	1.52	10.58	0.02	NO	161.72	7.49
2015	146.47	146.47	IE	1.74	10.96	0.02	NO	159.18	8.18
2016	141.36	141.36	IE	1.69	11.19	0.02	NO	154.26	10.29

Table A.II-3: NMVOC emissions [Kilotonnes] 1990–2016 based on fuel sold

	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	152.72	137.24	15.49	118.50	31.20	0.16	NO	302.58	0.18
1991	151.95	136.83	15.12	111.97	30.82	0.16	NO	294.90	0.20
1992	137.16	121.97	15.19	105.21	29.59	0.15	NO	272.11	0.22
1993	125.90	111.25	14.65	98.51	29.28	0.15	NO	253.85	0.24
1994	111.62	100.51	11.12	91.94	29.03	0.14	NO	232.74	0.25
1995	104.88	95.39	9.49	85.24	28.13	0.14	NO	218.38	0.29
1996	100.61	92.14	8.46	83.68	27.53	0.13	NO	211.94	0.34
1997	90.90	82.94	7.95	82.34	27.48	0.13	NO	200.84	0.37
1998	85.46	79.03	6.43	81.02	27.30	0.13	NO	193.91	0.40
1999	79.87	74.20	5.67	78.27	26.65	0.12	NO	184.92	0.39
2000	74.57	68.88	5.69	75.47	25.65	0.12	NO	175.81	0.42
2001	72.40	68.57	3.84	74.98	25.40	0.11	NO	172.89	0.41
2002	69.46	65.43	4.03	74.86	24.90	0.11	NO	169.33	0.37
2003	68.16	64.21	3.96	74.68	24.55	0.11	NO	167.50	0.34
2004	64.62	61.05	3.57	73.77	24.37	0.11	NO	162.88	0.40
2005	62.72	59.37	3.34	72.80	24.11	0.11	NO	159.73	0.47
2006	58.74	55.39	3.36	71.84	24.01	0.10	NO	154.70	0.50
2007	54.85	51.87	2.98	70.84	24.09	0.10	NO	149.88	0.53
2008	53.15	50.39	2.75	69.81	23.99	0.10	NO	147.05	0.52
2009	49.70	47.12	2.59	68.90	24.27	0.09	NO	142.97	0.45
2010	51.34	48.89	2.45	67.99	24.21	0.09	NO	143.63	0.49
2011	47.84	45.43	2.41	67.54	23.89	0.08	NO	139.35	0.51
2012	48.66	46.26	2.40	66.93	23.74	0.08	NO	139.40	0.49
2013	50.08	47.77	2.30	66.96	23.81	0.07	NO	140.92	0.46
2014	43.83	41.42	2.42	67.56	23.87	0.07	NO	135.33	0.46
2015	45.75	43.43	2.32	68.12	23.81	0.07	NO	137.75	0.50
2016	45.07	42.79	2.27	68.70	23.78	0.06	NO	137.62	0.23

Table A.II-4: NH_3 emissions [Kilotonnes] 1990–2016 based on fuel sold

	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	2.24	2.24	IE	0.32	63.23	0.36	NO	66.14	0.00
1991	2.84	2.84	IE	0.55	63.93	0.37	NO	67.70	0.00
1992	3.09	3.09	IE	0.42	61.96	0.42	NO	65.89	0.00
1993	3.40	3.40	IE	0.27	62.64	0.50	NO	66.80	0.00
1994	3.53	3.53	IE	0.21	63.76	0.57	NO	68.08	0.00
1995	3.70	3.70	IE	0.14	64.96	0.58	NO	69.38	0.00
1996	3.81	3.81	IE	0.14	63.42	0.60	NO	67.98	0.00
1997	3.82	3.82	IE	0.15	63.82	0.59	NO	68.37	0.00
1998	4.10	4.10	IE	0.15	64.03	0.60	NO	68.88	0.00
1999	4.07	4.07	IE	0.16	62.55	0.64	NO	67.42	0.00
2000	3.97	3.97	IE	0.14	61.23	0.67	NO	66.01	0.00
2001	4.09	4.09	IE	0.12	61.25	0.75	NO	66.21	0.00
2002	4.16	4.16	IE	0.10	60.50	0.82	NO	65.59	0.00
2003	4.19	4.19	IE	0.12	60.30	0.89	NO	65.50	0.00
2004	4.00	4.00	IE	0.10	59.90	1.12	NO	65.13	0.00
2005	3.87	3.87	IE	0.11	60.02	1.21	NO	65.21	0.00
2006	3.70	3.70	IE	0.12	60.44	1.22	NO	65.47	0.00
2007	3.56	3.56	IE	0.12	61.83	1.24	NO	66.75	0.00
2008	3.32	3.32	IE	0.12	61.69	1.22	NO	66.35	0.00
2009	3.13	3.13	IE	0.13	62.98	1.20	NO	67.45	0.00
2010	3.17	3.17	IE	0.13	62.25	1.22	NO	66.77	0.00
2011	3.00	3.00	IE	0.14	61.86	1.23	NO	66.23	0.00
2012	2.93	2.93	IE	0.14	62.06	1.23	NO	66.36	0.00
2013	2.85	2.85	IE	0.14	62.08	1.16	NO	66.23	0.00
2014	2.65	2.65	IE	0.13	62.70	1.20	NO	66.68	0.00
2015	2.74	2.74	IE	0.12	63.12	1.22	NO	67.20	0.00
2016	2.68	2.68	IE	0.13	63.79	1.26	NO	67.86	0.00

Table A.II-5: $PM_{2.5}$ emissions [Kilotonnes] 1990–2016 based on fuel sold

	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	3.68	0.40	0.26	NO	26.27	0.28
1995	21.81	21.73	0.09	3.03	0.40	0.27	NO	25.51	0.42
2000	21.18	21.09	0.09	2.81	0.37	0.26	NO	24.62	0.52
2001	21.57	21.48	0.09	2.71	0.38	0.26	NO	24.92	0.51
2002	21.14	21.04	0.10	2.33	0.37	0.27	NO	24.10	0.46
2003	21.06	20.96	0.10	2.29	0.37	0.27	NO	23.99	0.43
2004	20.62	20.53	0.09	2.26	0.42	0.28	NO	23.57	0.51
2005	20.56	20.47	0.09	2.20	0.37	0.27	NO	23.41	0.59
2006	20.02	19.93	0.09	1.96	0.36	0.28	NO	22.61	0.63
2007	19.10	19.02	0.08	1.76	0.36	0.29	NO	21.51	0.66
2008	18.39	18.31	0.08	1.87	0.36	0.28	NO	20.90	0.66
2009	17.20	17.14	0.06	1.73	0.35	0.28	NO	19.56	0.57
2010	17.91	17.84	0.07	1.73	0.35	0.29	NO	20.29	0.62
2011	17.09	17.02	0.07	1.80	0.33	0.29	NO	19.51	0.65
2012	17.04	16.97	0.07	1.74	0.32	0.30	NO	19.39	0.62
2013	17.50	17.43	0.07	1.73	0.31	0.30	NO	19.83	0.59
2014	15.30	15.24	0.06	1.74	0.32	0.32	NO	17.68	0.59
2015	15.61	15.55	0.07	1.66	0.31	0.33	NO	17.91	0.63
2016	15.28	15.22	0.06	1.68	0.31	0.33	NO	17.60	0.70

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The report on Austria's Annual Air Emission Inventory 1990–2016, 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 2016.

The report includes first information on emission trends and performed recalculations for the years 1990 and 2016. More detailed descriptions will be provided in Austria's Informative Inventory Report (IIR) 2018, which is to be submitted under the NEC Directive on 15 March 2018.

The results of the calculations compiled in the report show that between 2015 and 2016, emissions of sulphur dioxide (SO_2) decreased by 5.6%, nitrogen oxide emissions (NO_x) decreased by 2.1%, non-methane volatile organic compounds (NMVOCs) decreased by 0.1%, ammonia emissions (NH_3) increased by 1.0% and particulate matter ($PM_{2.5}$) decreased by 1.5%.

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