2025 SUBMISSION

MALTA'S ANNUAL INFORMATIVE INVENTORY REPORT

Submission under the UNECE Convention on Long-range Transboundary Air Pollution and Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants

Emission inventory from 1990 to 2023

MALTA'S ANNUAL INFORMATIVE INVENTORY REPORT, 2025
FOR REFERENCE YEAR 2023

REPORT PURSUANT TO

The UNECE Convention on Long-Range Transboundary Air Pollution and Directive (EU) 2016/2284 on the Reduction of National Emissions of Certain Atmospheric Pollutants

PREPARED BY THE ENVIRONMENT AND RESOURCES AUTHORITY

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Glossary of terms

Table 1: Glossary of terms

Term	Definition
2023GB	2023 guidebook
AAP	Annual animal population (animal heads)
AD	Anaerobic Digester
AER	Annual environment report
As	Arsenic
ATV	All-Terrain Vehicle
BC	Black Carbon
BPR	Bureau of public roads
Cd	Cadmium
CEMS	Continuous emission monitoring system
CH_4	Methane
CLRTAP	Convention on Long-range Transboundary Air Pollution
CO	Carbon monoxide
COVID-19	Coronavirus disease - Severe acute respiratory syndrome coronavirus 2
Cr	Chromium
CSAM	Connections for Safer Active Mobility
Cu	Copper
D3PG	D3 Power Generation Limited
EEA	European Environment Agency
EF	Emission factors
EGM	Electrogas Malta
EGTEI	Expert group on techno-economic issues
EI	Emission inventory
EMEP	European Monitoring and Evaluation Programme
ERA	Environment and Resources Authority
EU	European Union
EUROSTAT	Statistical office of the European Union
EV	Electric vehicles

EWA	Energy and Water Agency
EWC	European waste catalogue
FAOSTAT	Food and Agriculture Organization corporate statistical database
GCV	Good Commercial Vehicles
GE	Gross Feed Intake
GHG	Greenhouse Gas
GVA	Gross Value Added
GVW	Gross Vehicle Weight
HCB	Hexachlorobenzene
HDV	Heavy duty vehicle
HFO	Heavy fuel oil
Hg	Mercury
ICE	Internal combustion engine
IE	Included elsewhere
IEF	Implied Emission Factors
IFR	Instrument Flight Rules
IIR	Informative inventory report
IPCC	Intergovernmental panel on climate change
ITMS	Integrated Transport Management System
KPH	Milk breeders co-operative
LCV	Light commercial vehicles
LCDS	Low Carbon Development Strategy
LEZ	Low Emission Zone
LPG	Liquefied petroleum gas
LTO	Landing and Take-off cycle
MA	Mean activity
MC	Motorcycles
MDP	Malta Dairy Products
MEEE	Ministry for the Environment, Energy and Regeneration of the Grand Harbour
MPS5	Marsa Power Station Turbine 5
MRA	Malta Resources Authority
MTP	Mechanical Treatment Plant

MTTF	Malta Thermal Treatment Facility
NA	Not applicable
NAPCP	National Air Pollution Control Programme
NE	Not estimated
NECD	Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
NECP	National Energy and Climate Plan
NEX	Nitrogen excretion
NFR	Nomenclature for reporting
NFR1	Energy Sector
NFR2	IPPU Sector
NFR3	Agricultural Sector
NFR5	Waste Sector
Ni	Nickel
NMVOC	Non-methane volatile organic compounds
NO	Not occurring
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NSO	National Statistics Office
NTM	National transport model
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PC	Passenger cars
PCB	Polychlorinated Biphenyls
PCDD/Fs	Polychlorinated Dibenzodioxins/ Dibenzofurans
PHEV	Plug-in hybrid electric vehicles
PI	Projections Inventory
PM_{10}	Particulate matter of size 10 microns
$PM_{2.5}$	Particulate matter of size 2.5 microns
POPs	Persistent Organic Pollutants
ppm	Parts per million
QA/QC	Quality assurance and quality control

REWS	Regulator of Energy and Water Services
RRP	Recovery and Resilience Plan
S.L.	Subsidiary legislation
SCR	Selective catalytic reduction
Se	Selenium
SO_2	Sulphur dioxide
SO_x	Sulphur oxides
SPED	Strategic Plan for the Environment and Development
SPV	Special Purpose Vehicles
STS	Special Trade Statistics
SUMP	Sustainable Urban Mobility Plans
TERT	Technical Expert Review Team
TFTEI	Task Force on Techno-Economic Issues
TM	Transport Malta
TSP	Total Suspended Particles
TU	Tractor Unit
UAA	Utilized Agricultural Area
UNECE	United Nations economic commission for Europe
UNFCCC	United Nations framework convention on climate change
VERA	Vehicle Registration and Administrative System
Vkm	Vehicle/kilometres (mileage or activity)
VRT	Vehicle roadworthiness testing
VS	Volatilized Solids
WaM	With additional measures
WM	With measures
YOM	Year of manufacture
Zn	Zinc

1 Executive summary

Chapter Updated: 2025

The Environment and Resources Authority, as Malta's Competent Authority on air quality, is responsible for the compilation of the Emission Inventory (EI), Emission Projections (EP) and Informative Inventory Report (IIR) and their submission to the European Commission and the United Nations Economic Commission for Europe (UNECE) under the obligations of the Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (NECD) and the Convention on Long-Range Transboundary Air Pollution. Malta's annual Informative Inventory Report and the NFR tables cover the time series between 1990 and 2023.

Through such obligations, Malta is required to report emissions of air pollutants as follows:

Nitrogen oxides (NO_x), Sulphur oxides (SO_x), Non-Methane Volatile Organic Compounds (NMVOC), Ammonia (NH_3), Particulate Matter (PM) - fine fraction - $PM_{2.5}$ and coarse fraction - PM_{10}, Total Suspended Particles (TSP), Black Carbon (BC), Carbon monoxide (CO), heavy metals including; Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Copper (Cu), Nickel (Ni), Selenium (Se) And Zinc (Zn), Persistent Organic Pollutants (POPs) including; Polychlorinated dibenzodioxins/ dibenzofurans (PCDD/Fs), Polycyclic aromatic hydrocarbons (PAHs), Hexachlorobenzene (HCB) and Polychlorinated biphenyls (PCBs).

The IIR, which is updated annually in line with the EI provides a description of the data sources used, the methodologies applied to estimate emissions for the aforementioned air pollutants as well as information on quality assurance and quality control (QA/QC), uncertainties and recalculations, trends and planned improvements for the years to come.

1.1 Modifications from previous submissions

As a result of continuous improvements, Malta carried out recalculations for several sectors based on updated activity data sources or improved methodologies. The following points provide a summary of the major changes carried out this year, which can be viewed as Malta's efforts to improving the emission inventory.

- The Eurostat Energy Balance was revised in 2025 which resulted in minor updates across the time series for most sectors within NFR 1.
- For Public Electricity and Heat Production (1A1a) Malta included historical data on biogas input for electricity generation from 2011. The biogas has been produced locally and combusted in CHP plants in four facilities.
- For the International and Domestic Aviation sectors (1A3ai(i) and 1A3aii(i)), minor revisions were carried out following an emissions recalculations exercise for the years 2018-2023 based on data provided by EUROCONTROL.
- For the Road Transport (1A3bi - 1A3bvii) sector, an updated model (COPERT 5.8.1) was used to estimate emissions. Malta has further improved the selection criteria for the historical vehicle fleet to ensure that all road-worthy vehicles are accurately accounted for in the road transport calculations. Malta has made use of newly introduced COPERT categories for electric vehicles, in particular buses and Light Commercial Vehicles (LCV). Malta included electric motorcycles under the electric vehicles (EV) mini passenger cars category. Further to this, EV Heavy Duty Vehicles (HDV) were also included under the EV buses category as they were considered to be similar in nature, noting that an EV HDV category is not included in COPERT.
- For the Distribution of oil products sector (1B2av), was upgraded to a Tier 2 methodology in this submission through the use of moving emission factors which reflected the inclusion of fuel stations operating under Stage II controls.
- For sector 2D3b (Road paving with asphalt) Malta utilised actual asphalt thicknesses per road and was able to calculate amounts of asphalt use more accurately.
- For the Dry Cleaning sector (2D3f) adjustments were done to account for the use of both open-cycle and closed-cycle technology throughout the time series as opposed to using a static emission factor.

- For the Manure Management (3B) and Animal manure applied to soils sectors (3Da2a) significant updates were carried out, including improvements in livestock housing, manure application and storage, and changes to the use of straw.
- For Sector 5A (Solid waste disposal on land (including mineral waste handling)), Malta has identified an inconsistency in the default value provided in the 2023GB for the moisture content. A default value of 11% had been erroneously interpreted by Malta as 0.11% instead. This correction led to modification in the entire time series for the pollutants under this sector.
- For Cremation (5C1bv), Malta recalculated emissions from 2016 onwards using monthly average data from Continuous Emissions Monitoring System (CEMS) to improve accuracy for the following pollutants: CO, SO_x, NO_x, TSP and NH_3.
- For Open Burning of waste (5C2), the breakdown of utilised agricultural area into arable farmland and orchards resulted in improved activity data and recalculations for the entire time series of all pollutants under this sector.

Further details on improvements and recalculations under all NFR sectors can be found under their respective chapters.

1.2 Incompleteness or inconsistencies in the time series

Despite attempts to minimize discrepancies in Malta's emission inventory, a significant inconsistency that exists in multiple sectors is the lack of uniformity in activity data throughout the entire time series. In terms of the power generation sector activity data from 2005 onwards is rather accurate since a continuous emission monitoring system (CEMS) is used, whereas for pre-2005 data the activity data used is the fuel consumed as provided by Eurostat's energy Balance. Another example of this is the aviation sector, activity data prior to 1999 was sourced from the Civil Aviation Department at Transport Malta, while data from 1999 to 2004 was provided by the Malta International Airport. Post-2004 data was computed directly by EUROCONTROL. Having different data sources throughout the time series results in inaccuracies.

Malta's current vehicle stock projections show an inconsistency, as historical fleet data sourced directly from Transport Malta (TM) is generally accurate, while projected data is based on historical trends, with data from the National Statistics Office (NSO) and the Energy and Water Agency (EWA), that may not exclusively reflect road-worthy vehicles, potentially leading to over/under-estimates in the fleet size.

1.3 A brief of changes in emission trends

A brief summary of the trends across the main five pollutants is presented below.

- Nitrogen oxides (NO_x):
  - The dominant source for this pollutant is the energy sector. This is seen throughout the entire time-series from 1990 to 2023. The total NO_x emissions were at 9.63kt, which have since decreased to 4.51kt in 2023.
- Non-Methane Volatile Organic Compounds (NMVOC):
  - The dominant source of this pollutant is the energy sector and the IPPU sector. In 2005, the total NMVOC emissions were at 3.93kt, which have since decreased to 2.68kt in 2023.
- Sulphur oxides (SO_x):
  - Similarly to the previous two pollutants, the energy sector is the dominant source of this pollutant and has been throughout the entire time series. Malta recorded a drastic decrease in emissions under this sector from 12.27kt in 2005 to 0.16kt in 2023.
- Ammonia (NH_3):
  - Contrary to other pollutants, the agricultural sector is the dominant source of this pollutant. In 2005, the total NH_3 emissions were at 1.52kt, which have since decreased to 1.3kt in 2023.
- Fine Particulate Matter ($PM_{2.5}$):
  - The energy sector is the dominant source of this pollutant with IPPU also contributing in recent years. In 2005, the total $PM_{2.5}$ emissions were at 0.75kt, which have since decreased to 0.32kt in 2023.

2 Introduction

Chapter Updated: 2025

The emission inventory team within the Environment and Resources Authority (ERA) is responsible for the estimation of emissions and the compilation of the national emission inventories and any related reports and submission to the European Commission in accordance with the National Emission Ceilings Directive (NECD) and the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

Directive (EU) 2016/2284, came into force on December 14, 2016, and was transposed into national legislation via Subsidiary Legislation (S.L.) 549.124. Malta published the National Air Pollution Control Programme (NAPCP) in 2020, which outlines the strategies, policies, and measures implemented to adhere to the national emission reduction commitments specified in Annex II of NECD for the years 2020 and 2030.Under the revised 2023 EMEP/EEA Air Pollutant Emission Inventory Guidebook, all Member States must annually report national emissions of Sulphur oxides (SO_x), Nitrogen oxides (NO_x), Non-Methane Volatile Organic Compounds (NMVOC), Carbon monoxide (CO), Ammonia (NH_3), Particulate matter ($PM_{2.5}$, PM_{10}, BC & TSP), various heavy metals, and POPs.

2.1 National inventory background & institutional arrangements

As per the NECD requirements, an annual Informative Inventory Report (IIR) must be submitted, detailing the compilation process of the emission inventory for all relevant pollutants, including updates on methodologies, recalculations, and other relevant sections The emission inventory and emission projections are primarily compiled by ERA using data provided by various entities, including the (Maltese) National Statistics Office (NSO), the Energy and Water Agency (EWA), the Regulator for Energy and Water Services (REWS), the Climate Action Authority (CAA), Transport Malta (TM), as well as pertinent public entities (such as ministries, departments, and regulatory agencies) and private establishments. The diagram below outlines the responsibilities of each entity involved in this process.

The ERA, as the authority responsible for the compilation of the Emission Inventory (EI) and IIR, gathers all necessary data and information from the entities mentioned above to estimate emissions for all pollutants across the entire time series. Once finalised, the emission inventory, emission projections and the IIR are also approved by the Ministry responsible for the environment and Malta's Permanent Representation of the EU. The compiled data, along with methodological notes and correspondence, are stored within ERA's mainframe system.

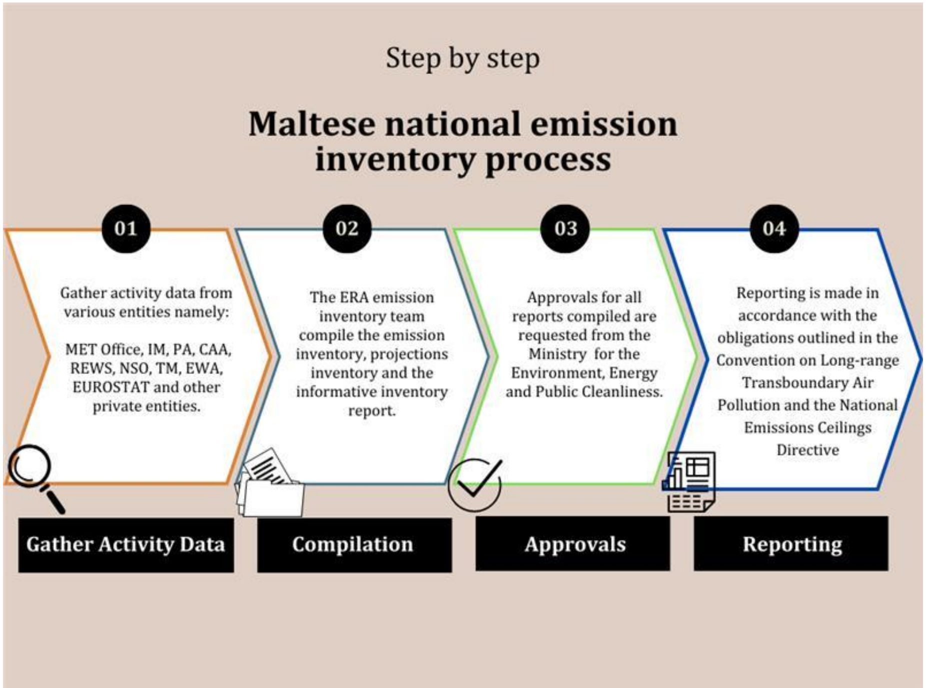

Figure 1: The Maltese national emission inventory process

2.2 Inventory preparation process

As previously mentioned, the ERA is responsible for the compilation of the EI, PI and the IIR. The following sections provide a description of the main responsibilities of ERA.

2.2.1 Inventory preparation & management

The EI team conducts various tasks, including gathering data and holding discussions with the relevant authorities, calculating emissions, and preparing reports

The inventory team consists of three primary compilers, two assistant compiler, and a manager overseeing the entire compilation process. All discussions regarding inventory planning, preparation, and management take place centrally within this team. Issues related to specific categories are brought forward by the designated inventory focal point and reviewed collaboratively by the team.

Regular communication occurs between the air emission inventory team and the CAA's inventory team, which handles Greenhouse Gas (GHG) inventory compilation. These two entities exchange data, share methodological experiences and assumptions, and are collaborating on establishing a shared dataset. When additional expertise beyond the Authority is required, ERA seeks guidance from experts in the field to assist in the compilation process.

2.2.2 Inventory planning

Inventory planning starts following the submission process of the previous reference year. During the initial phase, the inventory team focuses on research on possible enhancements to the current data which entails engagement with stakeholders and data providers, reaching out to potential contributors, and collaborating with relevant national entities for studies on national air pollution emissions and any new information available. Priority is given to the necessity of updating datasets to refine assumptions utilized by various entities sharing the same data. Effective collection of essential activity data is improved through effective communication channels between the inventory team and data providers.

2.2.3 Inventory improvements

Prioritization of improvements is based on their significance, determined by their potential impact on key categories and their influence on meeting emission ceilings. The Technical Expert Review Team (TERT) identifies these areas for improvement, which are then discussed and ranked by the inventory team.

Efforts are underway within the inventory team to pinpoint missing data sources and explore methods for enhancement. This involves reviewing activity data necessary for addressing gaps and making tier 1 estimations. Malta aims to transition to higher tiers whenever feasible to obtain more precise country-specific emission estimates.

2.3 Methods and data sources

The methodology used in compiling this year's emission inventory was mainly based on the 2023 EMEP/EEA Air Pollutant Emission Inventory Guidebook.

Equation 1 shows the basic equation for the compilation of the emission inventory.

$$\textit{emission load} = \textit{activity data} * \textit{emission factor}$$

Equation 1: Basic equation to estimate emission loads

Further information on the specific methodologies used for each sector is included under each chapter together with a detailed description of the activity data used to estimate emission loads.

2.3.1 Finalization, publication and submission of reports

As with all other Member States, Malta submits the inventory to the CLRTAP/UNECE and NEC Directive/European Commission on February 15th annually and the IIR on March 15th . Reported data in the submission of year X relates to emissions for year X-2, meaning that the emission inventory reported in 2025 represents 2023 data. Emission projections are submitted on March 15th , reporting data for the years 2025 and 2030. This report is submitted every 2 years. Gridded data and Large Point Sources (LPS) are reported every four years on 1st May.

2.3.2 Data storage

Concerning storage of files, all activity data, compilation files, inventory submissions and IIRs are digitally stored in a server, accessible to members of the inventory team. Data is updated annually by the inventory team.

2.4 Key category analysis

In this submission, *Approach 1 of the level of assessment* of emissions was calculated in line with the methodology presented within the EMEP/EEA Air Pollutants Emission Inventory Guidebook 2023. Key categories are defined as follows:

"Key categories are those which, when summed together in descending order of magnitude, cumulatively add up to 80 % of the total level".

The key category analysis for this submission can be found in Annex I.

2.5 QA/QC and verification methods

The inventory team identified the need to establish a Quality Assurance/Quality Control (QA/QC) system within the national emission inventory to ensure a high standard of quality and reliability during compilation. Efforts to develop this system aim to align all processes with principles of transparency, accuracy, consistency, comparability, and completeness (TACCC). For this submission, the team utilised the best available data sources, incorporating in-situ monitoring data where available. Sectoral experts focused on improving model clarity and reproducibility of the emissions inventory through model enhancements.

Each sector underwent a QA/QC exercise, ensuring accuracy of the input activity data, emission factors, and formulas used in models to the best of their ability. The inventory team internally validated the assumptions and criteria relevant to activity data. Additionally, thorough checks were conducted to ensure accurate unit conversions throughout the inventory, with results and pollutant trends analysed using an in-house trend checker model. This model considers year-on-year variances and changes in emissions compared to the previous submission

2.6 General uncertainty evaluation

Uncertainty estimates are necessary to ensure transparency and added reliability to the data within the inventory. Such uncertainties are associated with both the activity data and emission factors, and are reflected in the results. A detailed description of the methodology undertaken to calculate the uncertainties for each sector for the main five pollutants; Nitrogen oxides (NO_x), Sulphur oxides (SO_x), Non-Methane Volatile Organic Compounds (NMVOC), Ammonia (NH_3), and fine Particulate matter ($PM_{2.5}$).

2.7 General assessment of completeness

This submission includes the estimation of emissions from all the relevant sources and emissions listed in the NFR-19 template and explained in the EMEP/EEA air pollutant emission inventory guidebook 2023. Each chapter includes a comprehensive explanation on the use of notation keys for all the relevant sectors. The NFR as reported by Malta makes use of four notation keys: NO (Not Occurring), NA (Not Applicable), NE (Not Estimated) and IE (Included Elsewhere).

- NO refers to "categories or processes within a particular source category that do not occur within a Party".
- NA refers to "activities under a given source category that do occur within the Party but do not result in emissions of a specific pollutant".
- NE refers to instances where "for activity data and/or emissions by sources of pollutants which have not been estimated but for which a corresponding activity may occur within a Party".
- IE refers to instances where the "emissions by sources of pollutants estimated but included elsewhere in the inventory instead of under the expected source category".

3 Uncertainty assessment

Chapter Updated: 2025

The uncertainty analysis was conducted for the five main pollutants NO_x, SO_x, NMVOCs, NH_3, PM_{10} and $PM_{2.5}$, using emission data for the base year 2005 and the reporting year 2023. For this year's submission, Malta is once again making use of a tool developed by external consultants which provides detailed uncertainties to Malta's emission inventory.

3.1 Methodology

The uncertainty assessment is determined by the uncertainty associated with the activity data used to compile the inventory. This is based on an Approach 1 methodology as described in the EMEP/EEA Guidebook (2023), which was applied to all sectors and pollutants included in Malta's uncertainty analysis namely; NO_x, SO_x, NMVOCs, NH_3, PM_{10} and $PM_{2.5}$. Malta employed the error propagation method to estimate uncertainties by source category as well as the overall uncertainty for one year (2023) and the uncertainty in the trend. The Approach 1 method (error propagation) was preferred over the Approach 2 (Monte Carlo Simulation) method noting that it offers a good indication of the uncertainty per pollutant.

3.2 Data sources

The overall uncertainty for each sector and main pollutant was calculated by quantifying the uncertainties for both the activity data and emission factor. Malta makes use of the uncertainties of activity data at sectoral level based on the GHG uncertainty analysis coupled with the application of expert judgement.

Where data to calculate uncertainties was not available, Table 2-1 of Chapter 5. Uncertainties of the EMEP/EEA Guidebook (2023), was used to assign a percentage uncertainty based on the source of data.

3.3 Results

The estimated uncertainties are shown in Table 2 below, which includes all sectors reported.

Table 2: Table containing emissions (kt) and uncertainty estimates by pollutant

Pollutant	2023 Emissions (kt)	Contribution to Variance by Category in Year 2023	Combined Uncertainty in Trend in Total Emissions
NH_3	1.6326	31%	10%
NMVOC	2.8351	29%	2%
NO_x (as NO_2)	4.5687	31%	3%
PM_{10}	0.9818	45%	5%
$PM_{2.5}$	0.3095	35%	2%
SO_x (as SO_2)	0.1557	14%	3%

Further detail on the uncertainties at sectoral levels is provided in the following tables.

Table 3: Uncertainty estimation of NH_3 emissions

NH_3

Sector	Emissions (kt)	Sum of Sum of AD Uncertainty (%)	Sum of Combined Uncertainty (%)	Sum of Type A Sensitivity (%)	Sum of Type B Sensitivity (%)	Sum of Uncertainty in Trend in Total Emissions due to EF (%)	Sum of Uncertainty in Trend in Total Emissions due to AD (%)	Sum of Combined Uncertainty in Trend in Total Emissions (%)
1A1a	0.000	2.0%	100.0%	-0.1%	0.0%	-0.1%	0.0%	0.0%
1A2gviii	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A3ai(i)	0.000	2.0%	2.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A3aii(i)	0.000	2.0%	2.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A3bi	0.040	5.0%	100.1%	-0.1%	2.2%	-0.1%	0.2%	0.0%
1A3bii	0.001	5.0%	100.1%	-0.1%	0.1%	-0.1%	0.0%	0.0%
1A3biii	0.001	5.0%	100.1%	-0.1%	0.1%	-0.1%	0.0%	0.0%
1A3biv	0.000	5.0%	100.1%	-0.1%	0.0%	-0.1%	0.0%	0.0%
1A3bv	0.000	0.0%	100.0%	-0.1%	0.0%	-0.1%	0.0%	0.0%
1A3bvi	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A3bvii	0.000	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A3dii	0.000	2.0%	2.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A4ai	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A4bi	0.000	5.0%	100.1%	-0.1%	0.0%	-0.1%	0.0%	0.0%
1A4cii	0.000	5.0%	100.1%	-0.1%	0.0%	-0.1%	0.0%	0.0%
1A4ciii	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
1A5b	0.089	5.0%	100.1%	-0.1%	5.0%	-0.1%	0.4%	0.0%
1B2av	0.000	10.0%	10.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2A5b	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2B10b	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2D3a	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2D3b	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%

2D3d	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2D3e	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2D3f	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2D3h	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
2G	0.002	5.0%	100.1%	-0.1%	0.1%	-0.1%	0.0%	0.0%
2H2	0.000	5.0%	5.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
3B1a	0.158	15.0%	71.6%	-0.1%	8.9%	-0.1%	1.9%	0.0%
3B1b	0.101	15.0%	71.6%	-0.1%	5.7%	-0.1%	1.2%	0.0%
3B2	0.014	15.0%	71.6%	-0.1%	0.8%	-0.1%	0.2%	0.0%
3B3	0.175	15.0%	71.6%	-0.1%	9.8%	-0.1%	2.1%	0.0%
3B4d	0.011	15.0%	71.6%	-0.1%	0.6%	-0.1%	0.1%	0.0%
3B4e	0.014	15.0%	71.6%	-0.1%	0.8%	-0.1%	0.2%	0.0%
3B4f	0.000	15.0%	71.6%	-0.1%	0.0%	-0.1%	0.0%	0.0%
3B4gi	0.047	15.0%	71.6%	-0.1%	2.6%	-0.1%	0.6%	0.0%
3B4gii	0.061	15.0%	71.6%	-0.1%	3.4%	-0.1%	0.7%	0.0%
3B4giii	0.008	15.0%	71.6%	-0.1%	0.4%	-0.1%	0.1%	0.0%
3B4giv	0.000	15.0%	71.6%	-0.1%	0.0%	-0.1%	0.0%	0.0%
3B4h	0.134	15.0%	71.6%	-0.1%	7.5%	-0.1%	1.6%	0.0%
3Da1	0.167	50.0%	103.0%	-0.1%	9.4%	-0.1%	6.6%	0.4%
3Da2a	0.581	15.0%	71.6%	-0.1%	32.5%	-0.1%	6.9%	0.5%
3Da4	0.027	20.0%	92.2%	-0.1%	1.5%	-0.1%	0.4%	0.0%
3Dc	0.000	50.0%	50.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
3De	0.000	50.0%	50.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
3F	0.000	50.0%	111.8%	-0.1%	0.0%	-0.1%	0.0%	0.0%
Total	1.633	538.0%	2419.6%	-3.8%	91.4%	-1.8%	23.1%	1.0%

Table 4: Uncertainty estimation of NMVOC emissions

NMVOC

Sector	Emissions (kt)	Sum of Sum of AD Uncertainty (%)	Sum of Combined Uncertainty (%)	Sum of Type A Sensitivity (%)	Sum of Type B Sensitivity (%)	Sum of Uncertainty in Trend in Total Emissions due to EF (%)	Sum of Uncertainty in Trend in Total Emissions due to AD (%)	Sum of Combined Uncertainty in Trend in Total Emissions (%)
1A1a	0.045	5.0%	100.1%	-0.3%	1.1%	-0.3%	0.1%	0.0%
1A2gviii	0.019	5.0%	70.2%	-0.3%	0.5%	-0.2%	0.0%	0.0%
1A3ai(i)	0.013	2.0%	100.0%	-0.3%	0.3%	-0.3%	0.0%	0.0%
1A3aii(i)	0.000	2.0%	100.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
1A3bi	0.240	5.0%	100.1%	-0.3%	6.0%	-0.3%	0.4%	0.0%
1A3bii	0.023	5.0%	100.1%	-0.3%	0.6%	-0.3%	0.0%	0.0%
1A3biii	0.041	5.0%	100.1%	-0.3%	1.0%	-0.3%	0.1%	0.0%
1A3biv	0.148	5.0%	100.1%	-0.3%	3.7%	-0.3%	0.3%	0.0%
1A3bv	0.341	5.0%	100.1%	-0.3%	8.5%	-0.3%	0.6%	0.0%
1A3bvi	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
1A3bvii	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
1A3dii	0.021	2.0%	100.0%	-0.3%	0.5%	-0.3%	0.0%	0.0%
1A4ai	0.019	5.0%	70.2%	-0.3%	0.5%	-0.2%	0.0%	0.0%
1A4bi	0.010	5.0%	80.2%	-0.3%	0.2%	-0.2%	0.0%	0.0%
1A4cii	0.019	5.0%	100.1%	-0.3%	0.5%	-0.3%	0.0%	0.0%
1A4ciii	0.020	5.0%	100.1%	-0.3%	0.5%	-0.3%	0.0%	0.0%
1A5b	0.173	5.0%	100.1%	-0.3%	4.3%	-0.3%	0.3%	0.0%
1B2av	0.107	5.0%	100.1%	-0.3%	2.7%	-0.3%	0.2%	0.0%
2A5b	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2B10b	0.000	0.0%	0.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2D3a	0.309	5.0%	100.1%	-0.3%	7.7%	-0.3%	0.5%	0.0%
2D3b	0.001	5.0%	100.1%	-0.3%	0.0%	-0.3%	0.0%	0.0%

2D3d	0.369	5.0%	100.1%	-0.3%	9.2%	-0.3%	0.7%	0.0%
2D3e	0.106	5.0%	100.1%	-0.3%	2.6%	-0.3%	0.2%	0.0%
2D3f	0.001	5.0%	50.2%	-0.3%	0.0%	-0.1%	0.0%	0.0%
2D3h	0.373	5.0%	100.1%	-0.3%	9.3%	-0.3%	0.7%	0.0%
2G	0.003	5.0%	100.1%	-0.3%	0.1%	-0.3%	0.0%	0.0%
2H2	0.090	5.0%	83.2%	-0.3%	2.2%	-0.2%	0.2%	0.0%
3B1a	0.082	20.0%	102.0%	-0.3%	2.0%	-0.3%	0.6%	0.0%
3B1b	0.023	20.0%	102.0%	-0.3%	0.6%	-0.3%	0.2%	0.0%
3B2	0.002	20.0%	102.0%	-0.3%	0.1%	-0.3%	0.0%	0.0%
3B3	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4d	0.001	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4e	0.010	20.0%	102.0%	-0.3%	0.2%	-0.3%	0.1%	0.0%
3B4f	0.001	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4gi	0.029	20.0%	102.0%	-0.3%	0.7%	-0.3%	0.2%	0.0%
3B4gii	0.064	20.0%	102.0%	-0.3%	1.6%	-0.3%	0.5%	0.0%
3B4giii	0.002	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4giv	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4h	0.014	20.0%	102.0%	-0.3%	0.4%	-0.3%	0.1%	0.0%
3Da1	0.000	50.0%	50.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3Da2a	0.113	20.0%	102.0%	-0.3%	2.8%	-0.3%	0.8%	0.0%
3Da4	0.000	20.0%	20.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3Dc	0.000	50.0%	50.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3De	0.005	50.0%	111.8%	-0.3%	0.1%	-0.3%	0.1%	0.0%
3F	0.000	50.0%	111.8%	-0.3%	0.0%	-0.3%	0.0%	0.0%
Total	2.835	606.0%	3940.3%	-12.6%	70.7%	-10.3%	6.8%	0.1%

Table 5: Uncertainty estimation of NO_x emissions

NO_x (as NO_2)

Sector	Emissions (kt)	Sum of Sum of AD Uncertainty (%)	Sum of Combined Uncertainty (%)	Sum of Type A Sensitivity (%)	Sum of Type B Sensitivity (%)	Sum of Uncertainty in Trend in Total Emissions due to EF (%)	Sum of Uncertainty in Trend in Total Emissions due to AD (%)	Sum of Combined Uncertainty in Trend in Total Emissions (%)
1A1a	0.396	5.0%	100.1%	-0.5%	4.1%	-0.5%	0.3%	0.0%
1A2gviii	0.178	5.0%	70.2%	-0.5%	1.8%	-0.3%	0.1%	0.0%
1A3ai(i)	0.272	2.0%	100.0%	-0.5%	2.8%	-0.5%	0.1%	0.0%
1A3aii(i)	0.000	2.0%	100.0%	-0.5%	0.0%	-0.5%	0.0%	0.0%
1A3bi	0.658	5.0%	100.1%	-0.5%	6.8%	-0.5%	0.5%	0.0%
1A3bii	0.411	5.0%	100.1%	-0.5%	4.3%	-0.5%	0.3%	0.0%
1A3biii	0.779	5.0%	100.1%	-0.5%	8.1%	-0.5%	0.6%	0.0%
1A3biv	0.011	5.0%	100.1%	-0.5%	0.1%	-0.5%	0.0%	0.0%
1A3bv	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
1A3bvi	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
1A3bvii	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
1A3dii	0.682	2.0%	70.0%	-0.5%	7.1%	-0.3%	0.2%	0.0%
1A4ai	0.111	5.0%	70.2%	-0.5%	1.2%	-0.4%	0.1%	0.0%
1A4bi	0.026	5.0%	80.2%	-0.5%	0.3%	-0.4%	0.0%	0.0%
1A4cii	0.113	5.0%	80.2%	-0.5%	1.2%	-0.4%	0.1%	0.0%
1A4ciii	0.282	5.0%	100.1%	-0.5%	2.9%	-0.5%	0.2%	0.0%
1A5b	0.459	5.0%	100.1%	-0.5%	4.7%	-0.5%	0.3%	0.0%
1B2av	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2A5b	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2B10b	0.000		0.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2D3a	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2D3b	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%

2D3d	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2D3e	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2D3f	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2D3h	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
2G	0.001	5.0%	100.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
2H2	0.000	5.0%	5.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
3B1a	0.003	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B1b	0.001	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B2	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B3	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4d	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4e	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4f	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4gi	0.002	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4gii	0.002	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4giii	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4giv	0.000	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3B4h	0.004	15.0%	101.1%	-0.5%	0.0%	-0.5%	0.0%	0.0%
3Da1	0.079	50.0%	111.8%	-0.5%	0.8%	-0.5%	0.6%	0.0%
3Da2a	0.097	15.0%	101.1%	-0.5%	1.0%	-0.5%	0.2%	0.0%
3Da4	0.000	20.0%	20.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
3Dc	0.000	50.0%	50.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
3De	0.000	50.0%	50.0%	-0.5%	0.0%	0.0%	0.0%	0.0%
3F	0.000	50.0%	111.8%	-0.5%	0.0%	-0.5%	0.0%	0.0%
Total	4.569	541.0%	3089.9%	-23.0%	47.3%	-14.4%	3.6%	0.1%

Table 6: Uncertainty estimation of $PM_{2.5}$ emissions

$PM_{2.5}$

Sector	Emissions (kt)	Sum of Sum of AD Uncertainty (%)	Sum of Combined Uncertainty (%)	Sum of Type A Sensitivity (%)	Sum of Type B Sensitivity (%)	Sum of Uncertainty in Trend in Total Emissions due to EF (%)	Sum of Uncertainty in Trend in Total Emissions due to AD (%)	Sum of Combined Uncertainty in Trend in Total Emissions (%)
1A1a	0.003	1.0%	100.0%	-0.3%	0.4%	-0.3%	0.0%	0.0%
1A2gviii	0.005	5.0%	80.2%	-0.3%	0.7%	-0.3%	0.1%	0.0%
1A3ai(i)	0.002	2.0%	30.1%	-0.3%	0.2%	-0.1%	0.0%	0.0%
1A3aii(i)	0.000	2.0%	30.1%	-0.3%	0.0%	-0.1%	0.0%	0.0%
1A3bi	0.015	5.0%	100.1%	-0.3%	2.1%	-0.3%	0.1%	0.0%
1A3bii	0.020	5.0%	100.1%	-0.3%	2.7%	-0.3%	0.2%	0.0%
1A3biii	0.014	5.0%	100.1%	-0.3%	1.9%	-0.3%	0.1%	0.0%
1A3biv	0.003	5.0%	100.1%	-0.3%	0.4%	-0.3%	0.0%	0.0%
1A3bv	0.000		0.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
1A3bvi	0.042	10.0%	100.5%	-0.3%	5.6%	-0.3%	0.8%	0.0%
1A3bvii	0.015	15.0%	101.1%	-0.3%	2.0%	-0.3%	0.4%	0.0%
1A3dii	0.009	2.0%	100.0%	-0.3%	1.2%	-0.3%	0.0%	0.0%
1A4ai	0.003	5.0%	80.2%	-0.3%	0.4%	-0.3%	0.0%	0.0%
1A4bi	0.013	5.0%	70.2%	-0.3%	1.8%	-0.2%	0.1%	0.0%
1A4cii	0.004	5.0%	100.1%	-0.3%	0.5%	-0.3%	0.0%	0.0%
1A4ciii	0.005	5.0%	100.1%	-0.3%	0.7%	-0.3%	0.0%	0.0%
1A5b	0.079	5.0%	100.1%	-0.3%	10.7%	-0.3%	0.8%	0.0%
1B2av	0.000	10.0%	10.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2A5b	0.037	5.0%	100.1%	-0.3%	5.0%	-0.3%	0.4%	0.0%
2B10b	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2D3a	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2D3b	0.009	5.0%	100.1%	-0.3%	1.1%	-0.3%	0.1%	0.0%

2D3d	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2D3e	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2D3f	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2D3h	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
2G	0.020	5.0%	100.1%	-0.3%	2.7%	-0.3%	0.2%	0.0%
2H2	0.000	5.0%	5.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3B1a	0.002	20.0%	102.0%	-0.3%	0.3%	-0.3%	0.1%	0.0%
3B1b	0.001	20.0%	102.0%	-0.3%	0.2%	-0.3%	0.0%	0.0%
3B2	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B3	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4d	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4e	0.001	20.0%	102.0%	-0.3%	0.1%	-0.3%	0.0%	0.0%
3B4f	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4gi	0.001	20.0%	102.0%	-0.3%	0.2%	-0.3%	0.0%	0.0%
3B4gii	0.001	20.0%	102.0%	-0.3%	0.2%	-0.3%	0.0%	0.0%
3B4giii	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4giv	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3B4h	0.000	20.0%	102.0%	-0.3%	0.0%	-0.3%	0.0%	0.0%
3Da1	0.000	50.0%	50.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3Da2a	0.000	20.0%	20.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3Da4	0.000	20.0%	20.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3Dc	0.003	50.0%	103.0%	-0.3%	0.4%	-0.3%	0.3%	0.0%
3De	0.000	50.0%	50.0%	-0.3%	0.0%	0.0%	0.0%	0.0%
3F	0.000	50.0%	111.8%	-0.3%	0.0%	-0.3%	0.0%	0.0%
Total	0.309	622.0%	3317.0%	-15.1%	41.6%	-10.1%	4.1%	0.0%

Table 7: Uncertainty estimation of SO_x emissions

SO_x (as SO_2)

Sector	Emissions (kt)	Sum of Sum of AD Uncertainty (%)	Sum of Combined Uncertainty (%)	Sum of Type A Sensitivity (%)	Sum of Type B Sensitivity (%)	Sum of Uncertainty in Trend in Total Emissions due to EF (%)	Sum of Uncertainty in Trend in Total Emissions due to AD (%)	Sum of Combined Uncertainty in Trend in Total Emissions (%)
1A1a	0.010	1.0%	100.0%	-0.9%	0.1%	-0.9%	0.0%	0.0%
1A2gviii	0.041	5.0%	30.4%	-0.9%	0.3%	-0.3%	0.0%	0.0%
1A3ai(i)	0.015	2.0%	30.1%	-0.9%	0.1%	-0.3%	0.0%	0.0%
1A3aii(i)	0.000	2.0%	30.1%	-0.9%	0.0%	-0.3%	0.0%	0.0%
1A3bi	0.002	5.0%	100.1%	-0.9%	0.0%	-0.9%	0.0%	0.0%
1A3bii	0.000	5.0%	100.1%	-0.9%	0.0%	-0.9%	0.0%	0.0%
1A3biii	0.000	5.0%	100.1%	-0.9%	0.0%	-0.9%	0.0%	0.0%
1A3biv	0.000	5.0%	100.1%	-0.9%	0.0%	-0.9%	0.0%	0.0%
1A3bv	0.000	0.0%	0.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
1A3bvi	0.000	2.0%	2.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
1A3bvii	0.000	2.0%	2.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
1A3dii	0.012	2.0%	30.1%	-0.9%	0.1%	-0.3%	0.0%	0.0%
1A4ai	0.038	5.0%	30.4%	-0.9%	0.3%	-0.3%	0.0%	0.0%
1A4bi	0.001	5.0%	30.4%	-0.9%	0.0%	-0.3%	0.0%	0.0%
1A4cii	0.009	5.0%	30.4%	-0.9%	0.1%	-0.3%	0.0%	0.0%
1A4ciii	0.005	5.0%	30.4%	-0.9%	0.0%	-0.3%	0.0%	0.0%
1A5b	0.023	5.0%	30.4%	-0.9%	0.2%	-0.3%	0.0%	0.0%
1B2av	0.000	10.0%	10.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2A5b	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2B10b	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2D3a	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2D3b	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%

2D3d	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2D3e	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2D3f	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2D3h	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
2G	0.000	5.0%	100.1%	-0.9%	0.0%	-0.9%	0.0%	0.0%
2H2	0.000	5.0%	5.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B1a	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B1b	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B2	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B3	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4d	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4e	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4f	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4gi	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4gii	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4giii	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4giv	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3B4h	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3Da1	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3Da2a	0.000	50.0%	50.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3Da4	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3Dc	0.000	20.0%	20.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3De	0.000	50.0%	50.0%	-0.9%	0.0%	0.0%	0.0%	0.0%
3F	0.000	50.0%	111.8%	-0.9%	0.0%	-0.9%	0.0%	0.0%
Total	0.156	571.0%	1444.1%	-42.0%	1.3%	-8.9%	0.1%	0.1%

4 Energy (NFR 1)

Chapter Updated: 2025

4.1 Category description

Table 8 shows the detailed source categories for energy. The relevant pollutant trends for key categories, as well as the methodologies used are explained in the sections below.

The sub-categories estimated in this submission are listed below.

Table 8: Coverage of NFR 1 categories in 2023

NFR Code	Pollutants			Method	KC
	Covered	Exceptions			
		NE	NA		
1A1a	Rest of Pollutants	-	HCB, PCBs	Tier 1, 2, 3	✓
1A1b	Not Occurring				✕
1A1c	Not Occurring				✕
1A2a	Not Occurring				✕
1A2b	Not Occurring				✕
1A2c	Not Occurring				✕
1A2d	Not Occurring				✕
1A2e	Not Occurring				✕
1A2f	Not Occurring				✕
1A2gvii	Included Elsewhere (reported in 1A2gviii)				✕
1A2gviii	Rest of Pollutants	-	NH_3, HCB, PCBs	Tier 1, 2	✓
1A3ai(i)	NO_x, NMVOC, SO_x, $PM_{2.5}$, PM_{10}, TSP, CO	-	Rest of Pollutants	Tier 3	✕
1A3aii(i)	NO_x, NMVOC, SO_x, $PM_{2.5}$, PM_{10}, TSP, CO	-	Rest of Pollutants	Tier 3	✕
1A3bi	Rest of Pollutants	-	-	Tier 3	✓
1A3bii	Rest of Pollutants	-	-	Tier 3	✓
1A3biii	Rest of Pollutants	-	-	Tier 3	✓
1A3biv	Rest of Pollutants	-	-	Tier 3	✓
1A3bv	NMVOC	-	Rest of Pollutants	Tier 3	✓
1A3bvi	Rest of Pollutants	Hg, PCDD/PCDF, Benzo(a)pyrene, Benzo(b)flouranthene, Benzo(k)flouranthene, Indeno (1,2,3-cd)pyrene, HCB, PCBs	NO_x, NMVOC, SO_x, NH_3, CO	Tier 3	✓
1A3bvii	$PM_{2.5}$, PM_{10}, TSP, BC	Rest of Pollutants	NO_x, NMVOC SO_x, NH_3, CO	Tier 3	✓
1A3c	Not Occurring				✕
1A3di(ii)	Not Occurring				✕
1A3dii	Rest of Pollutants	-	NH_3	Tier 2	✓

1A3ei	Not Occurring				✕
1A3eii	Not Occurring				✕
1A4ai	All pollutants	-	-	Tier 1, 2	✓
1A4aii	Included Elsewhere (reported in 1A4ai)				✕
1A4bi	All pollutants	-	-	Tier 1, 2	✕
1A4bii	Included Elsewhere (reported in 1A4bi)				✕
1A4ci	Not Occurring				✕
1A4cii	Rest of Pollutants	-	PCDD/PCDF, Indeno (1,2,3-cd)pyrene	Tier 1, 2	✓
1A4ciii	Rest of Pollutants	NH_3	PCDD/PCDF	Tier 1	✕
1A5a	Not Occurring				✕
1A5b	All pollutants	-	-	Tier 1, 2	✓
1B1a	Not Occurring				✕
1B1b	Not Occurring				✕
1B1c	Not Occurring				✕
1B2ai	Not Occurring				✕
1B2aiv	Not Occurring				✕
1B2av	NMVOC	-	Rest of Pollutants	Tier 1	✓
1B2b	Not Occurring				✕
1B2c	Not Occurring				✕
1B2d	Not Occurring				✕

NE: Not Estimated, NA: Not Applicable, KC: Key Category.

Shares of emissions from this NFR sector for all pollutants in 2023 are shown Figure 2. Most pollutant emissions originate primarily from NFR 1.

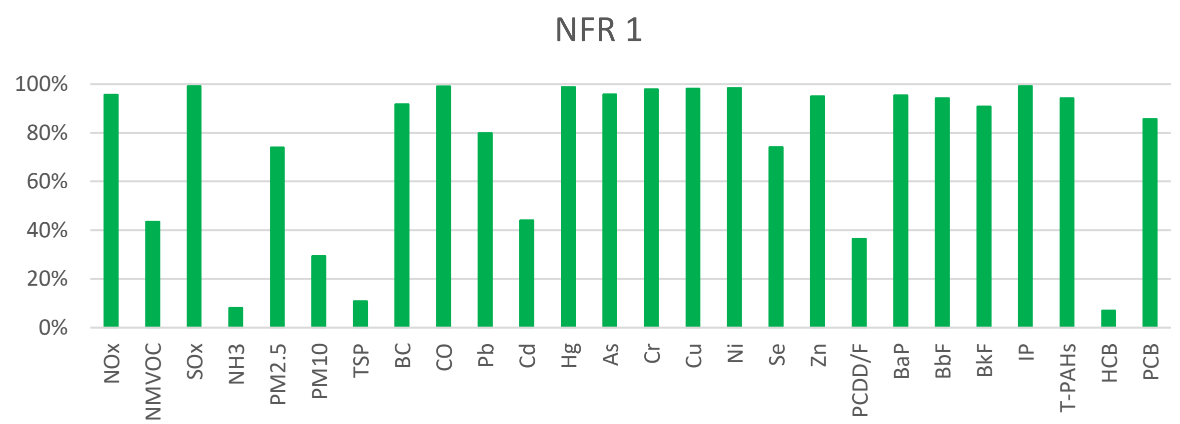

Figure 2: Shares of emissions from the NFR 1 category in percentage of national total

4.2 Sector 1A1a: Public Electricity and Heat Production

Table 9: Sector 1A1a general characteristics

NFR Code	**1A1a**
Sub-Category	Power Generation and Electricity Production
Method	2023GB
Activity Data	AERs & Eurostat
Emission Factors	Tier 1, Tier 2 & Tier 3 (Direct Measurements)
Key Category	NO_x, SO_x, As & Hg
Year of Last Update	2025 submission

4.2.1 Sector description

This subcategory includes emissions of air pollutants from large combustion plants (> 50 MWth) as point sources and from biogas combustion to produce electricity.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 3.

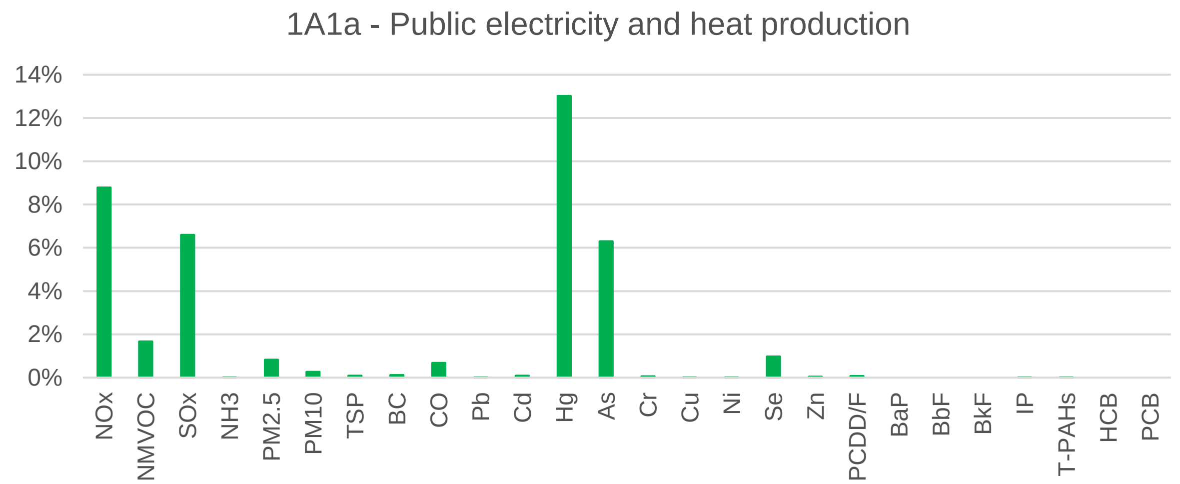

Figure 3: Shares of emissions from the NFR 1A1a category in percentage of national total

4.2.2 Methodology

The methodology used to estimate emissions from this sector is as follows:

- 1990-2004:
  - Calculated through a Tier 1 methodology, by multiplying the total fuel by type, as found under the 'Electricity & heat generation' section in the Eurostat Energy Balance, with the respective EF found within the 2023GB.

- 2005-2016:
  - NO_x, SO_x, NH_3, TSP, and heavy metals emissions from Enemalta were measured through CEMS and reported in their respective Annual Environment Report (AER).
  - Emissions of $PM_{2.5}$ and PM_{10} were estimated by taking the ratio of the $PM_{2.5}$ and PM_{10} EF to TSP, as provided within the 2023GB, and the multiplying that ratio by the TSP emission load reported through CEMS.
  - The total emissions from As, Cr, Cd, Cu, Ni, and Pb, from 2011-2016 were estimated by splitting the emission load reported for heavy metals within the AER by the EFs for each pollutant. The EFs (as provided though the 2023GB) were taken according to the fuel consumed and the technology utilized by each plant. The emission load for heavy metals was not provided from 2005-2010. Hence, an emission load was calculated through the use of a country-specific EF, based on the fuel consumption

and emission loads reported for 2011-2016. The emissions for each heavy metal were then calculated through the same methodology as that used for 2011-2016.
  - All other pollutants were estimated through the Tier 1 and Tier 2 methodology provided within the 2023GB.
  - From 2011 onwards, emissions from biogas combustion in CHP plants for electricity generation have been estimated using a Tier 1 methodology. This involves multiplying the total biogas input for electricity, as reported in the Eurostat Energy Balance under the "Transformation input – electricity and heat generation – energy use" section, by the respective emission factor (EF) from the 2023 GB.

- 2017-2023:
  - The Electrogas and D3 Power Generation Limited commenced their operations in 2017. The emissions of NO_x, SO_x, TSP, NH_3 and CO from these facilities were monitored through CEMS. The Enemalta power station was converted into a back-up plant, and hence, the CEMS was decommissioned.
  - Emissions of $PM_{2.5}$, PM_{10}, and BC were estimated by taking the ratio of the $PM_{2.5}$, PM_{10}, and BC EFs to TSP, as provided within the 2023GB, and multiplying that ratio by the TSP emission load reported through CEMS.
  - The emissions of Pb, Cd, Hg, As, Cr, Cu, Ni, Se, and Zn from Electrogas Malta were estimated through the use of plant-specific EFs.
  - All other pollutants from the other power plants were estimated through the Tier 2 methodology provided within the 2023GB.

- 2024-2030:

Power Stations: NO_x, SO_2, NH_3, and TSP emissions were estimated by calculating a country-specific EF for each plant, based on the quantity of fuel consumed as reported in the AER and the emissions reported through CEMS, making use of data from 2018-2023. The CEMS emissions from D3PG were not separated according to the fuel consumption. Therefore, the share of pollutant emitted per fuel was obtained by taking a weighted average of the fuel consumption for both natural gas and gasoil, as well as the respected EF for both fuels, as provided within the 2023GB.

Emissions of $PM_{2.5}$ and BC were estimated by taking the ratio of the $PM_{2.5}$ and BC EFs to TSP, as provided within the 2019GB, and multiplying that ratio by the TSP emission load estimated using a country-specific EF.

The emissions of NMVOC were estimated through the Tier 2 methodology provided within the 2023GB.

CHP plants: Emissions from biogas combustion in CHP plants were estimated through a Tier 1 methodology. This involved multiplying the annual biogas input for electricity by the respective emissions factors from the 2023GB.

Waste to Energy facility (WtE): Emissions of NO_x, NMVOC, SO_2, NH_3, and $PM_{2.5}$ were estimated by multiplying the annual quantity of waste entering the WtE by the country-specific EF provided through the Air Quality Technical Study of the facility.

4.2.3 Activity data

4.2.3.1 Historical

Power station Malta's electricity production, at Marsa (MPS) and Delimara (DPS), has mostly relied on Heavy Fuel Oil (HFO) and Gasoil, with a small amount of coal utilized until 1995. However, a significant shift in local electricity generation occurred in 2017 with the introduction of two privately owned power plants: Electrogas Malta (EGM) and D3 Power Generation Limited (D3PG). These plants joined Enemalta, the state-owned energy producer, in generating electricity using natural gas and gas diesel oil.

Currently, Enemalta continues to operate the MPS and the DPS, both running on gas diesel oil and serving as standby backup plants. MPS has a single gas turbine (MPS5), while DPS has four gas turbines (DPS2 to DPS5).

The combustion of Heavy Fuel Oil at the Marsa and Delimara power stations was fully phased out in 2015 and 2018, respectively.

As of 2023, 98.6% of fuel use is natural gas and only 1.4% is gasoil.

The table below shows the set-up of the electricity generating plants present locally during 2023.

Table 10: Set up of electricity generating plants

Operator	Plant	Technology	Fuel
Electrogas Malta	CCGT 1	Combined Cycle Gas Turbines	Natural Gas
	CCGT 2	Combined Cycle Gas Turbines	
	CCGT 3	Combined Cycle Gas Turbines	
Enemalta (Back up plants)	DPS2	Gas Turbine	Gasoil
	DPS3	Gas Turbine	
	DPS4	Gas Turbine	
	DPS5	Gas Turbine	
	MPS 5	Gas Turbine	Gasoil
D3PG (D3 Power Generation Limited)	DPS6 C	Diesel Engines	Natural Gas/Gasoil
	DPS6 D	Diesel Engines	
	DPS6 A	Diesel Engines	Natural Gas
	DPS6 B	Diesel Engines	

In addition to gaseous and liquid fuel plants, the interconnector (electricity imported to Malta from mainland Europe) and renewable energy sources such as biogas input for electricity and photovoltaic (PV) cells, supply the remaining electricity entering the grid.

Biogas is produced locally since 2011 in four facilities as listed below and it is used for electricity production throughout combustion in CHP plants.

- Malta North Anaerobic digester
- Landfill gas extraction system at the Ghallis landfill
- Ta' Barkat Sewage Treatment Plant (Malta south)
- Sant' Antnin waste treatment facility (SAWTP) until 2019

4.2.4 Methodology & activity data – Projections

Power generation and electricity production in Malta are expected to consist of:

Power stations:

The projected gasoil and natural gas consumption from 2024 to 2030, which is identical under both the WM and WaM scenarios, was provided by the Energy & Water Agency (EWA). However, the activity data (sourced from financial analytics providers) showed an unexpected spike in gasoil usage between 2024 and 2026. This inconsistency did not align with historical trends and led to an overestimation of emissions.

To address this, an adjustment was made to redistribute fuel shares across these three years among power plants operating on natural gas, such as EGM and D3PG, and those running on gasoil, including MPS, DPS backup plants, and DPS6 at D3PG.

This adjustment, based on plant efficiencies, historical fuel share trends, and forecasted electricity consumption, resulted in the fuel consumption (in GJ) shown in the figure below.

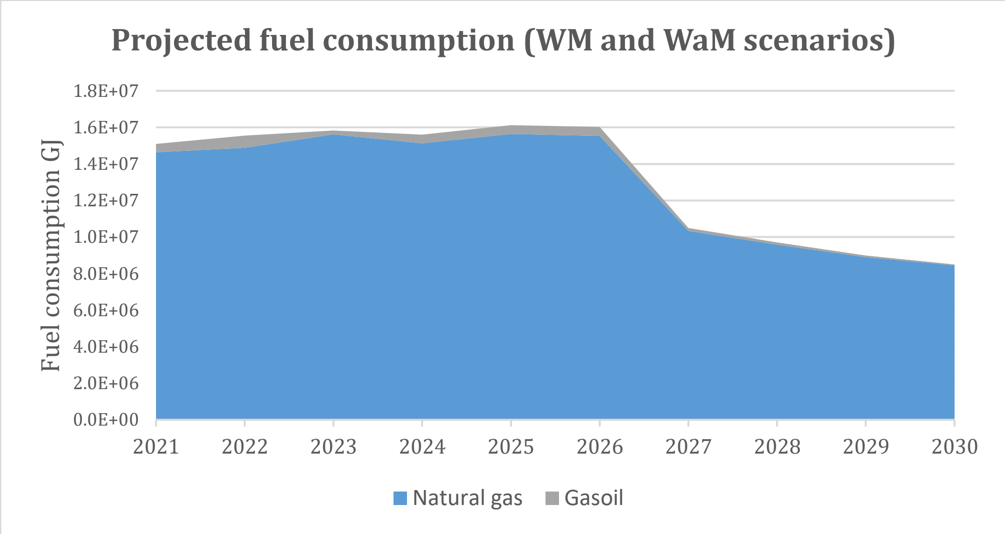

Figure 4: Projected fuel consumption for the public electricity sector

The drop in natural gas and gasoil consumption in 2027 is attributed to an increase in electricity production from other sources, such as the commissioning of the second interconnector in 2027, the Waste-to-Energy facility in 2028 and the spike of biogas combustion for electricity generation.

CHP plants:

The projected biogas input for electricity generation, as shown in Figure 5, was provided by EWA. Under the WM scenario, biogas production is expected to take place at the following facilities:

- Malta North anaerobic digester (until 2028)
- Organic Processing Plant (from 2028 onwards)
- Ta' Barkat Sewage Treatment Plant (Malta South)
- Landfill gas extraction system at the managed Għallis landfill

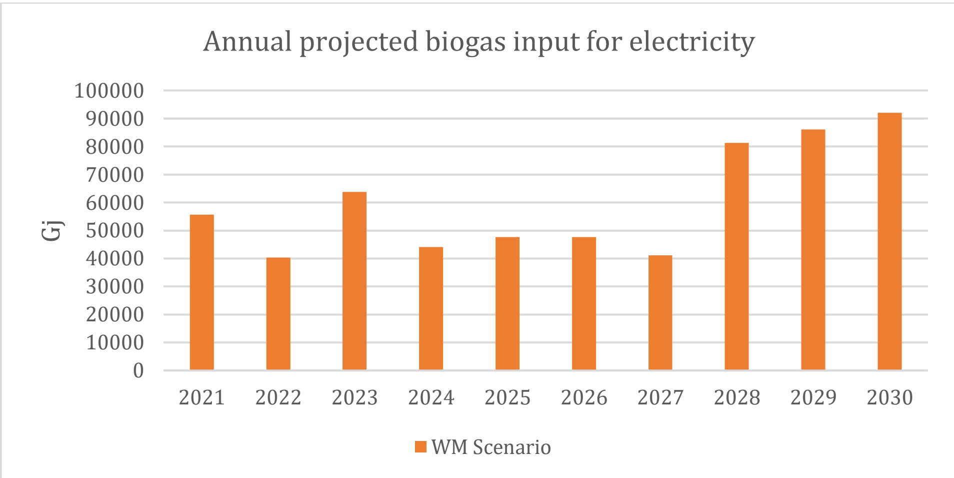

Figure 5: Total biogas input for electricity 2021-2030 (WM Scenario)

Under the WaM scenario, biogas production is expected to occur at the same facilities mentioned in the WM scenario. However, from 2027 onwards, a spike in biogas combustion is anticipated due to an increase in landfill gas extraction points at the managed Għallis landfill.

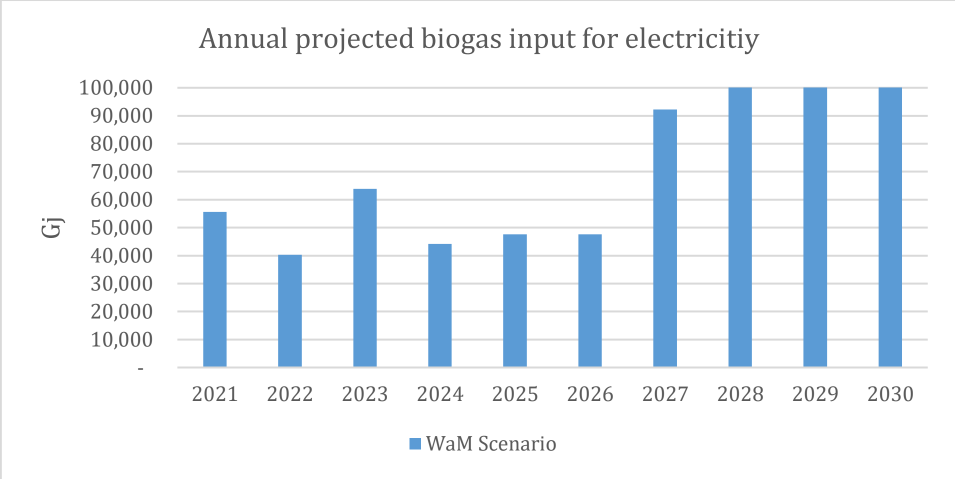

Figure 6: Total biogas input for electricity 2021-2030 (WaM Scenario)

Waste to Energy:

This facility is projected to begin operations in 2028. The activity data consist of the annual projected waste input in tonnes, entering the facility. According to MEEC, the facility is expected to operate at its full capacity of 192,000 tonnes per year throughout all projected years. Both the WM and WAM scenarios use the same input data.

4.2.5 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The emission loads and fuel consumption reported within the AERs were compared to the emission calculation worksheets provided by the facility operator. Checks were also carried out on the emission factors and the formulas utilized within the model. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.2.6 Sector-specific recalculations

The inclusion of historical data on biogas input for electricity generation from 2011 onwards has led to emissions recalculations in 1A1a for all pollutants except TSP, PM_{10}, and $PM_{2.5}$.

4.2.7 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

4.3 Sector 1A2gviii: Stationary Combustion in Manufacturing Industries and Construction

Table 11: Sector 1A2gviii general characteristics

NFR Code	1A2gviii
Sub-Category	Stationary Combustion in Manufacturing Industries and Construction: Other
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1 & 2
Key Category	NO_x, SO_x, Hg, As, Ni, PCDD-PCDF, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, & indeno(1,2,3-cd)pyrene
Year of Last Update	2025 submission

4.3.1 Introduction

This subcategory includes emissions of air pollutants from the energy generation, which is used in activities, such as manufacturing.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 7.

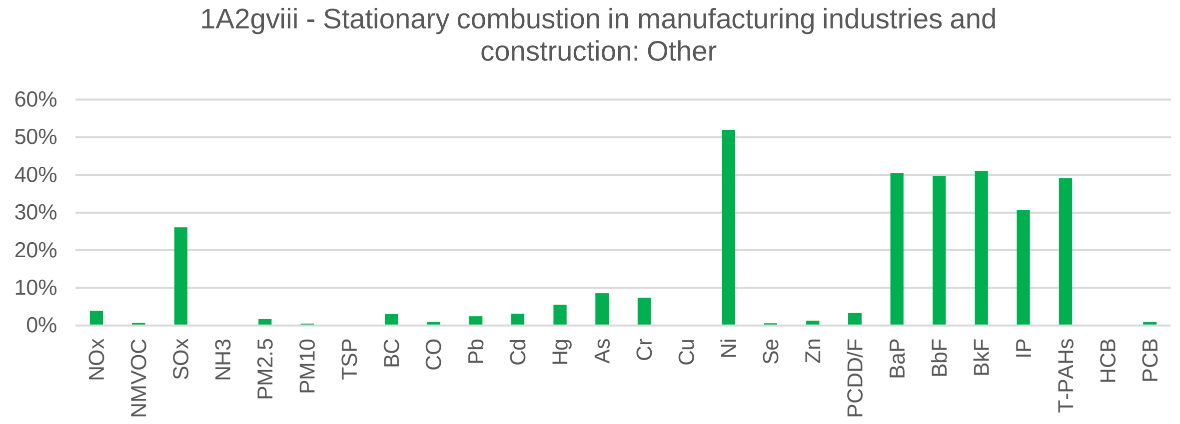

Figure 7: Shares of emissions from the NFR 1A2gviii category in percentage of national total

4.3.2 Methodology

4.3.2.1 Historical

Emissions from the combustion of gasoil and fuel oil were estimated through a Tier 2 methodology, whereas the remaining fuels were estimated through a Tier 1 methodology, as provided within the 2023GB. The tables used, as provided within the 2023GB, are provided below:

Table 12: Source of Emission Factors within the 2023GB

Fuel	Technology	Table	Chapter
Motor gasoline	N/A	Table 3-4	1.A.2 Manufacturing industries and construction (combustion)
Other kerosene	N/A	Table 3-4	1.A.2 Manufacturing industries and construction (combustion)
Gas oil and diesel oil	Boiler	Table 3-24	1.A.4 Small combustion
Gas oil and diesel oil	Generator	Table 3-31	1.A.4 Small combustion
Fuel oil	Boiler	Table 3-24	1.A.4 Small combustion

Liquefied petroleum gases	N/A	Table 3-3	1.A.2 Manufacturing industries and construction (combustion)

4.3.2.2 Projections

The impact of the implementation of the Medium Combustion Plants (MCP) Directive was modelled for the year 2030. The Directive targets MCP which range between 1MW and 50MW. The 2023GB (Table 3-33) provided the total fuel combustion per fuel type and combustion plant size. When taking note of such figures, a share of 75% of fuel was combusted in plants between 1MW and 50MW whereas 25% of fuel was combusted in plants between 50KW and 1MW. Hence, it was assumed that 75% of fuel in 2030 will be combusted in plants regulated through the MCP Directive. It is worth noting that plants operating for less than 500 hours may apply for an exemption from the emission limit values (ELVs) stipulated in the Directive, however, the model assumes that all plants comply with MCP ELVs.

The ELVs are based on the fuel type, the technology type and whether the combustion plant is new or existing. The technology share for gaseous fuels and liquid fuels was assumed to be 80% boilers and 20% reciprocating engines as per the data provided in the 2023GB Table 3-33. The technology share for fuel oil and gas oil are reflected in Table 12. The share of new and existing combustion plants, as defined in the MCP Directive, was taken from the Regulatory Impact Assessment (RIA) report for the MCP Directive.

The ELVs in the MCP Directive refer to concentrations of mg/Nm^3, and therefore a conversion was needed to align with the units used for the 2023GB emission factors, which are in g/GJ. The GAINS model provided two conversion coefficients and the smallest coefficient was applied ($1.06 mg/Nm^3$ – 1 g/GJ) to assume a conservative scenario. The ELVs were then compared with the 2023GB emission factors and the lowest value of the two was used within the calculation. The reasoning behind this is that should the 2023GB emission factors be lower than the ELVs set out in the Directive, the use of emission factors would reflect a realistic scenario whereas the use of the ELVs would result in an overestimation of emissions. The emissions from the non-MCPs and MCPs were summed together to calculate the total emissions.

4.3.3 Activity Data

The quantities of fuel used from 2005 onwards were taken from the 'Industry sector' section within the Eurostat Energy Balance. The Energy Balance could not be used from 1990-2004, since the figures reported within the Energy Balance were all '0'. Data from the climate change model was used to gap fill these years.

4.3.3.1 Gasoil and diesel oil

An exercise was carried out for the 2023 submission, to determine the share of technology used to combust gasoil for both NFR 1A2gviii and NFR1A4ai. The fuel consumption per technology for all permitted combustion plants in 2019 was noted. The consumption of gasoil under these permitted facilities comprised 5.4% of the total gasoil combusted under both NFR1A2gviii and NFR1A4ai, as reported through the Eurostat Energy Balance. Thus, for that 5.4% of gasoil consumed, the technology share reported through the permitted facilities (as provided within Table 13) was taken. For the remaining 94.6% of gasoil combusted, the default technology share provided through the 2023GB, as provided in Table 13, was taken.

Table 13: Share of technology type per gasoil consumed in NFR1A2gviii

Technology	Permit fuel use %	2023GB fuel use %
Reciprocating Engine	10.9%	20.0%
Boiler	89.1%	80.0%

The technology share for gasoil consumption was assumed to be the same for all the years.

4.3.3.2 Sulphur content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2014 to 2023. Therefore, the sulphur content from 2014 was used to calculate SO_x emissions prior to 2014.

4.3.3.3 Projections

The EWA provided projected fuel consumption for the Industry sector. The projected fuel consumption could only be provided under the WM scenario, and therefore the WaM scenario was assumed to be the same as the WM scenario. Furthermore, the sulphur content value for 2023 was carried forward for the projected years under both the WM and WaM scenarios.

4.3.3 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.3.4 Sector-specific recalculations

Recalculation of SO_x across the time series due to introduction of country specific sulphur content values for heavy fuel oil.

4.3.5 Sector-specific planned improvements

Efforts will be made to provide more representative EFs across the time series.

4.4 Sector 1A3ai(i): International aviation LTO (civil)

Table 14: Sector 1A3ai(i) general characteristics

NFR Code	**1A3ai(i)**
Sub-Category	International aviation LTO (civil)
Method	2023 LTO emissions calculator & EUROCONTROL data
Activity Data	Malta International Airport
Emission Factors	EUROCONTROL
Key Category	Not Applicable
Year of Last Update	2025 submission

4.4.1 Sector description

This subcategory includes emissions of air pollutants generated from the civil commercial use of aeroplanes, during the landing and take-off cycles (LTOs), on flights which departed from the Malta International Airport and landed in foreign airports. Shares of emissions of the particular pollutants from 1A3ai(i) in 2023 are shown in Figure 8.

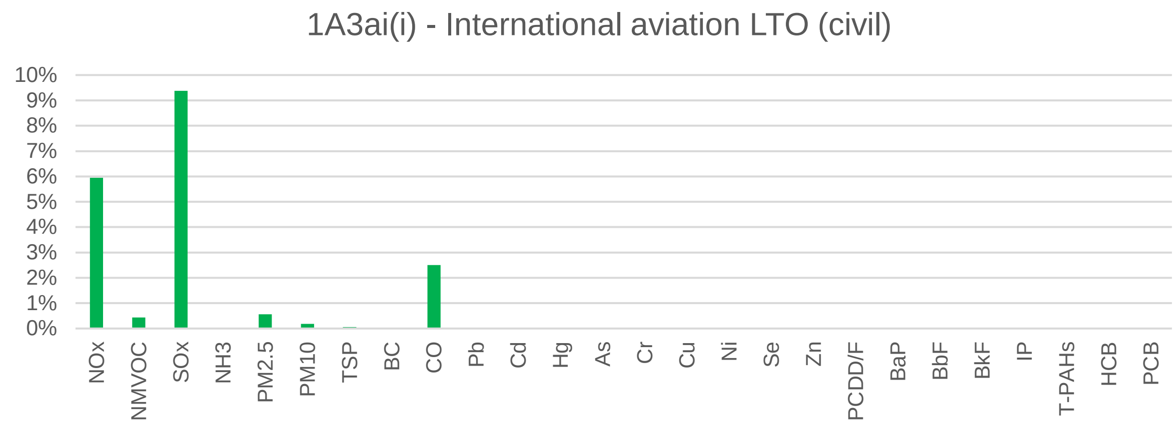

Figure 8: Shares of emissions from the NFR 1A3ai(i) category in percentage of national total

4.4.2 Methodology & activity data - Historical

Emissions from 1990 to 2004 are estimated using the 2023 LTO emissions calculator, which was developed by EUROCONTROL. This methodology assigns a specific EF to each aircraft type, according to its ICAO classification. Additionally, the taxi in and out are altered based on the specific airport and year in question. The taxi arrival and departure times from 2005 were applied to the period from 1990 to 2004, as they were deemed the most closely aligned with the emission years being calculated. The number of LTO cycles for international flights from 1990 to 1998 were provided by the Civil Aviation Department at Transport Malta whilst the number of LTO cycles from 1999 to 2004 were provided by the Malta International Airport.

Conversely, LTO emissions from 2005 to 2023 are calculated directly by EUROCONTROL, and the values provided are reported directly within the NFR table. The emissions estimated directly by EUROCONTROL are deemed more representative, since they take into consideration the flight paths.

4.4.3 Methodology & activity data – Projections

For projected emissions, a relationship was established between the number of IFR (Instrument Flight Rules) flights and historically reported emissions to obtain a value of emission in kt per IFR flights. An average value of all non-COVID years was established and utilized as an emission factor and then multiplied by the projected IFR flights obtained from EUROCONTROL (EUROCONTROL, 2023). The average split of domestic and international flights was calculated for all the non-COVID years and utilized to obtain final projected emissions for this sector.

4.4.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. The trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.4.5 Sector-specific recalculations

- Recalculations for the years 1990 to 2004 have been conducted to account for updates in emission factors, reflecting the differences between the 2019 and 2023 LTO emissions calculators.
- Recalculations for all pollutants due to updated data by EUROCONTROL from 2018 onwards.

4.4.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

4.5 Sector 1A3aii(i): Domestic aviation LTO (civil)

Table 15: Sector 1A3aii(i) general characteristics.

NFR Code	**1A3aii(i)**
Sub-Category	Domestic Aviation LTO (civil)
Method	2023 LTO emissions calculator & EUROCONTROL data
Activity Data	Malta International Airport
Emission Factors	EUROCONTROL
Key Category	Not Applicable
Year of Last Update	2025 submission

4.5.1 Sector description

This subcategory includes emissions of air pollutants generated from the civil commercial use of aeroplanes, during the landing and take-off cycles (LTOs), on flights which departed and landed in the Maltese Islands. Shares of emissions of the particular pollutants from 1A3aii(i) in 2023 are shown in Figure 9.

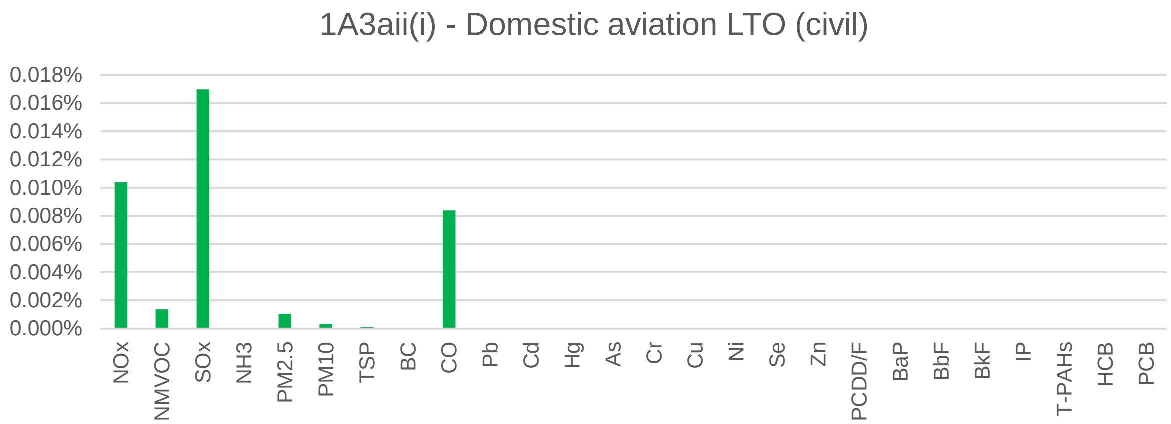

Figure 9: Shares of emissions from the NFR 1A3aii(i) category in percentage of national total

4.5.2 Methodology & activity data - Historical

Emissions from 1990 to 2004 are estimated through the 2023 LTO emissions calculator, which was developed by EUROCONTROL. This methodology assigns a specific EF to each aircraft type, according to its ICAO classification. Additionally, the taxi in and out are altered based on the specific airport and year in question. The taxi arrival and departure times from 2005 were applied to the period from 1990 to 2004, as they were deemed the most closely aligned with the emission years being calculated. The number of LTOs from 1999-2004 were provided by the Malta International Airport. No activity data was available for domestic flights prior to 1999 therefore, to estimate the activity data for these years, a rounded up average of the number of LTO cycles from 1999 to 2004 is used as a proxy. This approach was considered reasonable as there was no significant change in the number of domestic flights during this period, and it allowed for the calculation of estimates for the entire time series.

Conversely, LTO Emissions from 2005-2023 are calculated directly by EUROCONTROL, and the values provided are reported directly within the NFR table. The emissions estimated directly by EUROCONTROL are deemed more representative, since they take into consideration the flight paths.

4.5.3 Methodology & activity data - Projections

For projected emissions, a relationship was established between the number of IFR (Instrument Flight Rules) flights and historically reported emissions to obtain a value of emission in kt per IFR flights. An average value of all non-COVID years was established and utilized as an emission factor and then multiplied by the projected IFR flights obtained from EUROCONTROL (EUROCONTROL, 2023). The average split of domestic and international flights was calculated for all the non-COVID years and utilized to obtain final projected emissions for this sector.

4.5.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.5.5 Sector-specific recalculations

- Recalculations for the years 1990 to 2004 have been conducted to account for updates in emission factors, reflecting the differences between the 2019 and 2023 LTO emissions calculators.
- Recalculations for all pollutants due to updated data by EUROCONTROL from 2018 onwards.

4.5.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

4.6 Sector 1A3b: Road Transport

Table 16: Sector 1A3b general characteristics

NFR Code	**1A3b**
Sub-Category	Road Transport
Method	COPERT 5.8.1
Activity Data	Energy and Water Agency Climate Action Authority Transport Malta Regulator for Energy and Water Services MET Office
Emission Factors	Tier 3
Key Category	NO_x, NMVOC, $PM_{2.5}$, PM_{10}, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Se, Zn, & PCDD/PCDF
Year of Last Update	2025 submission

4.6.1 Sector description

This subcategory encompasses emissions from both internal-combustion engine vehicles (ICE) and electric vehicles (EV) in Malta. The emission estimates for this sector are based on the licenced vehicle fleet circulating on public roads, excluding non-road machinery such as agricultural equipment and military transport.

Emissions were calculated for each of the following categories:

- 1A.3.bi, Passenger Cars;
- 1A.3.bii, Light Commercial Vehicles;
- 1A.3.biii, Heavy-Duty Vehicles and Buses;
- 1A.3.biv, Mopeds and Motorcycles;
- 1A.3.bv, Gasoline Evaporation;
- 1A.3.bvi, Tyre & brake Wear;
- 1.A.3.bvii, Road Surface Abrasion

The shares of emissions for all pollutants estimated under this subcategory in 2025 for the reference year 2023, as a percentage of the national total are shown in Figure 10.

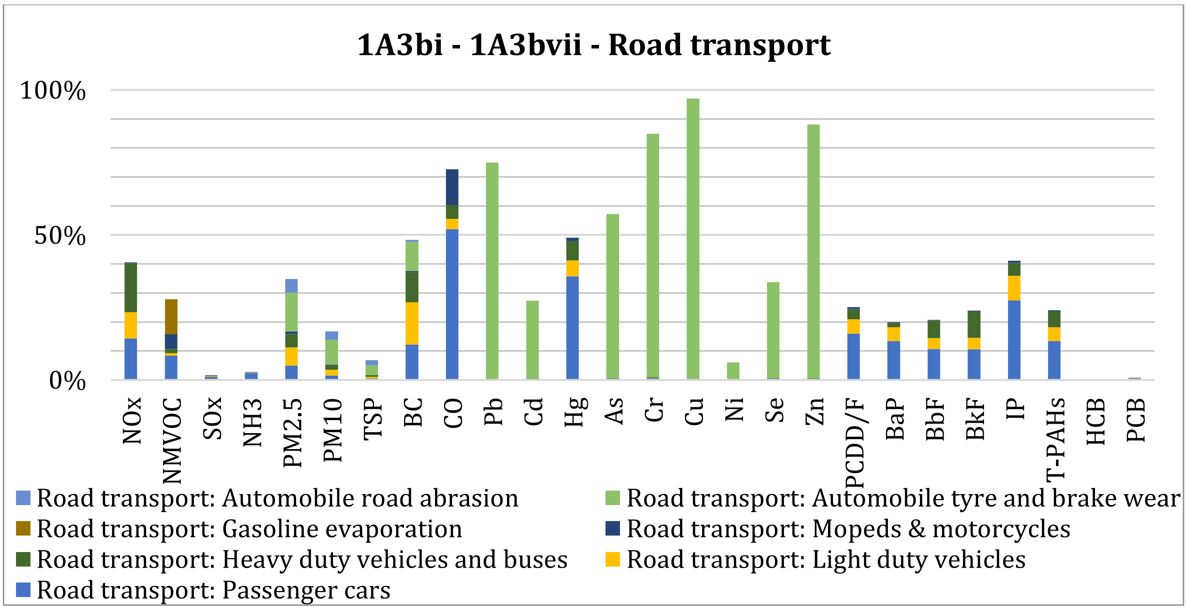

Figure 10: Shares of emissions from the NFR 1A1b category in percentage of the national total

4.6.2 Methodology – Historical

For this sector, Malta applied a Tier 3 approach utilizing a vehicle activity-based model to estimate exhaust emissions. This method integrates detailed technical specifications with activity data to enhance accuracy. Road transport emissions were calculated using COPERT 5.8.1, which incorporates multiple parameters—such as vehicle fleet composition, mileage, speed, and meteorological conditions—to quantify emissions from the road transport sector.

4.6.3 Activity Data - Historical

A list of the activity data together with a list of their respective data sources is provided below:

Table 17: List of activity data utilised for the Road Transport sector together with the entity that provides the data.

Parameters	Source of parameters used
Environmental Information	Data was obtained from the National Meteorological Office. This includes minimum and maximum average monthly temperatures as well as monthly average %age humidity from 1990 to 2023.
Trip Characteristics (trip duration and trip length)	This data was sourced from Transport Malta (TM) through the National Transport Model (NTM), which relies on the national household travel survey, compiled in 2021, to determine trip origins and destinations. In response to the COVID-19 situation in 2020, adjusted trip duration values were applied, as reduced traffic and congestion led to shorter travel times, despite trip distances remaining unchanged. For years post 2020, the values used reverted to those applied in the pre-2020 historical years.
Fuel Specifications	The sulphur content in fuel for diesel (2004) and petrol (2005) was retroactively applied to cover the period from 1990 to 2003. For the years 2004 to 2007, values were reported in accordance with Directive 98/70/EC, with data provided by the then Malta Resources Authority (MRA) now Climate Action Authority (CAA). Between 2008 and 2013, extrapolated values were used, while for the years 2014 to 2023, sulphur content data was sourced from the Regulator of Energy and Water Services (REWS). Regarding lead content in fuel, REWS supplied data for the period between 2004 and 2010, with the 2004 petrol value applied retrospectively. From 2011 onwards, COPERT default values were used due to the unavailability of local data. For diesel, as there is no requirement for lead testing, the default COPERT lead content was applied throughout the entire time series.
Statistical consumption	The total fuel sales were obtained from Eurostat for the entire time series, although Malta does not make use of fuel consumption in its calculations. Further details are included in section 4.6.3.3 below.
Stock	Vehicle stock for the years 1995 to 2023 was obtained from TM. For pre-1995 years, ERA uses the fleet totals split according to the vehicle share categories of 1995.
VKM[1]	For the period 1990 to 2009, the mean VKM per age of vehicle was assumed equal to the data provided by the Energy and Water Agency (EWA) from 2010 onwards. Data for 2010 to 2023 was generated using a model, which EWA developed in order to generate VKM for historical and projected years (up to 2030).
Circulation (Average speed and percentage	This data was sourced from Transport Malta (TM) through the National Transport Model (NTM).

[1] VKM represents the total vehicle kilometres travelled annually by each vehicle category. In Malta, distance is measured in kilometres, although the term "mileage" is commonly used in everyday language. Therefore, any reference to "mileage" in this context refers to the total distance travelled in kilometres.

mileage share per road type)	The COVID-19 pandemic and the associated restrictions led to reduced traffic and congestion in 2020. Consequently, speed data for that year differs from the trends observed in both previous and post years.
Fuel blend	The REWS provided fuel blends as follows: E0 (petrol) and B7 (diesel).
Load and road slope	This was assumed to be 50% and 0% respectively.

The following compilation of activity data was used for this year's submission of the emission inventory and projections reporting.

4.6.3.1 Stock data

Stock data was sourced from Transport Malta (TM), which maintains a comprehensive register of all vehicles registered and licensed in Malta through the Vehicle Registration and Administrative System (VERA).

The following vehicle categories have been reported in this year's submission for all historical years:

Table 18: Table highlighting Malta's stock for the historical years. Categories highlighted in bold refer to new entries added in the latest reporting period. Other categories were already included in Malta's stock in previous submissions.

Category	Fuel	Segment
Passenger Cars	Petrol	Small
		Medium
		Large-SUV-Executive
	Diesel	Small
		Medium
		Large-SUV-Executive
	LPG Bifuel	Medium
	Petrol Hybrid	**Small**
		Medium
		Large-SUV-Executive
	Petrol PHEV	**Small**
		Medium
		Large-SUV-Executive
	Battery Electric	**Mini**
		Small
		Medium
		Large-SUV-Executive
Light Commercial Vehicles	Petrol	N1-I
		N1-II
		N1-III
	Diesel	N1-I
		N1-II
		N1-III
	Battery Electric	**N1-I**

		N1-II
		N1-III
Heavy-Duty Vehicles	Diesel	Diesel Rigid ≤7.5t
		Diesel Rigid 7.5-12t
		Diesel Rigid 12-14t
		Diesel Rigid 14-20t
		Diesel Articulated 14-20t
Buses	Diesel	Urban Buses Midi ≤15t
		Urban Buses Standard 15-18t
		Coaches Standard ≤18t
	Battery Electric	**No specific category (default within COPERT)**
L-category	Petrol	Mopeds 2-stroke <50 cm^3
		Motorcycles 2-stroke >50 cm^3
		Motorcycles 4-stroke <250 cm^3
		Quads & ATVs

Various assumptions were applied in compiling stock data, aligning with those adopted by EWA in their post-2010 stock and VKM model, as outlined in previous IIRs.

General assumptions considered for the historical time series:

1 Heavy Commercial Vehicles:
- Due to the lack of VKM data for heavy-duty vehicles (HDVs) over 14 tonnes, all such vehicles were classified under the COPERT category HDV 14t-20t.
- Malta also has a small fleet of LPG HGVs and given that there is no COPERT category that addresses this group, Malta included such vehicles under the HDV diesel category according to weight of vehicle.

2 Light Commercial Vehicles:
- Malta has a small fleet of LPG LCVs and given that there is no COPERT category that addresses this group, Malta included such vehicles under the LCV N1-III diesel category.

3 Motorcycles and Quads/ATVs:
- COPERT Emission factors are available only for petrol L-category vehicles. A small number of diesel L-category vehicles was incorporated into the petrol vehicle stock.
- Given that COPERT has no category for EV motorcycles, these were included under the Battery Electric Mini Passenger Cars category in order to ensure that the rather large fleet of Motorcycle EVs is included in the model and resulting emissions.

4 Buses:
- Since COPERT only provides emission factors for diesel buses, a minor fraction of petrol buses was included in the diesel vehicle stock for this analysis.

5 Freight:
- The average VKM for Tractor Units (TU) was significantly higher than that of the overall HDV fleet, which would have skewed the combined average if categorized together with Goods Commercial Vehicles (GCV) and Special Purpose Vehicles (SPV). To address this, the total annual VKM for TU was estimated separately from the LCV and HDV analyses and later integrated into the HDV category for forecasting purposes.
- It was assumed that a significant portion of freight VKM occurs overseas. Based on EWA's model, only 5% of total freight VKM was considered to be driven within Malta, and only this fraction was included for articulated 14-20t diesel HDVs.
- Since COPERT does not provide specific emission factors for freight, values for Articulated HDVs >14t were applied, as 99% of the TU stock consists of vehicles heavier than 15 tonnes.

- Unlike previous reporting years, stock and VKM data were provided for all vehicle Euro standards rather than solely for Euro II and Euro VI A/B/C categories. In cases where VKM data was unavailable but stock data was present, linear interpolation was used to estimate mean activity.

6 Passenger Cars
- During this reporting period, Malta included both petrol plug-in hybrid and hybrid vehicles across small, medium, and large categories. Given the country's small geographical size and relatively short travel distances, vehicles with an electric component are assumed to rely primarily on battery power for most daily trips. Consequently, an 80% battery use and 20% liquid fuel use assumption was applied to hybrids.

In addition to the aforementioned general assumptions, certain assumptions were considered in order to be able to sort the VERA data provided by TM into the appropriate COPERT vehicle categories for the years 1995 to 2023. These were also somewhat in line with the assumptions made by EWA for different stocks reported in previous years[2].

- Non-road machinery, including agricultural tractors and large construction equipment, was excluded from the stock.
- Caravan trailers were also omitted, as the majority are either parked long-term in designated areas and remain stationary or are used for travel abroad, meaning most of their VKM occurs outside Malta's territory;

The following fuel-related assumptions were applied:

- Vehicles listed with paraffin as their fuel type were classified as petrol, as this was likely a data entry error in the VERA database.
- Motorcycles with no specified fuel type were assigned to the petrol category, given that COPERT only provides emission factors for petrol L-category vehicles.
- Vehicles classified under N2, N3, M2, M3, SP1, and SP2 without a designated fuel type were assumed to be diesel within their respective categories.
- Passenger cars and LCVs lacking fuel type information were randomly assigned as either diesel or petrol, based on the 2017[3] fuel share distribution, as follows:

Table 19: Table highlighting the percentage share of PCs and LCVs in 2017, which percentages were applied to the vehicles that had no fuel assigned to them in the pre-2010 stock.

	Petrol	Diesel
Passenger Cars	68%	32%
Light Commercial Vehicles	0.34%	96.6%

- All M1 vehicles with more than nine seats were reclassified under the bus categories based on their body type.
- N1 vehicles and commercial special purpose vehicles (excluding caravans) were grouped under the Light Commercial Vehicle (LCV) category.
- Diesel LCVs exceeding 3.5 tonnes in weight were reallocated to the Heavy-Duty Vehicle (HDV) category according to their Gross Vehicle Weight (GVW).
- All N2 and N3 vehicles were categorized as HDVs based on their GVW.
- Tractor Units (TUs) were classified as Articulated HDVs, following the same rationale as previously mentioned, while non-TU vehicles were categorized as Rigid HDVs.
- For buses, two classification approaches were considered:
  - Sorting according to vehicle GVW, aligning with COPERT classifications.

[2] Assumptions considered by EWA for post-2010 stock as reported in previous years may be found in Malta's Annual Informative Inventory Report – 2023 submission

[3] The year 2017 was selected as the reference year because it marks the development of the EWA model.

- Categorizing all route buses as Urban Buses Standard in line with EWA classifications. Meanwhile, the Coaches Standard category included CO, CBP, PM3, PT3, and P6 vehicles (excluding vans, limousines, and ambulances), as well as single/double-decker buses. Remaining bus types were placed under Urban Buses Midi, which primarily includes minibuses.

- For L-category vehicles:
  - All petrol-powered vehicles were included except for L6 and L7, along with M1 vehicles classified as tricycles.
  - Vehicles with engine capacities below 50cc were assigned to the <50cc 2-stroke category, those above 50cc were placed in the >50cc 4-stroke category, and the remainder were categorized based on engine size.
  - L6 and L7 vehicles were grouped under the Quads category, along with M1 vehicles classified as buggies or all-terrain vehicles (ATVs).

Additional refinements were made to ensure comprehensive coverage of on-road vehicles across different categories. Due to limitations in the EWA VKM model, which does not account for certain vehicle types, some stocks recorded in the VERA database could not be fully considered due to the absence of VKM data. The table below summarizes the vehicle categories that were reassigned to other COPERT classifications due to this data limitation. Addressing these gaps remains a priority for Malta, with ongoing efforts to enhance vehicle stock accuracy and ensure precise categorization in future reporting.

Table 20: Vehicle categories for which stock was available from 1990-2009, which have been assigned to similar vehicle categories since VKM was lacking.

Available stock between 1990-2009	**Assigned to existing categories**
Rigid 20 - 26 t	Rigid 14 - 20 t
Rigid 26 - 28 t	
Rigid 28 - 32 t	
Rigid >32 t	
Coaches Articulated >18t	Coaches Standard ≤18 t
Urban Buses Articulated >18t	Urban Buses Standard 15-18t
Motorcycles 4-stroke 250 - 750 cm^3	Motorcycles 4-stroke <250 cm^3
Motorcycles 4-stroke >750 cm^3	

4.6.3.2 Annual average vehicle per km data

The Vehicle Roadworthiness Testing (VRT) data for the years 2017–2023, provided by NSO to EWA, included VKM information. This data was utilized to estimate the annual mean mileage a vehicle is expected to travel based on its year of manufacture. A database was compiled, recording the total mileage for vehicles aged between 4 and 100 years.

The VRT dataset contains details on vehicle type, engine size, weight, fuel type, year of manufacture, and a representative sample of vehicles contributing to the annual VKM estimate. According to the NSO, the annual average VKM was calculated as follows:

$$VRT\ Mileage\ difference = VRTyear2 - VRTyear1 = A$$

$$VRT\ Days = VRTdate2 - VRTdate1 = B$$

$$VKM\ average\ /\ day = A/B = C$$

$$Annual\ Ave.VKM = C * 365\ days = D$$

Equation 2: Calculation of annual average VKM

Only vehicles with an annual average VKM between 500 km and 150,000 km were considered to mitigate the impact of data anomalies. Additionally, after applying this filter, outliers deemed unrealistic by NSO were also removed. Since vehicles under five years old are not subject to VRT, a constant VKM figure was assigned to them. The resulting normalized plot showed that as vehicles age, their annual mileage decreases.

Given that the EWA VKM model only caters for VKM post-2010, for the period 1990 to 2009, the mean VKM per age of vehicle was assumed equal to the data provided by EWA from 2010 onwards. An important thing to note is the fact that this year Malta made use of VKM provided by EWA but stock provided by TM. EWA's VKM is calculated using vehicle stock as provided by NSO. However, due to large discrepancies with the data, ERA opted to make use of actual stock data. In this context, in order to get the mean activity for all vehicles, the VKM provided for the various vehicle types was divided by the actual stock data provided by TM. The resulting mean activity was used as input data into COPERT 5.8.1.

4.6.3.3 Fuel consumption data

The total fuel share for the entire time series was obtained from Eurostat's Energy Balances. Having a look at the fuel consumption trend across the time series as shown in Figure 11, one would note that there are certain fluctuations in fuel use particularly for pre-2005 years. The model that EWA generated, provides a more accurate representation of the driving patterns in Malta across the time series than fuel consumption data provides. In this context, the energy balance function within COPERT is not utilized as ERA makes use of the VKM rather than the fuel consumption to estimate emissions.

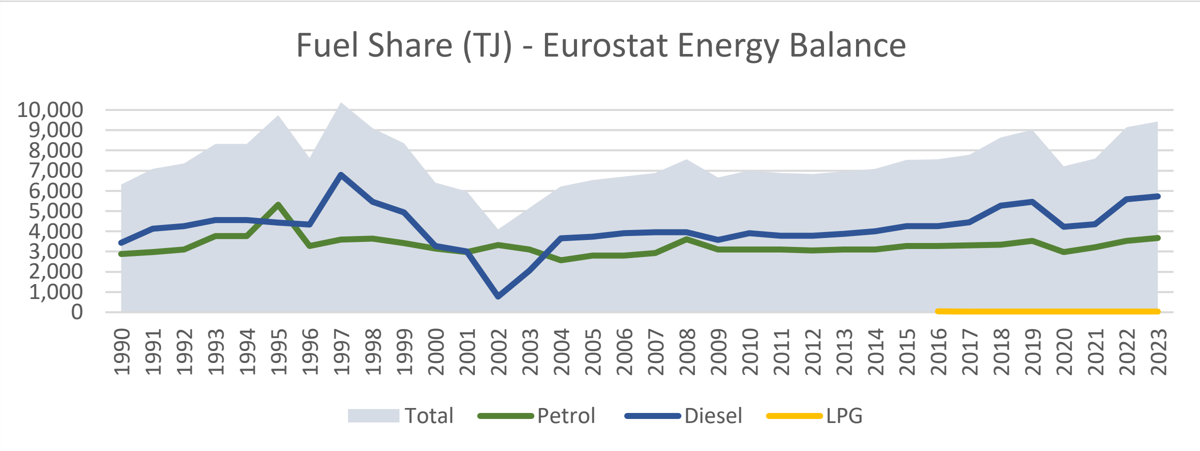

Figure 11: Fuel consumption per fuel type and as totals for road transport 1990-2023

When using the VKM modelled by EWA, a more realistic fuel consumption trend emerges, as illustrated in Figure 12. Given the uncertainties associated with the reported Eurostat Energy Balance, Malta opted to assess fuel consumption based on VKM data. The figure below demonstrates an increasing trend, which aligns with the growing vehicle stock and the annual mileage driven.

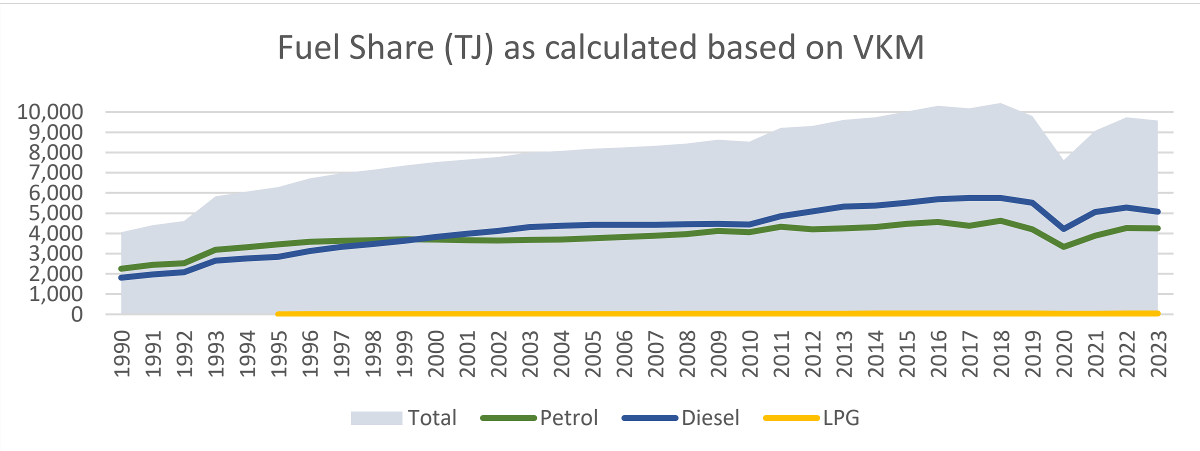

Figure 12: Fuel consumption per fuel type and as totals for road transport 1990-2023 based on mileage.

4.6.3.4 Trip characteristics and circulation data

4.6.3.4.1 Trip length and trip duration

Trip length and trip duration data was provided by Transport Malta (TM) as calculated from the National Transport Model (NTM), which uses Census data to establish trip origins and destinations. The average of AM and PM trip durations and lengths was used for the average daily trip distance, as the NTM does not cater for off-peak scenarios. Data on the average trip duration for the year 2017 was used for the entire time series and projected years except for 2020. Due to the COVID-19 pandemic, a different trip duration was provided due to an increase in speeds as a result of the restrictions put in place in the country during the initial months of the pandemic. The pre-2020 parameters were used for the year 2021, 2022 and 2023.

The values provided by TM were used for the passenger cars, light commercial vehicles and the L-category. TM values also applied to HDVs and Buses, however, noting that bus trips and HDV trips are generally longer and lengthier, different values were used for both parameters. In last year's submission default, COPERT values were used, however, such values have now been considered unrealistic for the Maltese scenario. The below table provides an overview of the values used for every parameter.

Table 21: Input parameters used for trip length and trip duration

Vehicle category	**Trip Length (km)**	**Trip Duration (hr)**	
		Pre-2020, 2021-2023, 2025 & 2030 (WM/WaM)	**2020**
Passenger cars	5.95	0.25	0.23
Light Commercial Vehicles	5.95	0.25	0.23
Heavy Duty Vehicles	12.0	0.85	0.85
Buses	12.0	0.85	0.85
L-category	5.95	0.25	0.23

Concerning the average trip length this was the same for the entire time series as this is based on the trip origins and destinations as modelled by TM. This might be revised once the updated NTM is published.

4.6.3.4.2 Average speed and road share

The COPERT 5.8.1 model requires circulation and speed values for both off-peak and peak periods. However, since the NTM simulated the road network under peak-hour conditions, long-term traffic count data, combined with Bureau of Public Roads (BPR) curves, was used to address this limitation. BPR curves define the relationship between time delay (and consequently speed) and congestion. This data was provided by TM, and the same average speed based on 2017 calculations was applied consistently across the entire time series from 1990 to 2023, excluding 2020.

For the year 2020, due to local restrictions resulting from the COVID-19 pandemic, traffic volumes decreased, leading to an expected increase in speeds. To account for this, an adjusted factor was applied to reflect the 2020 volume-capacity ratio. For the years 2021 to 2023, pre-2020 figures were used since TM was not in a position to update the data for the most recent years. These figures may be revised once the updated NTM is published.

As for road shares (%), COPERT 5.8.1 provides 4 types of roads categories:

- Highway
- Rural
- Urban peak
- Urban off peak

Conversely, the NTM includes various road classifications, requiring efforts to align the road classes from the NTM's structure plan with COPERT's road classification system. To achieve this, a shapefile delineating urban areas, as defined by the Strategic Plan for the Environment and Development (SPED), was utilized to categorize road links accordingly.

The average daily speed was then computed for each road category, along with the percentage mileage share per road type. However, no distinction was made between different vehicle types, as this level of detail was not available. The table below summarizes the data input into COPERT 5.8.1.

Table 22: Circulation data

	Urban Peak	**Urban Off Peak**	**Rural**	**Highway**	**Urban Peak**	**Urban Off Peak**	**Rural**	**Highway**
	% shares				**Speed in km/h**			
Pre-2020, 2021-2023, 2025 and 2030 (WM/WaM)	2.55	34.94	28.7	33.82	14.92	28.59	14.41	53.77
2020					15.85	29.40	14.81	55.44

4.6.3.5 Additional parameters

As previously mentioned, the energy balance function was not verified for all years, as the actual mileage data was deemed sufficiently representative of real-world conditions. Additionally, the following parameters were not considered when running the model with the specified input data: SCR CO_2 emissions, air conditioning (A/C) usage, CO_2 emissions from lube oil, and mileage degradation functions. The inspection and maintenance scheme (IM effect) was also excluded from the analysis.

4.6.4 Projections

The forthcoming subchapters provide an overview of the methodology, assumptions and updates applied to the projected scenarios for 2025 and 2030.

The measures included in the With Measures (WM) scenario are included in Malta's National Energy and Climate Plan (NECP) section 3.1.3.iii. The below provides an overview of what is included in the WM scenario for the road transport sector for ease of reference:

- **Electrification of vehicles**, is considered to be a priority area to reduce emissions from the road transport sector. In fact, this was also highlighted in the Low Carbon Development Strategy (LCDS). The Maltese Government has committed to make efforts to introduce the GHG emission savings of 65,000 EVs equivalent by 2030, including additional policies and measures to assist this transition. The Government has invested greatly in this to ensure uptake, in the form of grants to instigate a wider shift towards electric mobility and as a result, reduce exhaust emissions from this sector. To assist further in the uptake of EVs, Malta has outlined additional policies and measures to allow for a smoother transition towards electrification:

    - **Roll-out of EV publicly accessible charging points** – Malta aims to have installed around 6,500 charging points in addition to the 360 charging point already installed. 1,200 of these charging points will be installed by 2025 funded through the Cohesion Fund.

    - **Legislative obligations and incentives for private charging pillars** – Malta has recently amended its subsidiary legislation to allow for provision related to the installation of EV charging infrastructure including:
        - The mandatory inclusion of charging infrastructure for at least one EV in new non-residential buildings as well as those undergoing major renovations which cater for more than 10 parking spaces;
        - Provide for ducting infrastructure for electric cables ensuring that 1 in every 5 parking spaces within carparks are equipped for EV charging;

    - By January 1, 2025, a minimum number of EV recharging points will be required in all non-residential buildings with >20 parking spaces;
    - Preferential electricity tariffs for EV charging in residential & non-residential premises.
    - Providing also off-peak tariffs between midnight and 6am and noon and 4pm from Monday to Saturday and all day on Sunday.

  - **Electrification of Public Sector Vehicle Fleet** – the Government is also leading by example and introducing 250 EVs as part of the public sector vehicle fleet thus improving the efficiency of current operations through the concept of ridesharing between the various ministries and government departments, aiming to see a change in mobility management in Malta's public service.

  - **Work Plan of Cleaner Vehicles Commission** – Malta is offering a scheme that the procurement, installation, and commissioning of smart charging infrastructure for businesses, offering financial assistance in the form of either a grant covering up to 100% of the interest paid during the first three years on a loan from the Malta Development Bank or a recognized financial institution, or a tax rebate calculated as a percentage of eligible costs. Additionally, tax credits are available for leasing clean or zero-emission commercial vehicles for a minimum of 12 months, with support extending for up to 36 months from the start of the lease agreement[4].

  - **Assessment of the vehicle-to-grid systems** – Malta is studying the introduction of flexibility services as part of the Government's efforts in modernising the electricity grid.

  - **Scrappage Scheme** - Malta is committed to phasing out ICE vehicles and increasing EV adoption. A grant scheme offers €8,000 for EV purchases, plus €1,000 for scrapping a vehicle over 10 years old, supported by Malta's Recovery and Resilience Plan (RRP). A study is underway on financial incentives to reduce vehicle age and encourage clean fuel vehicles. By 2030, Malta aims to continue scrappage incentives, update fiscal measures, and boost zero-emission vehicle uptake.

- **National Free Public and School transport service** - The introduction of free public transport, expanded nationwide in late 2022, led to a significant rise in passenger trips, with 2023 projections exceeding 67.4 million—a 37% increase from 2022—while reducing traffic congestion and saving commuters an average of €300 annually. Moreover, free school transport is provided annually to over 33,000 state and non-state school students, with plans to enhance efficiency by optimizing routes and improving service quality.

- **Active Transport** - Malta's National Cycling Strategy and Active Mobility Strategy aim to reduce car dependency by enhancing cycling infrastructure, expanding walking and micro mobility options, and investing €35 million by 2029 to develop a 50-60km clean urban transport network. Projects like the Connections for Safer Active Mobility (CSAM) initiative and Grand Harbour area improvements further support this shift by creating safer, pedestrian-friendly spaces and multimodal connections.

- **Roads Infrastructure Network Improvements** - Upgrades to the TEN-T network aim to reduce congestion at traffic bottlenecks, increasing average speeds and lowering fuel consumption.

[4] Malta Enterprise (2024), Green Mobility Incentive Guidelines. Available at: https://maltaenterprise.com/sites/default/files/Green%20Mobility%20Scheme%20-%20Incentive%20Guidelines%20%28V%201.0%29_1.pdf

- **Sustainable Urban Mobility Plans (SUMP) -** Malta's first SUMP (2006-2012) focused on Valletta, while the 2022 Northern and Southern Harbour Regions SUMP extends to 27 localities, aiming to improve mobility, safety, and quality of life. Key measures include incentivizing alternatives to car use, transitioning to cleaner transport, optimizing the transport system, and enhancing goods delivery, as demonstrated by a successful pilot project using shared electric vans.

- **Low Emission Zone study -** The Government is studying the introduction of Low Emission Zones (LEZ) in Malta, particularly in the Grand Harbour area, to improve air quality and reduce emissions, with an ongoing project assessing potential designated areas.

- **Development of a real-time journey planner -** Malta's public transport system has improved with a real-time journey planner in the 'Tal-Linja' app, allowing users to track buses and plan routes, with further enhancements planned under the Transport Master Plan 2030.

- **Smart Parking Systems for Valletta -** Malta implemented a smart parking system at Hastings in Valletta to reduce congestion and emissions by providing real-time parking availability, preventing unnecessary vehicle circulation. Under the Transport Master Plan 2030, the government plans to assess national parking provisions and expand smart parking technology as part of a broader on-street parking reform, this helping in reducing pollution due to parking circulation.

- **Urban transport and urban logistics -** To reduce congestion and emissions, Malta plans to restrict commercial and heavy vehicles from operating during peak hours, improving traffic flow and public transport speed, particularly in the Northern and Southern Harbour Area. This measure aims to enhance air quality and will be continuously monitored and assessed.

- **Integrated Transport Management System (ITMS) Platform -** Malta's ITMS aims to reduce road congestion and emissions by improving public transport efficiency through real-time data, encouraging a shift from private cars to public transport. The system will also enhance traffic management using ITS technologies, including bus prioritization at junctions and advanced data analytics for better decision-making.

- **Permanent Link between Malta and Gozo -** The Government remains committed in assessing the feasibility of a permanent Malta-Gozo link, considering economic, social, and environmental factors through various studies that evaluate external influences on the project.

- **Remote working -** The Remote Working Policy, introduced in 2021 and updated in 2023, aims to enhance work-life balance while reducing peak-hour traffic, fuel consumption, and emissions. By promoting flexible work arrangements, it contributes to fewer journeys and alleviates congestion.

- **Further grants on pedelecs and L-category -** These aim to further encourage the use of smaller vehicles for urban mobility, such as pedelecs and L-category vehicles (e.g., mopeds, motorcycles, tricycles, and quadricycles). By promoting these alternatives, the initiative seeks to reduce road congestion, lower emissions, and improve overall transport efficiency in urban areas.

Malta's National Transport Master Plan is currently being updated and extended to 2030 in alignment with the 2050 National Transport Strategy. This updated Master Plan comes at a time of strong post-pandemic recovery, sustained economic growth, population expansion, and record employment levels, all contributing to an increasing demand for transportation and energy. The Master Plan provides a comprehensive overview of the actions being implemented within the transport sector, addressing both current and future needs. It aims to establish an optimal policy mix of measures that support economic progress and infrastructure development while effectively managing the environmental, public health, and climate change impacts of transport. As part of this process, the updated Master Plan will also pave the way for the development of additional measures aimed at reducing traffic and congestion, ultimately contributing to lower pollution levels and improved air quality.

Malta is actively advancing efforts to introduce additional measures aimed at ensuring compliance with the 2030 ceilings. As part of this process, Malta will be submitting a With Measures (WM) scenario and a With Additional Measures scenario under the NECD projections reporting. The With Additional Measures (WAM) scenario includes measures outlined in Malta's Air Quality Plan 2025; however, these measures are not yet quantifiable. Hence, the reported emissions for both scenarios will not differ.

4.6.4.1 Methodology and Activity data

The same methodology as applied for the historical time-series was also applied to the Projections reporting. COPERT 5.8.1 was used to calculate emissions for both years.

All activity data is sourced by the same entities as already highlighted in Table 17. For the following parameters either a five-year average was considered or the same input data used for the year 2023 was also used for 2025 and 2030.

Table 23: Table highlighting the methodology used for certain parameters where data was not available

Parameter	Methodology
- **Sulphur content** - **Humidity** - **Min temperature** - **Min temperature** - **Total Fuel Sales**	5-year average
- **Lead content** - **Trip length** - **Trip duration** - **Road Shares** - **Road speeds**	Same as 2023

Concerning stock and VKM the general methodology already explained in Section 4.6.3.1 and 4.6.3.2 was used. Further to that the total VKM was projected by EWA for each of the five major vehicle categories. These projections made use of historical information to estimate the elasticity of total VKM of each vehicle type against a macroeconomic indicator as per below:

Table 24: Macroeconomic drivers used to project VKM

Vehicle category	**Macroeconomic driver to estimate total VKM**
New PC	Population
New LCV	Wholesale and Retail GVA
New HDV	Wholesale, Retail and construction GVA
New L-category	Population
New Buses	Mini Buses: Population (4 -15 years) Coaches and Private Buses: Inbound tourists (Air passengers) Route Buses: No driver used

The mileage of each of the five vehicle types between 2018 and 2040 was estimated using the following equation:

$$VKM_t = VKM_{t-1} + (1 \times m \times g_t)$$

Equation 3: Equation to estimate total mileage by vehicle type

Where:

- VKMt = The estimate of total VKM driven by a vehicle category at period t;

- VKMt-1 = The estimate of total VKM driven by a vehicle category at period t-1;
- m = The elasticity of total VKM of a vehicle category against a macroeconomic indicator which is expected to drive the demand for that vehicle's use;
- gt = annual growth rate of the indicator between period t-1 and t

The model was utilized to estimate annual VKM for each vehicle category between 2010 and 2017. The resulting data was then used to calibrate the model against energy balance statistics. The projected VKM for 2025 and 2030 was assumed to correspond to the demand that would be met by the remaining vehicle stock at the end of 2017.

Vehicle stock data was provided to EWA by NSO for the five primary vehicle categories: Passenger Cars, Light Commercial Vehicles, Heavy Duty Vehicles, Buses, and L-category vehicles. This data was further aggregated by fuel type and year of manufacture (YOM). The stock profile from the 2010–2017 dataset was extracted and used to generate a survival profile for each vehicle type using the equation below:

$$Survival\ rate_v = Average\left(\frac{Stock_v - Stock_{v-1}}{Stock_v}\right) * (1 + Survival\ rate_{v-1})$$

Equation 4: Equation for the survival rate profile of vehicles

Where; v = vehicle's age

The survival profile was used to generate the projected stock. The number of new vehicles in circulation was estimated by finding the difference between the total vehicle demand and the actual service demand provided by the existing stock.

The same assumptions related to the organisation of data into COPERT format was used. The total mileage of each sub-category aggregated per Euro standard was divided by the stock to get the average annual VKM.

4.6.4.2 Assumptions and Improvements

The assumptions used for the projections are the same as those used for the historical time-series and have already been addressed under section 4.6.3.

4.6.5 Sector-specific QA/QC and verification

A comprehensive QA/QC exercise was conducted for the Road Transport sector to ensure the accuracy and reliability of emissions data. This year, the reclassification of vehicles into their respective COPERT categories was fully automated through a dedicated in-house Python script. This tailored solution was developed to streamline the process, minimize human errors, and improve the identification of outliers, ensuring greater accuracy and efficiency in emissions calculations.

The sector compiler verified that all input activity data used in COPERT emission calculations were properly referenced. While all input data originate from external entities, the Environment and Resources Authority is responsible for compiling the Road Transport emission inventory. In-house checks were carried out to validate all assumptions and criteria relevant to the activity data. Additionally, unit conversions were carefully reviewed to meet COPERT's requirements, including those for trip duration, road share, and total fuel sales. Emission trends for each pollutant were rigorously analysed using a trend checker model, which evaluates both year-on-year variances and changes relative to previous submissions, ensuring data consistency and accuracy.

4.6.6 Sector-specific recalculations

Last year, a major overhaul of the stock data was conducted for the years 1995 to 2009. Building on this effort, Malta has sustained these improvements in this reporting period by implementing further refinements to ensure that all road-worthy vehicles are accurately accounted for in the calculations. Additionally, the classification of vehicles into their respective COPERT categories was automated using a dedicated Python script. This process included a pre-processing script to assess outliers and verify data integrity, ensuring that all vehicles were correctly categorized before classification.

For this reporting period, Malta adopted the newly introduced COPERT categories for electric vehicles (buses and LCVs), replacing the previous EV model used in past submissions. This transition ensures greater accuracy and consistency in emission estimations. Given that COPERT does not yet provide a dedicated category for electric HDVs, Malta has classified these vehicles under the EV bus category, assuming their characteristics align more closely with buses. Similarly, electric motorcycles have been categorized under the EV mini passenger car category, as their size and operational profile are considered more comparable, allowing their inclusion in the modelling framework.

4.6.7 Sector-specific planned improvements

For its next submission, Malta is committed to implementing several key improvements to enhance the accuracy and robustness of its road transport emissions reporting:

- **Updated Trip Characteristics Data**: Malta aims to incorporate revised trip duration, length, speed, and road share data, leveraging insights from the updated national transport model.
- **Enhanced Vehicle Kilometres Travelled (VKM)**: Efforts will be made to improve VKM estimations across all vehicle categories to better reflect real-world usage patterns.
- **Refined Projected Stock Data**: Malta plans to refine its vehicle stock projections, ensuring that future estimates only account for vehicles registered and in use between 2010 and 2023, improving alignment with actual fleet trends.

4.7 Sector 1A3dii: National navigation (shipping)

Table 25: Sector 1A3dii general characteristics

NFR Code	**1A3dii**
Sub-Category	National navigation (shipping)
Method	2023GB
Activity Data	Direct communication
Emission Factors	Tier 2
Key Category	NO_x, Hg & PCBs
Year of Last Update	2025 submission

4.7.1 Sector category description

This subcategory includes emissions of air pollutants from the combustion of fuel from vessels (excluding recreational crafts), which depart and arrive in the Maltese Islands.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 13.

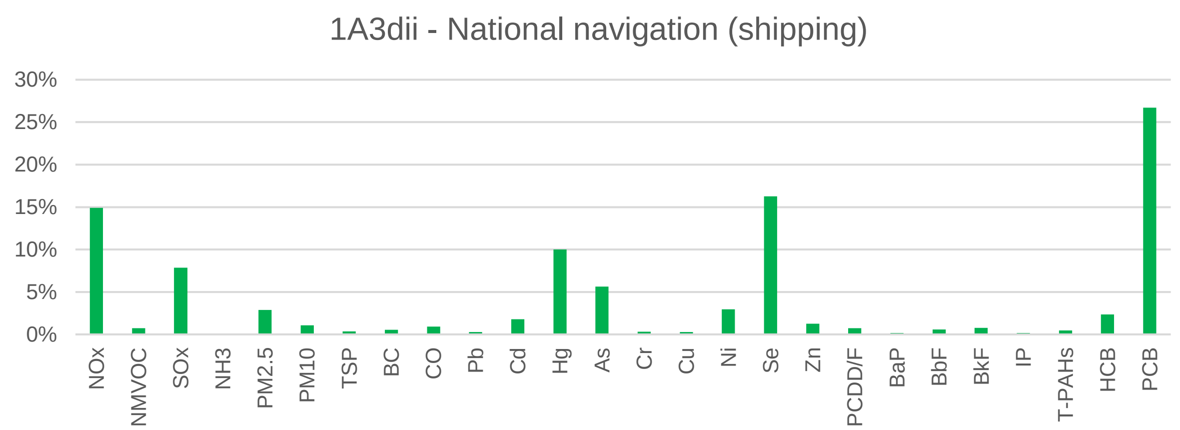

Figure 13: Shares of emissions from the NFR 1A3dii category in percentage of national total

4.7.2 Methodology

Following a suggestion by the TERT, emissions from recreational crafts were reported under NFR 1A5b. Hence, emissions under this sector were attributed to the Gozo Channel Ferry, the Valletta Ferry Services, and the Fast Ferry. This sector was estimated through the Tier 2 methodology presented within the 2023GB. The Gozo Channel Ferry was classified as a medium speed diesel engine, while both the Valletta Ferry Services and Fast Ferry were deemed to operate through a high speed diesel engine. The Tier allocation per vessel was explained in the activity data section below.

The tables used, as provided within the 2023GB, are provided below:

Table 26: Source of Emission Factors within the 2023GB

Fuel	Technology	Table	Chapter
Gasoil and diesel oil	Tier 0	Table 3-2	1.A.3.d Navigation (shipping)
Gasoil and diesel oil	Tier I, II, III	Table 3-7	1.A.3.d Navigation (shipping)

4.7.3 Activity Data

For this submission, the fuel consumption from the Gozo Channel Ferry, the Valletta Ferry Services, and the Fast Ferry were considered under this sector. The Gozo Channel has been operating prior to 1990, the Valletta Ferry Services commenced its operations in October 2012, whereas the Fast Ferry started operating in 2021.

NO_x emissions are determined by the Tier system employed through Regulation 13 in Annex VI of the MARPOL Convention. The regulation applies for vessels having a power output, which is greater than 130kW. All the vessels within the National Navigation sector were deemed to comply with this requirement. Furthermore, the maritime territory surrounding the Maltese Islands is not designated as a NO_x Emission Control Area, under the aforementioned regulation. Therefore, Tier III limits cannot be applied locally.

4.7.3.1 Gozo Channel

All three operators run on marine gas diesel oil. The fuel consumption from the Gozo Channel Ferry was available from 2002, and hence, the value for 2002 was carried backwards. The current fleet consists of the MV Ta' Pinu, MV Gaudos, and MV Malita, which were introduced as new vessels in 2000, 2001, and 2002 respectively. These three vessels are classified as Tier I. Prior to the introduction of all vessels were classified as Tier 0. In 2019, the Nikolaos was introduced. Since this vessel was constructed in 1987, it was classified as Tier 0. The table below presents the change in Tiers across the time series:

Table 27: Gozo Channel vessels and their respective Tier classification

Tier level	1990-1999	2000-2001	2002-2018	2019-
Tier 0	All vessels	Shift occurring due to the introduction of new vessels	No vessels	1 vessel
Tier I	No vessels		3 vessels	3 vessels

4.7.3.2 Valletta Ferries

The Valletta Ferry service was introduced in late 2012, with multiple different vessels being used until the introduction of Top Cat One in late 2014 and Top Cat Two in 2015. Both these vessels were constructed in 2014, and they are still currently in use. The fuel data provided by the operator is available from 2015 onwards. Thus, fuel consumption before 2015 had to be carried backwards. This assumption was adjusted to reflect the fact that the Valletta Ferries only operated for a few months in 2012.

The table below presents the share of fuel consumption and the respective Tiers applied:

Table 28: Valletta Ferries vessels and their respected Tier classification

Tier level	2012	2013	2014	2015	2016 onwards
Tier 0	1 vessel	1 vessel	1 vessel (full year) & 1 vessel (half year)	1 vessel (half year)	0 vessels
Tier I	1 vessel	1 vessel	1 vessel (half year)	0 vessels	0 vessels
Tier II	0 vessels	0 vessels	0 vessels	1 vessel (half year)	2 vessels

4.7.3.3 Gozo Fast Ferry

The fuel consumption for 2021 and 2022 was provided by both Virtu Ferries Ltd and Gozo Fast Ferry Ltd. There are four vessels operating this service. In 2021, a total of four vessels were used. Two vessels were constructed in 2018, and the other two were constructed in 1989 and 1990 respectively. However, in 2022 the ferry constructed in 1990 was replaced with a vessel constructed in 2022. The table below explains this change in vessels according to the Tier structure utilised:

Table 29: The Gozo Fast Ferries and their respective Tier classification

Tier level	2021	2022
Tier 0	2 vessels	1 vessel
Tier II	2 vessels	3 vessels

4.7.3.4 Sulphur content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2018 to 2023. The average sulphur content from 2018 and 2019 was used to calculate SO_x emissions prior to 2018. The 2020 values onwards were not considered within this average, since the sulphur content for these years was significantly lower than that of the previous years.

4.7.3.5 Projections

The EWA provided projected fuel consumption for Domestic Navigation as a whole. The projected fuel consumption could only be provided under the WM scenario, and therefore the WaM scenario was assumed to be the same as the WM scenario. Therefore the fuel consumption from national navigation was projected in line with the table below and the remaining fuel reported under Domestic Navigation was attributed to recreational crafts (NFR 1A5b). Furthermore, the sulphur content value for 2023 was carried forward for the projected years under both the WM and WaM scenarios.

Table 30: Assumptions to project fuel consumption under the WM and WaM scenarios

Vessel	**WM Scenario**	**WaM Scenario**
Gozo Channel	Carried forward from 2023	Carried forward from 2023
Valletta Ferry Services	Carried forward from 2023	Carried forward from 2023
Fast Ferry	Carried forward from 2023	Carried forward from 2023

4.7.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.7.5 Sector-specific recalculations

- The emissions for SO_x were recalculated for 2022, due to a revision in the sulphur content of gasoil.

4.7.6 Sector-specific planned improvements

Efforts will be made to provide more representative EFs across the time series.

4.8 Sector 1A4ai: Commercial/Institutional: Stationary

Table 31: Sector 1A4ai general characteristics

NFR Code	**1A4ai**
Sub-Category	Commercial/Institutional: Stationary
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1 & 2
Key Category	SO_x, As, Ni, Benzo(a) pyrene, Benzo(b) fluoranthene, & benzo(k) fluoranthene
Year of Last Update	2025 submission

4.8.1 Sector category description

This subcategory includes emissions of air pollutants from energy generation, which is used in activities related to commercial and public services.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 14.

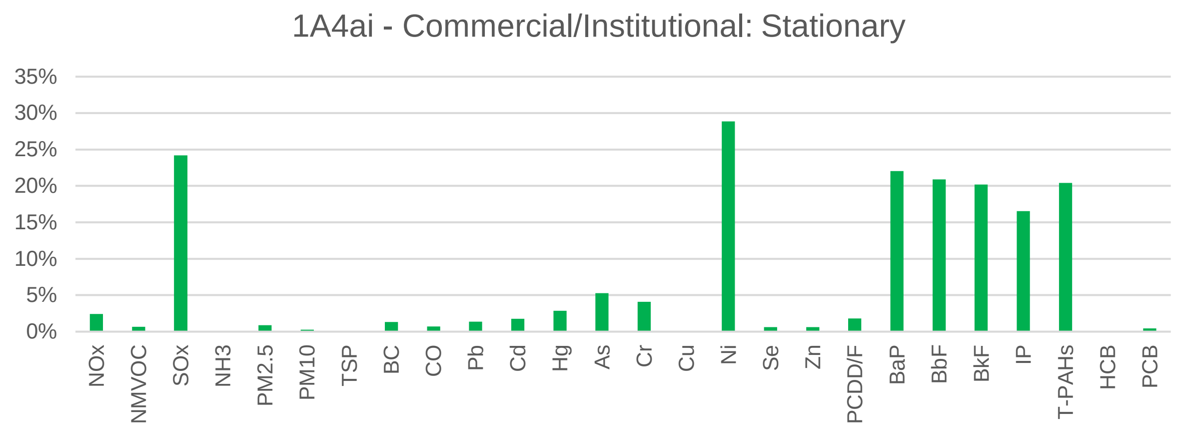

Figure 14: Shares of emissions from the NFR 1A4ai category in percentage of national total

4.8.2 Methodology

4.8.2.1 Historical

Emissions from the combustion of gasoil and fuel oil were estimated through a Tier 2 methodology, whereas the remaining fuels were estimated through a Tier 1 methodology, as provided within the 2023GB.The tables used, as provided within the 2023GB, are provided below:

Table 32: Source of emission factors split by fuel and technology

Fuel	Technology	Table	Chapter
Motor gasoline	N/A	Table 3-9	1.A.4 Small combustion
Other kerosene	N/A	Table 3-9	1.A.4 Small combustion
Gas oil and diesel oil	Boiler	Table 3-24	1.A.4 Small combustion
Gas oil and diesel oil	Generator	Table 3-31	1.A.4 Small combustion
Fuel oil	N/A	Table 3-24	1.A.4 Small combustion
Liquefied petroleum gases	N/A	Table 3-8	1.A.4 Small combustion
Biogases	N/A	Table 3-8	1.A.4 Small combustion

4.8.2.2 Projections

The impact of the implementation of the Medium Combustion Plants (MCP) Directive was modelled for the year 2030. The Directive targets MCP which range between 1MW and 50MW. The 2023GB (Table 3-33) provided the total fuel combustion per fuel type and combustion plant size. When taking note of such figures, a share of 75% of fuel was combusted in plants between 1MW and 50MW whereas 25% of fuel was combusted in plants between 50KW and 1MW. Hence, it was assumed that 75% of fuel in 2030 will be combusted in plants regulated through the MCP Directive. It is worth noting that plants operating for less than 500 hours may apply for an exemption from the emission limit values (ELVs) stipulated in the Directive, however, the model assumes that all plants comply with MCP ELVs.

The ELVs are based on the fuel type, the technology type and whether the combustion plant is new or existing. The technology share for gaseous fuels and liquid fuels was assumed to be 80% boilers and 20% reciprocating engines as per the data provided in the 2023GB Table 3-33. The technology share for fuel oil and gas oil are reflected in Table 12. The share of new and existing combustion plants, as defined in the MCP Directive, was taken from the Regulatory Impact Assessment (RIA) report for the MCP Directive.

The ELVs in the MCP Directive refer to concentrations of mg/Nm^3, and therefore a conversion was needed to align with the units used for the 2023GB emission factors, which are in g/GJ. The GAINS model provided two conversion coefficients and the smallest coefficient was applied ($1.06mg/Nm^3$ – 1 g/GJ) to assume a conservative scenario. The ELVs were then compared with the 2023GB emission factors and the lowest value of the two was used within the calculation. The reasoning behind this is that should the 2023GB emission factors be lower than the ELVs set out in the Directive, the use of emission factors would reflect a realistic scenario whereas the use of the ELVs would result in an overestimation of emissions. The emissions from the non-MCPs and MCPs were summed together to calculate the total emissions

4.8.3 Activity Data

Quantities of fuel used from 2005 onwards were taken from the ‘Commercial & public services’ section within the Eurostat Energy Balance. The Energy Balance could not be used from 1990-2004, since the figures reported within the Energy Balance were all ‘0’. Data from the climate change model was used to gap fill these years.

4.8.3.1 Gasoil and diesel oil

An exercise was carried out for the 2023 submission, to determine the share of technology used to combust gasoil for both NFR 1A2gviii and NFR1A4ai. The fuel consumption per technology for all permitted combustion plants in 2019 was noted. The consumption of gasoil under these permitted facilities comprised 5.4% of the total gasoil combusted under both NFR1A2gviii and NFR1A4ai, as reported through the Eurostat Energy Balance. Thus, for that 5.4% of gasoil consumed, the technology share reported through the permitted facilities (as provided within Table 33) was taken. For the remaining 94.6% of gasoil combusted, the default technology share provided through the 2023GB, as provided in Table 33 was taken.

Table 33: Share of technology type per gasoil consumed in NFR1A4ai

Technology	Permit fuel use %	2023GB fuel use %
Reciprocating Engine	10.9%	20.0%
Boiler	89.1%	80.0%

The technology share for gasoil consumption was assumed to be the same for all the years.

4.8.3.2 Sulphur content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2014 to 2023. Therefore, the sulphur content from 2014 was used to calculate SO_x emissions prior to 2014.

4.8.3.3 Projections

The EWA provided projected fuel consumption for the Commercial and public services sector. The projected fuel consumption could only be provided under the WM scenario, and therefore the WaM scenario was assumed to be the same as the WM scenario. Furthermore, the sulphur content value for 2023 was carried forward for the projected years under both the WM and WaM scenarios.

4.8.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.8.5 Sector-specific recalculations

- Recalculation from 2011 onwards due to changes in the quantities of biogases for NO_x, NMVOC, $PM_{2.5}$, PM_{10}, TSP, BC, CO, Pb, Cd, Hg, As, Se, Cr, Cu, No, Zn.
- Recalculation of SO_x across the time series due to introduction of country specific sulphur content values for heavy fuel oil.

4.8.6 Sector-specific planned improvements

Efforts will be made to provide more representative EFs across the time series

4.9 Sector 1A4bi: Residential: Stationary

Table 34: Sector 1A4bi general characteristics

NFR Code	**1A4bi**
Sub-Category	Residential: Stationary
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1 & 2
Key Category	$PM_{2.5}$, Cd, PCDD-PCDF
Year of Last Update	2025 submission

4.9.1 Sector category description

This subcategory includes emissions of air pollutants from small combustion activities, such as domestic internal heating.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 15.

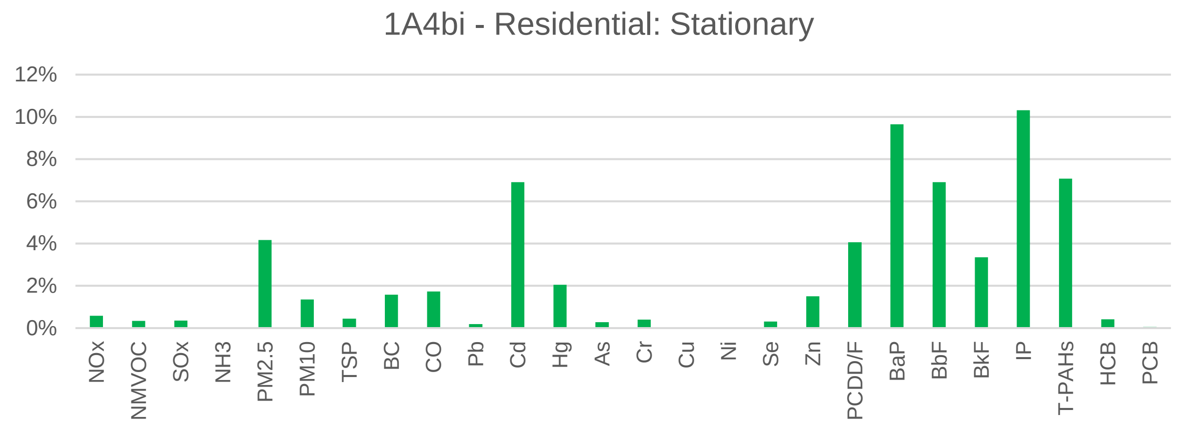

Figure 15: Shares of emissions from the NFR 1A4bi category in percentage of national total

Emissions from combustion in the residential sector were reported under NFR code 1A4bi. This sub-category includes emissions from small combustion activities, such as domestic internal heating.

4.9.2 Methodology

Emissions from LPG, other kerosene, and gasoil were estimated through the Tier 1 methodology provided within the 2023GB. In contrast, emissions from primary solid biofuels were estimated through a Tier 2 methodology by making use of the technology shares provided through the GAINS model. These shares can be observed in the table below:

Table 35: Technology share for primary solid fuel combustion

Technology	1990-2014	2015 - 2019	2020-2024	2025-2029	2030
Rural Fireplaces (households)	0.0%	0.0%	11.1%	0.0%	0.0%
Rural Single house boilers (<50 kW) - automatic (households)	66.7%	75.0%	55.6%	75.0%	50.0%
Rural Single house boilers (<50 kW) - manual (households)	0.0%	0.0%	11.1%	0.0%	0.0%
Rural Heating stoves (households)	33.3%	25.0%	22.2%	25.0%	50.0%

The tables used, as provided within the 2023GB, are provided below:

Table 36: Source of Emission Factors within the 2023GB

Fuel	Technology	Table	Chapter
Liquefied petroleum gases	N/A	Table 3-4	1.A.4 Small combustion
Other kerosene	N/A	Table 3-5	1.A.4 Small combustion
Gas oil and diesel oil	N/A	Table 3-5	1.A.4 Small combustion
Primary solid biofuels	Rural fireplaces (households)	Table 3-39	1.A.4 Small combustion
Primary solid biofuels	Rural Single house boilers (<50 kW) - automatic (households)	Table 3-44	1.A.4 Small combustion
Primary solid biofuels	Rural Single house boilers (<50 kW) - manual (households)	Table 3-43	1.A.4 Small combustion
Primary solid biofuels	Rural heating stoves (households)	Table 3-40	1.A.4 Small combustion

4.9.3 Activity Data

The quantities of fuel used from 2005 onwards were taken from the 'Households' section within the Eurostat Energy Balance. The Energy Balance could not be used from 1990-2004, since the figures reported within the Energy Balance were all '0'. Data from the climate change model was used to gap fill these years.

4.9.3.1 Primary solid biofuels

The quantities of primary solid biofuels are only available from 2010 onwards in the Eurostat Energy Balance. Hence, an exercise was carried out to obtain the quantities of primary solid biofuels pre-2010. The Trade Statistics Unit within the NSO were contacted, following a suggestion by the EWA. The Trade Statistics Unit provided the quantities of biofuels imported by HS code from 2004-2020. The data from the Trade Statistics Unit was compared to the data in the Eurostat Energy Balance. The values provided by the Trade Statistics Unit were found to be similar, i.e. on average 4.7% greater than those in the Eurostat Energy Balance from 2010-2020.

The Energy Balance was assumed to better reflect the combustion of biofuels. Thus, the quantity of primary solid biofuels consumed from 2010-2020 was taken from the Eurostat Energy Balance. The quantities of biofuels provided by the Trade Statistics Unit from 2004-2009 were calibrated to the values in the Eurostat Energy Balance by dividing by 104.7%.

However, upon closer inspection, it was noted that certain categories of biofuels were not included in 2004-2009. Additionally, multiple HS codes had the same, or a similar definition. As a result, a particular biofuel may have been classified differently across the years. Consequently, HS codes had to be grouped together, and then a gap filling exercise would be carried out for the missing HS codes. The HS code groupings can be observed in Table 37. Once the HS codes were grouped, gap-filling techniques such as a 3 or 5-year moving average, or carrying a value backwards were applied. The nature of each trend was considered when choosing the gap-filling technique. The same gap-filling techniques were then used for pre-2004 data. Figure 16 compares the trends with and without gap-filling.

Table 37: HS Code classification groupings for gap filling

HS Code	1A4bi
44011000 **44011100** **44011200**	Fuel wood, in logs, billets, twigs, faggots or similar forms Fuel wood, in logs, billets, twigs, faggots or similar forms, coniferous Fuel wood, in logs, billets, twigs, faggots or similar forms, non-coniferous
44012100	Coniferous wood in chips or particles (excl. those of a kind used principally for dying or tanning purposes)
44012200	Wood in chips or particles (excl. those of a kind used principally for dying or tanning purposes, and coniferous wood)
44013020 **44013100**	Sawdust and wood waste and scrap, agglomerated in pellets Wood pellets

44013080 **44013990** **44013980** **44014090**	Wood waste and scrap, whether or not agglomerated in logs, briquettes or similar forms (excl. sawdust and pellets) Wood waste and scrap, whether or not agglomerated in logs, briquettes or similar forms (excl. sawdust and pellets) Wood waste and scrap, not agglomerated (excl. sawdust) Wood waste and scrap, not agglomerated (excl. sawdust)
44013040 **44013900** **44013910** **44013920** **44013930** **44014010**	Sawdust of wood, whether or not agglomerated in logs, briquettes or similar forms (excl. pellets) Sawdust and wood waste and scrap, agglomerated in logs, briquettes or similar forms (excl. pellets) Sawdust of wood, whether or not agglomerated in logs, briquettes or similar forms (excl. pellets) Sawdust and wood waste and scrap, agglomerated in logs, briquettes or similar forms (excl. pellets) Sawdust of wood, not agglomerated Sawdust, not agglomerated
44021000	Bamboo charcoal, incl. shell or nut charcoal, whether or not agglomerated (excl. used as a medicament, mixed with incense, activated bamboo charcoal and in the form of crayons)
44029000	Wood charcoal, incl. shell or nut charcoal, whether or not agglomerated (excl. bamboo charcoal, wood charcoal used as a medicament, charcoal mixed with incense, activated charcoal and charcoal in the form of crayons)

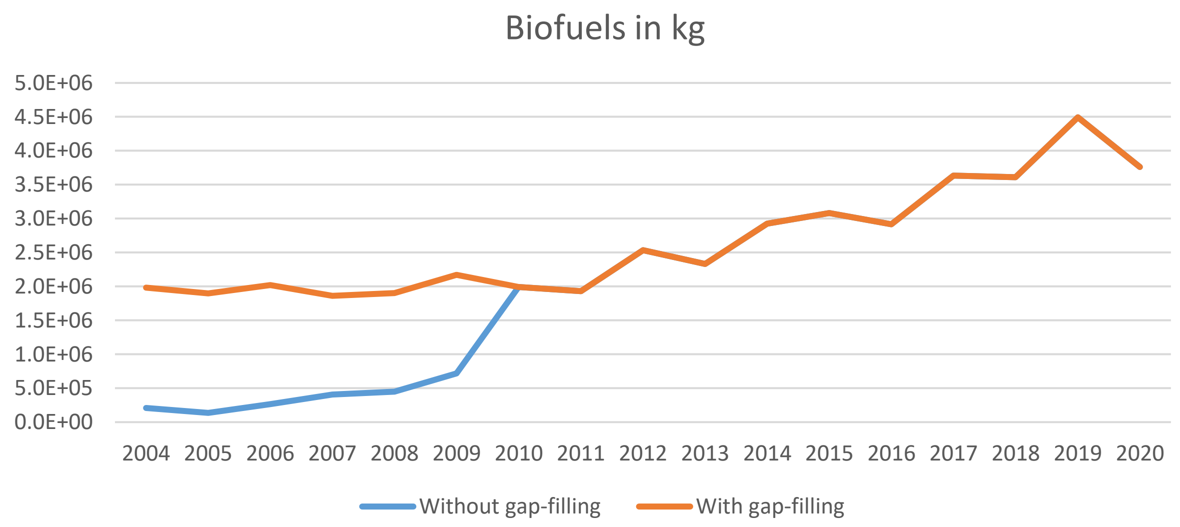

Figure 16: Results from gap-filling exercise on quantity of biofuels

4.9.3.2 Sulphur content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2014 to 2023. Therefore, the sulphur content from 2014 was used to calculate SO_x emissions prior to 2014.

4.9.3.3 Projections

The EWA provided projected fuel consumption for the households sector. The projected fuel consumption could only be provided under the WM scenario, and therefore the WaM scenario was assumed to be the same as the WM scenario. Furthermore, the sulphur content value for 2023 was carried forward for the projected years under both the WM and WaM scenarios.

4.9.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.9.5 Sector-specific recalculations

- All the pollutants emissions were updated following revisions and QA/QC to data provided in the previous submission from 1991 onwards.
- Recalculation of SO_x across the time series due to introduction of country specific sulphur content values for heavy fuel oil.
- Activity data for solid fuels was updated as the primary solid biofuels on the Eurostat energy balance was revised from 2021 onwards.

4.9.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

4.10 Sector 1A4cii: Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery

Table 38: Sector 1A4cii general characteristics

NFR Code	**1A4cii**
Sub-Category	Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1 & 2
Key Category	SO_x & CO
Year of Last Update	2025 submission

4.10.1 Sector category description

This subcategory includes emissions of air pollutants from off-road vehicles and other machinery used in agriculture/forestry mobile machinery (excluding fishing).

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 17.

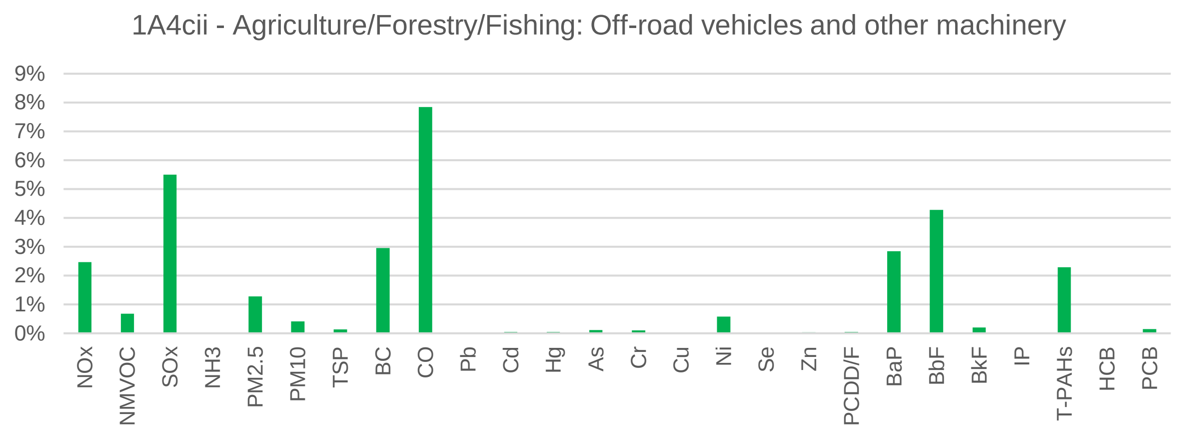

Figure 17: Shares of emissions from the NFR 1A4cii category in percentage of national total

4.10.2 Methodology

Emissions from the combustion of gasoil were estimated through the Tier 2 methodology provided within the 2023GB. The remaining fuels were estimated through a Tier 1 methodology.

The share of engine technology was required to estimate emissions from the combustion of gasoil at a Tier 2 level. The split of fuel consumption per engine age was taken from Table 3-3 of the 2023GB. The engine age was then combined with the EU Directive requirements relevant for emissions control from diesel-fuelled non-road machinery, as provided in Table 2-3 of the 2023GB. The table below provides a summary of the share of emission control requirements across the time series:

Table 39: Share of technology across the time series

Step 2: Share of technology	**Fuel type**	**Engine use**	**1990**	**2005**	**2015**	**2020**	**2021**	**2022**
Pre-1981	Gasoil	Agriculture	38.1%	5.7%	0.0%	0.0%	0.0%	0.0%
1981-1990	Gasoil	Agriculture	61.9%	16.6%	5.7%	0.0%	0.0%	0.0%
1991-Stage I	Gasoil	Agriculture	0.0%	30.2%	12.7%	9.9%	8.5%	7.0%
Stage I	Gasoil	Agriculture	0.0%	32.0%	12.2%	8.5%	8.1%	7.8%
Stage II	Gasoil	Agriculture	0.0%	15.6%	16.7%	9.0%	8.1%	7.5%
Stage IIIA	Gasoil	Agriculture	0.0%	0.0%	29.9%	19.9%	17.9%	15.9%

Stage IIB	Gasoil	Agriculture	0.0%	0.0%	7.2%	5.2%	4.8%	4.4%
Stage IV	Gasoil	Agriculture	0.0%	0.0%	15.6%	32.0%	29.9%	27.9%
Stage V	Gasoil	Agriculture	0.0%	0.0%	0.0%	15.6%	22.8%	29.6%

The tables used, as provided within the 2023GB, are provided below:

Table 40: Source of Emission Factors within the 2023GB

Fuel	Technology	Table	Chapter
Liquefied petroleum gases	N/A	Table 3-1	1.A.4 Non-road mobile sources and machinery
Motor gasoline	Four-stroke	Table 3-1	1.A.4 Non-road mobile sources and machinery
Kerosene-type jet fuel	N/A	Table 3-9	1.A.4 Small combustion
Other kerosene	N/A	Table 3-9	1.A.4 Small combustion
Fuel oil	N/A	Table 3-9	1.A.4 Small combustion
Blended biodiesels	Tier 1	Table 3-1	1.A.4 Non-road mobile sources and machinery
Blended Biodiesels	Tier 2 - Agriculture	Table 3-2	1.A.4 Non-road mobile sources and machinery
Gas oil and diesel oil	Tier 1	Table 3-1	1.A.4 Non-road mobile sources and machinery
Gas oil and diesel oil	Tier 2 - Agriculture	Table 3-2	1.A.4 Non-road mobile sources and machinery

4.10.3 Activity Data

The quantities of fuel used from 2005 onwards were taken from the 'Agriculture & forestry' section within the Eurostat Energy Balance. The Energy Balance could not be used from 1990 to 2004, since the figures reported within the Energy Balance were all '0'. Data from the climate change model was used to gap fill these years; however, there are significant differences between the two datasets. Additionally, the Energy Balance does not differentiate between mobile and stationary fuel use. Hence, the notation key 'IE' is used for sector 1A4ci, since emissions under the agriculture/forestry/fishing sector are included under the mobile sector.

4.10.3.1 Sulphur Content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2014 to 2023. Therefore, the sulphur content from 2014 was used to calculate SO_x emissions prior to 2014.

4.10.3.2 Projections

The EWA provided projected fuel consumption for the Agriculture & Forestry sector. The projected fuel consumption could only be provided under the WM scenario, and therefore the WaM scenario was assumed to be the same as the WM scenario. Furthermore, the sulphur content value for 2023 was carried forward for the projected years under both the WM and WaM scenarios.

4.10.3 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.10.4 Sector-specific recalculations

- Recalculation were carried out to NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, Dioxins & furans, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, PAHs, HCB and PCBs from 2018 onwards due to the inclusion of blended biodiesels under the emission factors used for gas oil and diesel oil. In previous submissions, blended biodiesels were calculated under the emission factors used for liquid fuels.
- Recalculation of SO_x across the time series due to introduction of country specific sulphur content values for heavy fuel oil.

4.10.5 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

4.11 Sector 1A4ciii: Agriculture/Forestry/Fishing: National Fishing

Table 41: Sector 1A4ciii general characteristics

NFR Code	**1A4cii**
Sub-Category	Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1
Key Category	NO_x
Year of Last Update	2025 submission

4.11.1 Sector category description

This subcategory includes emissions of air pollutants from fuels combusted for inland, coastal and deep-sea fishing.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 18.

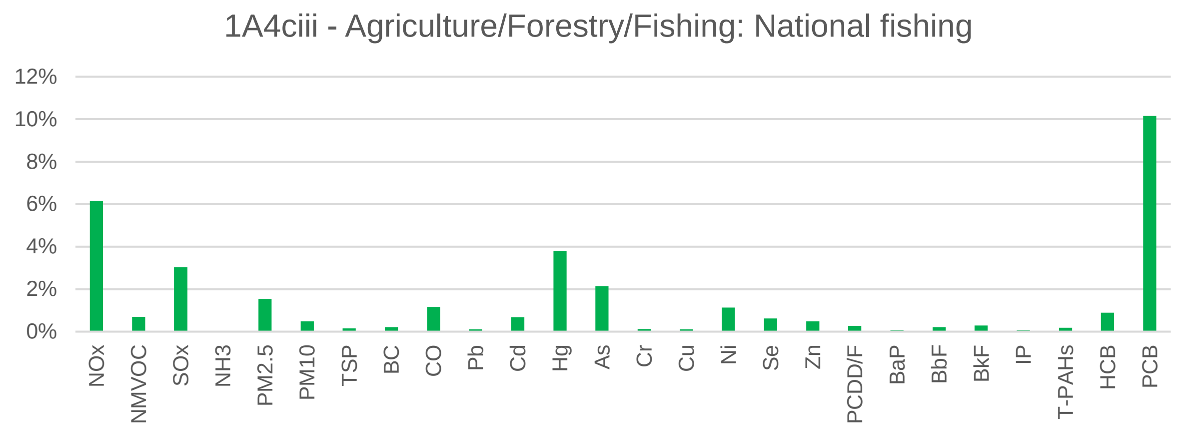

Figure 18: Shares of emissions from the NFR 1A4ciii category in percentage of national total

4.11.2 Methodology

This sector was estimated through the Tier 1 methodology provided within the 2023GB.

The tables used, as provided within the 2023GB, are provided below:

Table 42: Source of Emission Factors within the 2023GB

Fuel	Technology	Table	Chapter
Liquefied petroleum gases	N/A	Table 3-3	1.A.3.d Navigation (shipping)
Motor gasoline	N/A	Table 3-4	1.A.3.d Navigation (shipping)
Gas oil and diesel oil	N/A	Table 3-2	1.A.3.d Navigation (shipping)

4.11.3 Activity Data

The quantities of fuel used from 2005 onwards were taken from the 'Fishing' section within the Eurostat Energy Balance. The Energy Balance could not be used from 1990-2004, since the figures reported within the Energy Balance were all '0'. Data from the climate change model was used to gap fill these years; however, there are significant differences between the two datasets.

4.11.3.1 Sulphur Content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2018 to 2023. The average sulphur content from 2018 and 2019 was used to calculate SO_x emissions prior to 2018. The 2020, 2021, 2022 and 2023 values were not considered within this average, since the sulphur content for these years was significantly lower than that of the previous two years.

4.11.3.2 Projections

No projected fuel consumption was available. Hence, the 2023 values were carried forward under both the WM and WaM scenarios.

4.11.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.11.5 Sector-specific recalculations

- The emissions of NO_x, NMVOC, $PM_{2.5}$, PM_{10}, TSP, BC and CO were recalculated for 2017 following an update in the Eurostat Energy Balance for LPG

4.11.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

4.12 Sector 1A5b: Other, Mobile (including military, land based and recreational boats)

Table 43: Sector 1A5b general characteristics

NFR Code	**1A5b**
Sub-Category	Other, Mobile (including military, land based and recreational boats)
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1 & 2
Key Category	NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, BC, CO, Hg, Se, & PCBs
Year of Last Update	2025 submission

4.12.1 Sector category description

This subcategory includes emissions of air pollutants from the operation of recreational crafts within the Maltese Islands.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 19.

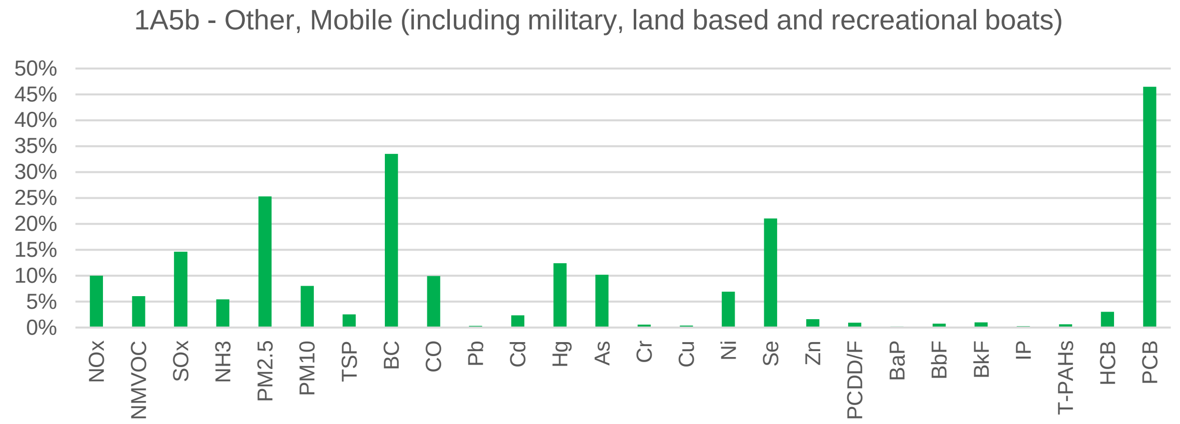

Figure 19: Shares of emissions from the NFR 1A5b category in percentage of national total

4.12.2 Methodology

The emissions from the combustion of gasoil and motor gasoline were estimated through the Tier 2 methodology provided within the 2023GB. The shares of 2-stroke and 4-stroke vessels, as well as the respective shares of vessels complying with the requirements of Directive 2003/44/EC, are explained in section 4.12.3.2 below. Moreover, emissions from Heavy Fuel Oil were estimated through the Tier 1 methodology provided within the 2023GB.

The tables used, as provided within the 2023GB, are provided below:

Table 44: Source of Emission Factors within the 2023GB

Fuel	Technology	Table	Chapter
Heavy fuel oil	N/A	Table 3-1	1.A.3.d Navigation (shipping)
Motor gasoline	2-stroke	Table 3-8	1.A.3.d Navigation (shipping)
Motor gasoline	4-stroke Conventional	Table 3-8	1.A.3.d Navigation (shipping)
Motor gasoline	4-stroke 2003/44/EC	Table 3-8	1.A.3.d Navigation (shipping)
Gasoil and diesel oil	Conventional	Table 3-8	1.A.3.d Navigation (shipping)
Gas oil and diesel oil	2003/44/EC	Table 3-8	1.A.3.d Navigation (shipping)

4.12.3 Activity Data

The fuel consumption was obtained by subtracting the fuel consumption from the Gozo Channel Ferry, Valletta Ferry Services, and the Fast Ferry, from the total fuel reported as ‘Domestic navigation’ section within the Eurostat Energy Balance. However, only data from 2005 onwards was used, since the Energy Balance reported a ‘0’ value from 1990-2004. Hence, the values were taken from the climate change model, as provided by the Climate Action Authority (CAA).

4.12.3.1 Motor Gasoline

No values for motor gasoline were provided from 2005-2016. A gap-filling exercise was carried out to identify the quantities of motor gasoline consumed in these years. The methodology to gap-fill these years is provided below:

Two potential data sources were identified for values from 2013-16, i.e. the National Statistics Office (NSO) and the Regulator for Energy and Water Services (REWS). When comparing the values provided by both data suppliers for 2017-2019 to those in the Eurostat Energy Balance, and it was noted that the values provided by the NSO were almost identical, differing by less than 0.1%. Hence, the data from the NSO was chosen for gap-filling from 2013-2016.

For the remaining years, i.e. 2005-2012, a linear interpolation was carried out from 2004-2013, as no potential indicators were identified. It is worth noting that the data from 2013 onwards is considered as being more robust than the data from pre-2005.

The share of 2-stroke and 4-stroke engines was not available. Thus, a share of 75% 2-stroke and 25% 4-stroke was assumed for the entire time series, in line with the note in Table 3-4 of the 2023GB.

4.12.3.2 Compliance with Directive 2003/44/EC

The number of vessels complying with the requirements of Directive 2003/44/EC was not available. However, the 2023GB states that a marine engine has a life cycle of 25 years, which is equivalent to annual replacement rate of 4%. The transposition of Directive 2003/44/EC, i.e. L.N. 128 of 2005, started applying to vessels constructed from 2006 onwards. An annual replacement of 4% was applied, ensuring that the share of vessels complying with the requirements of the Directive gradually increased across the time series.

4.12.3.3 Sulphur content

The percentage sulphur content obtained from the Regulator for Energy and Water Services (REWS) was used to estimate SO_x for some years and fuels. Data was available for 2018 to 2023 for gasoil and gasoline, and from 2014-2020 onwards for heavy fuel oil. For both gasoline and gasoil the average sulphur content from 2018 and 2019 was used to calculate SO_x emissions prior to 2018. The 2020 values onwards were not considered within this average, since the sulphur content for these years was significantly lower than that of the previous years. Conversely, for heavy fuel oil, the sulphur content for 2014 was carried backwards.

4.12.3.4 Projections

The EWA provided projected fuel consumption for Domestic Navigation as a whole. The projected fuel consumption could only be provided under the WM scenario, and therefore the WaM scenario was assumed to be the same as the WM scenario. Therefore the fuel consumption from national navigation (NFR 1A3dii) was projected and the remaining fuel reported under Domestic Navigation was attributed to recreational crafts. Furthermore, the sulphur content value for 2023 was carried forward for the projected years under both the WM and WaM scenarios.

4.12.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.12.5 Sector-specific recalculations

- The emissions for SO_x were recalculated for 2022, due to a revision in the sulphur content of gasoil.

4.12.6 Sector-specific planned improvements

Efforts will be made to further refine the technology share within this sector.

4.13 Sector 1B2av: Distribution of Oil Products

Table 45: Sector 1B2av general characteristics

NFR Code	**1B2av**
Sub-Category	Distribution of Oil Products
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 2
Key Category	NMVOC
Year of Last Update	2025 submission

4.13.1 Sector category description

This subcategory includes emissions of air pollutants from the filling of transport equipment and storage tanks, border terminal dispatch stations, and service stations while refuelling gasoline cars.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 20.

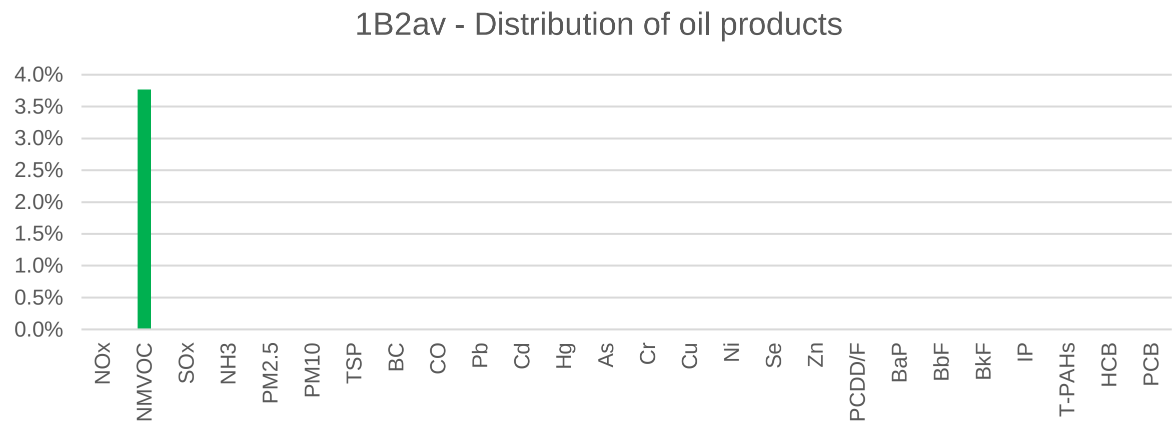

Figure 20: Shares of emissions from the NFR 1B2av category in percentage of national total

4.13.2 Methodology

This sector was estimated through the Tier 2 methodology provided within the 2023GB. Different emission factors were used in accordance with the changes carried out to legislation as provided in Table 3-1 of the 2023GB and noted below

Table 46: Emission Factors used based on timeframes

Timeframe	Emission Factor in kg/Mg gasoline handled
1990-2004	4.5
2005-2015	2.2
2016-2023	Split between 2.2 and 0.7
2024-2030	Split based on the year 2023

Data from 1990-2004, which encompasses data prior to Malta's EU Accession, was estimated using an NMVOC emission factor of 4.5 kg/Mg gasoline handled. Data covering base years 2005-2015 was estimated using an NMVOC emission factor of 2.2, in line with terms mandated by Directive 94/63/EC. From 2016 onwards, through the transposition of Directive 94/63/EC through S.L 549.52 on the Control of Volatile Organic Compound-VOC Emissions Regulations, the fuel throughput reported by permitted fuel stations which complied with Stage II controls were estimated through the use of emission factor of 0.7, whereas the remaining fuel stations were estimated using the emission factor of 2.2.

4.13.3 Activity Data

The emissions from 1990-2023 were based on the gross inland consumption of gasoline (gasoline without bio component and aviation gasoline), as reported by Eurostat. Data provided by permitted fuel stations from 2016 onwards was reviewed, specifically making use of the mass of fuel from permitted facilities compliant with Stage II controls. Data was received in volumetric units and calculations were carried out to convert these to mass units. The total quantity of fuel received and distributed by permitted fuel stations which are complaint with Stage II controls was then divided by the gross inland consumption of gasoline as reported by Eurostat, which was extracted on 20th December 2024.

4.13.3.1 Projections

No projected gross inland consumption of gasoline (gasoline without bio component and aviation gasoline) was available. Hence, the 2023 values were carried forward under both the WM and WaM scenarios.

4.13.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by comparing the values submitted within the Eurostat Energy Balance to those utilised in the Eurostat Energy Balance database), the emission factors, and the formulas utilised within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

4.13.5 Sector-specific recalculations

Emissions of NMVOC were recalculated from 1990-2023 following changes in methodology presented in Section 4.13.3

4.13.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

5 Industry (NFR 2)

Chapter Updated: 2025

5.1 Category overview

Emissions from the following sectors are estimated:

- 2A5b (construction and demolition)
- 2D3a (domestic solvent use including fungicides)
- 2D3b (road paving with asphalt)
- 2D3d (coating applications)
- 2D3e (degreasing)
- 2D3f (dry cleaning)
- 2D3h (printing)
- 2G (other product use)
- 2H2 (food and beverages industry)

This sector includes all emissions emanating from the industrial processes, which are not related to the combustion of fossil fuels. Malta has a limited industrial landscape mainly due to limitations in land area. Hence, Malta is forced to opt for imports of products, which are not produced locally. The main pollutants emitted from industrial processes in Malta are NMVOC and PMs.

Table 47 shows the detailed source categories for the industry sector. The relevant pollutant trends for key categories, as well as, the methodologies used are explained in the sections below.

Table 47: Coverage of NFR 2 categories in 2023

NFR Code	**Pollutants**			**Method**	**KC**
	Covered	Exceptions			
		NE	NA		
2A1	Not Occurring				✕
2A2	Not Occurring				✕
2A3	Not Occurring				✕
2A5a	Not Occurring				✕
2A5b	$PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 1	✓
2A5c	Not Occurring				✕
2A6	Not Occurring				✕
2B1	Not Occurring				✕
2B2	Not Occurring				✕
2B3	Not Occurring				✕
2B5	Not Occurring				✕
2B6	Not Occurring				✕
2B7	Not Occurring				✕
2B10a	Not Occurring				✕
2B10b	Not Occurring				✕
2C1	Not Occurring				✕
2C2	Not Occurring				✕
2C3	Not Occurring				✕
2C4	Not Occurring				✕
2C5	Not Occurring				✕
2C6	Not Occurring				✕

2C7a	Not Occurring				✕
2C7b	Not Occurring				✕
2C7c	Not Occurring				✕
2C7d	Not Occurring				✕
2D3a	NMVOC	-	Rest of Pollutants	Tier 2	✓
2D3b	NMVOC , $PM_{2.5}$, PM_{10}, TSP, BC	-	Rest of Pollutants	Tier 2	✓
2D3c	Not Occurring				✕
2D3d	NMVOC	-	Rest of Pollutants	Tier 2	✓
2D3e	NMVOC	-	Rest of Pollutants	Tier 1	✓
2D3f	NMVOC	-	Rest of Pollutants	Tier 1	✕
2D3g	Not Occurring				✕
2D3h	NMVOC	-	Rest of Pollutants	Tier 2	✓
2D3i	Not Occurring				✕
2G	Rest of Pollutants	-	Se, HCB, PCB	Tier 2	✓
2H1	Not Occurring				✕
2H2	NMVOC, PM_{10}	-	Rest of Pollutants	Tier 2	✓
2H3	Not Occurring				✕
2I	Not Occurring				✕
2J	Not Occurring				✕
2K	Not Occurring				✕
2L	Not Occurring				✕

NE: Not Estimated, NA: Not Applicable, KC: Key Category.

Shares of emissions from this NFR sector for all pollutants in 2023 are shown Figure 21. Most pollutant emissions originate primarily from NFR 2.

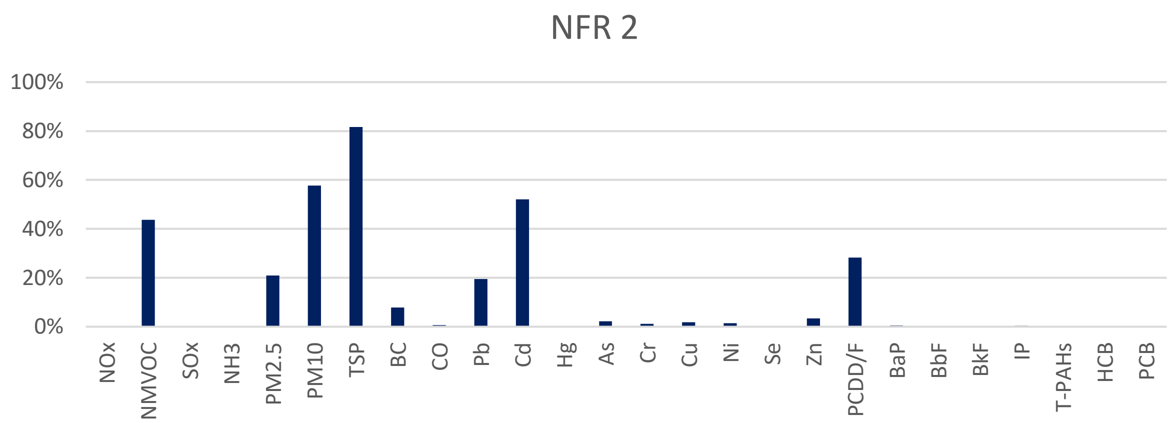

Figure 21: Shares of emissions from the NFR 2 category in percentage of national total

5.2 Sector 2A5b: Construction and demolition

Table 48: Sector 2A5b general characteristics

NFR Code	**2A5b**
Sub-Category	Construction and demolition
Method	2023GB
Activity Data	Eurostat Malta MET Office Building and Construction Authority Planning Authority
Emission Factors	Tier 1
Key Category	$PM_{2.5}$, PM_{10} & TSP
Year of Last Update	2025 submission

5.2.1 Sector description

This sector covers the emissions emerging from the construction of buildings. Emissions emerging from the construction of roads are not included within this sector as no activity data is currently available. Shares of emissions of the particular pollutants from 2A5b in 2023 are shown in Figure 22.

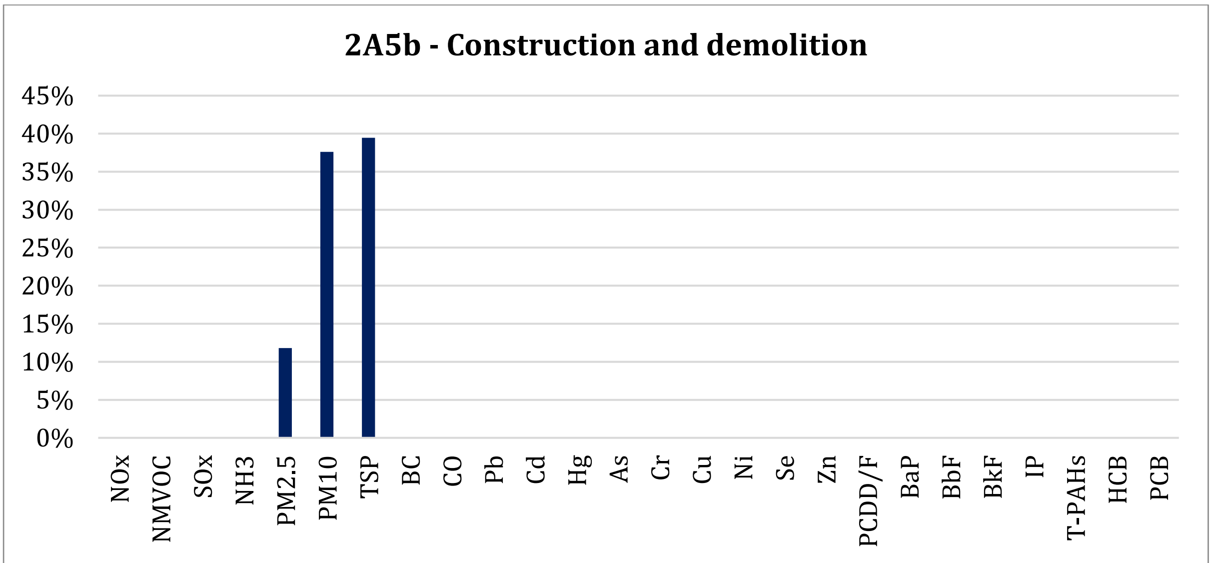

Figure 22: Shares of emissions from the NFR 2A5b category in percentage of the national total

5.2.2 Methodology & activity data – Historical

The estimations of the emissions are based on the US EPA Tier 1 methodology as described within the 2023GB. Effort was made to use country-specific parameters whenever this was deemed optimal by the sectoral expert. As previously disclosed, the data required to estimate the emissions emerging from the construction of roads was not available for this submission. Hence, no emissions resulting from the construction of roads have been included within this year's submission.

Estimations made utilized the following base equation (US EPA method):

$$EM_{PM10} = EF_{PM10} * A_{affected} * d * (1 - CE) * \left(\frac{24}{PE}\right) * \left(\frac{s}{9\%}\right)$$

Equation 5: Equation utilized to estimated construction and demolition emissions based on the US EPA method.

Where:

- EM_{PM10} = PM_{10} emissions (kg)
- EF_{PM10} = Emission factor for PM_{10} (kg/(m^2.year))
- $A_{affected}$ = Area affected by construction (m^2)

- d = duration of construction (year)
- CE = efficiency of emission control measures
- PE = Thornthwaite precipitation-evaporation index
- s = soil silt content (%)

The emission factors applied in this sector are derived from those specified in the Tier 1 methodology outlined in the 2023GB. Detailed information can be located in Table 49.

Table 49: Emission factors utilised for all years [1990 to 2023] based on the Tier 1 methodology.

Emission Factors	Units	TSP	PM_{10}	$PM_{2.5}$
Houses	kg/[m² year]	0.29	0.086	0.0086
Apartments	kg/[m² year]	1	0.3	0.03
Non-residential buildings	kg/[m² year]	3.3	1	0.1

The duration and soil silt content were also extracted from the Tier 1 methodology presented within the 2023GB. The related information can be located in Table 50.

Table 50: Parameter data inputs utilised for all years [1990 to 2023] based on Tier 1 methodology.

Parameters	**Duration** (Years)	**Soil Silt Content** (%)
Houses	0.5	29%
Apartments	0.75	29%
Non-residential buildings	0.83	29%

The affected area varies from year to year. This parameter is mainly based on data provided by the Planning Authority (PA). For houses and apartments, PA provided the total site area from 2010 to 2023. For years 2000 to 2009, area affected was extrapolated using Eurostat data on one-dwelling buildings and two- and more dwelling buildings respectively, in order to inform the trend. Subsequent extrapolation was conducted for the years 1995 to 1999, employing Eurostat Gross Value Added (GVA) data specifically related to the construction sector to guide the trend analysis. The 1995 value was utilized for 1990 to 1994. For non-residential building construction, the PA provided the total site area from 2013 to 2023. For the period spanning 2007 to 2012, projections were derived by extrapolating values based on data from the relevant permits granted, as provided by PA. Additionally, extending from 1995 to 2006, Eurostat GVA data pertaining to the construction sector was utilized for further extrapolation to delineate the trend. The 1995 value was then utilized for 1990 to 1994. Excerpts from the data can be found in Table 51.

Table 51: Affected area for years 2005 and the latest 3 data years.

Affected Area	Units	2005	2021	2022	2023
Houses	m^2	109,196.25	142,504.81	137,177.42	69,222.96
Apartments	m^2	225,714.51	318,529.55	265,312.79	113,344.15
Non-residential buildings	m^2	43,688.61	164,177.64	246,303.98	222,248.99
Total	***m^2***	***378,599.37***	***625,212.00***	***648,794.19***	***404,816.10***

Discussions with the Building and Construction Authority (BCA) were held regarding the use of emission control measures in Maltese work sites. BCA specified that although wetting is required by law during all construction and demolition activities (as per S.L.552.09) not all sites utilize this practice. BCA quantified that around 35% of sites utilized wetting in 2005 whilst 60% utilized wetting in 2022. In the year 2030 BCA estimates that around 75% of sites will be utilising this practice. Excerpts from the data utilized can be found in Table 52.

Table 52: Efficiency of emission control measures for years 2005 and the latest 3 data years.

Efficiency of emission control measures	2005	2021	2022	2023
Houses Apartments Non-residential buildings	0.18	0.29	0.30	0.31

The Thornthwaite precipitation-evaporation index was calculated based upon the monthly total precipitation and the mean monthly temperature provided by the Malta MET Office. Excerpts from the data utilized can be found in Table 53.

Table 53: Thornthwaite precipitation-evaporation index for years 2005 and the latest 3 data years.

Thornthwaite precipitation-evaporation index	2005	2021	2022	2023
Houses Apartments Non-residential buildings	33.42	35.08	22.70	30.66

5.2.3 Methodology & activity data – Projections

Projected emissions for the construction and demolition sector were derived using projected population data as a proxy, given its direct correlation with construction activity. Since population growth is the key driver in this sector's emissions modelling, both the With Measures (WM) and With Additional Measures (WAM) scenarios yield identical projections for both 2025 and 2030.

5.2.4 Sector-specific QA/QC and verification

A comprehensive QA/QC exercise was conducted for this sector to ensure data accuracy and consistency. The sector compiler verified the correctness of input activity data, emission factors, and formulas used within the model. All assumptions and criteria related to activity data underwent in-house validation, and unit conversions were carefully checked for accuracy throughout the model. Additionally, pollutant trends were analysed using a trend checker model, which assesses year-on-year variances and compares emission changes against the previous submission to ensure reliability.

5.2.5 Sector-specific recalculations

Minor recalculations for all related pollutants ($PM_{2.5}$, PM_{10} & TSP) took place as a result of improvements in the models used for classifying data as well as updates in data provided by the Planning Authority. For residential dwellings, updates took place from 2018 onwards whereas for non-residential buildings updates were carried out from 2013 to latest year. Naturally because the pre-2013 data for non-residential buildings is extrapolated using 2013, changes to these years also occurred. The below tables provide an overview of the values used in the last report period compared to the values used for this reporting round for the three building categories.

Table 54: Modified activity data – changes in apartments' affected area

Activity Data – Affected area (m^2) - Apartments

Year	2024 Submission	2025 Submission
2018	335627.26	337007.26
2019	318087.85	319314.55
2020	276849.48	283790.83
2021	309269.65	318529.55
2022	237418.71	265,312.79

Table 55: Modified activity data – changes in houses' affected area

Activity Data – Affected area (m^2) - Houses

Year	2024 Submission	2025 Submission
2018	151560.99	153730.99
2019	150238.78	153645.78
2020	104188.51	105507.51
2021	135218.9639	142504.81
2022	125601.45	137177.42

Table 56: Modified activity data – changes in non-residential buildings affected area.

Activity Data – Affected area (m²) - Non-residential buildings		
Year	**2023 Submission**	**2024 Submission**
2013	28627.70	30943.03
2014	25000.55	27022.53
2015	31062.03	33574.24
2016	28530.33	30837.78
2017	46118.26	118249.29
2018	71361.00	70128.64
2019	110549.22	147529.70
2020	91656.21	121512.89
2021	252505.84	255432.55
2022	242510.47	140877.95

5.2.6 Sector-specific planned improvements

Efforts are being made to obtain the necessary data to calculate the emissions emerging from the construction of roads. Efforts will also be made to further fine tune the classification of building permits under their respective years. In fact, Malta aims to automate this process using Python scripts and introduce spatial data to compare, making sure that data received on planning applications and data received in shapefile format is comparable therefore introducing another step in the QA/QC process.

5.3 Sector 2D3a: Domestic solvent use including fungicides

Table 57: Sector 2D3a general characteristics

NFR Code	**2D3a**
Sub-Category	Domestic solvent use including fungicides
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 2
Key Category	NMVOC
Year of Last Update	2025 submission

5.3.1 Sector description

This sector covers the emissions emerging from the domestic use of solvent-containing products. It should be noted that many of these products are also used in industry and commerce. Shares of emissions of the particular pollutants from 2D3a in 2023 are shown in Figure 23.

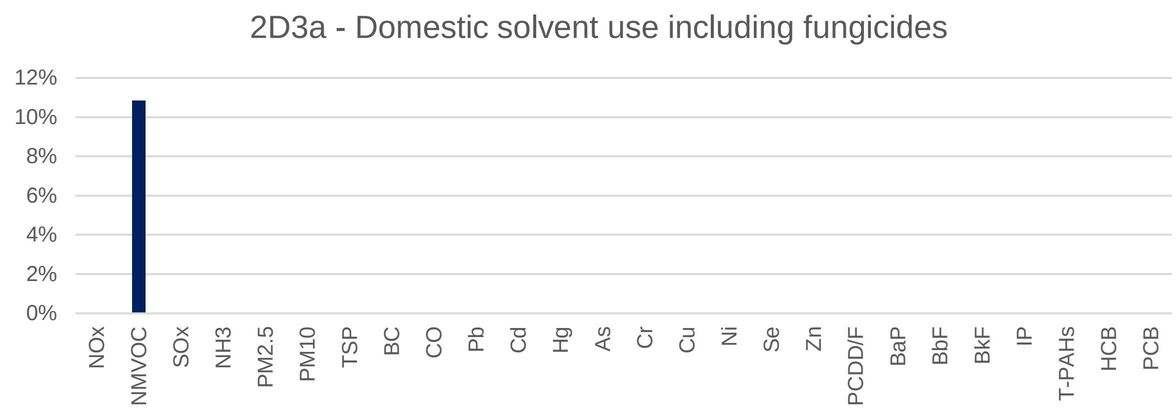

Figure 23: Shares of emissions from the NFR 2D3a category in percentage of the national total

5.3.2 Methodology & activity data - Historical

The Tier 2 approach employed in the previous submission, has been retained for this submission. This approach involves utilizing import and export data of domestic solvent products, categorized by PRODCOM codes, and complemented by Special Trade Statistics (STS) as activity data. Eurostat has made available data starting from 2004. For previous years (1990 to 2003), the activity data was estimated using a five-year moving average for both imports and exports.

$$\text{Total products per annum (Kg)} = \text{Products imported (Kg)} + \text{Products produced locally (Kg)} - \text{Products exported (Kg)}$$

Equation 6: 2D3a total products utilized by MT calculation

Equation 6 is utilized to estimate the apparent consumption; however, it is documented that the results of this calculation can be unreliable due to a range of factors. An assumption is required in this methodology for cases where the above formula produced a negative value (i.e. the number of products exported were higher than imported and produced combined), the weight of products for that year was assumed to be zero. Therefore, it was assumed that such products were not consumed locally. It is likely that this is caused by a discrepancy between the coverage of production statistics and trade statistics.

This methodology assumes that all the product destined for use in Malta will be sold and utilized within a five-year period. Consequently, any emissions resulting from the use of these products are evenly distributed over the data year and the following four years. All solvents disposed of in landfills were excluded from the total product utilization. These subtractions in activity data were directly attributed to the year of disposal. This methodology involves a combination of Tier 2A and Tier 2B, as necessitated by the data collection process. Excerpts from the activity data can be found in Table 58.

Table 58: Product total for each PRODCOM code for years 2005 and the latest 3 data years.

Product Total (PRODCOM code)	Units	2005	2021	2022	2023
20421915	Kg	424108	485491	524244	567976
20421930	Kg	136922	932855	1001619	1089515
20413150	Kg	135156	31235	35632	54366
20413250	Kg	7117620	10345626	10086315	9515910
20413120	Kg	314041	215074	227378	293785
20413180	Kg	192564	367629	510021	632314
20413240	Kg	221587	2562984	2511449	2371253
20412020	Kg	400967	218230	218712	224578
20412030	Kg	17795	27458	14813	22226
20412050	Kg	190814	143038	140709	146526
20412090	Kg	89299	59774	64342	67927
20414100	Kg	0	0	0	0
20414330	Kg	1892	12780	11850	10898
20414350	Kg	70192	23976	25079	29350
20414389	Kg	83300	18013	23459	23909
20414383	Kg	53090	19983	18232	18682
20414400	Kg	140645	80720	63519	53406
20414370	Kg	40536	47558	50426	50576
20594350	Kg	310717	251421	256757	247506
20421150	Kg	0	0	0	0
20421170	Kg	0	0	0	0
20421945	Kg	0	0	0	0
20421250	Kg	0	0	0	0
20421270	Kg	0	0	0	0
20421400	Kg	0	0	0	0
20421500	Kg	0	0	0	0
20421300	Kg	0	0	0	0
20421630	Kg	0	0	0	0
20421650	Kg	0	0	0	0
20421670	Kg	0	0	0	0
20421700	Kg	0	0	0	0
20421960	Kg	0	0	0	0
20421975	Kg	0	0	0	0
20421990	Kg	0	0	0	0
20421850	Kg	0	0	0	0
20421890	Kg	0	0	0	0
20531020	Kg	2692	7020	8004	7095

Tier 2A relies on the solvent amount per product as the emission factor, while Tier 2B multiplies the product quantity by the emission factor provided in the 2023GB. This improvement was developed in collaboration with an external consultant as part of the NECD capacity-building project carried out in 2021.

Table 59 provides a comprehensive list of the PRODCOM codes used in estimating this sector using the tier 2A methodology, along with the consistent solvent content of each product. PRODCOM data are detailed production data at an 8-digit level. It is important to highlight that the solvent content remains consistent throughout the entire time series. As a result, the emission estimates do not incorporate any variations in the solvent content of products over time.

Table 60 lists the PRODCOM codes used to estimate this sector via the Tier 2B methodology.

Table 59: PRODCOM codes utilized and the corresponding solvent content used for the Tier 2A calculation.

Categories	Prodcom Label	Prodcom Code	Solvent Content (% Mass)	Data Source
Soap	Soap and organic surface-active products in bars, etc., for toilet use	20421915	3.5	RIVM 2006 German Disseration / 2023GB Table 3-2 - Household products (soaps: liquid or paste)
	Organic surface-active products and preparations for washing the skin; whether or not containing soap, p.r.s.	20421930	0.5	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (body care)
	Soap in the form of flakes, wafers, granules or powders	20413150	0.5	RIVM 2006 / 2023GB Table 3-2 - Household products (soaps: liquid or paste)
Deodorants	Preparations for perfuming or deodorising rooms	20414100	28.95	German Disseration / 2023GB Table 3-2 - Cosmetics and toiletries (personal deodorants and antiperspirants)
Shoe and leather care products	Polishes, creams and similar preparations, for footwear or leather (excluding artificial and prepared waxes)	20414330	31.38	Average determined with: RIVM 2018 European Commission / 2023GB Table 3-2 - Household products (show polishes and creams)
Furniture and floor care products	Polishes, creams and similar preparations, for the maintenance of wooden furniture, floors or other woodwork (excluding artificial and prepared waxes)	20414350	46.00	RIVM 2018 / 2023GB Table 3-2 - Household products (polishes and creams for floors)

	Other polishes, creams and similar preparations, n.e.c.	20414389	27	RIVM 2018 / 2023GB Table 3-2 - Household products (polishes and creams for floors)
Polishing and abrasives	Metal polishes	20414383	49.6	RIVM 2018 / 2023GB Table 3-2 - Household products (polishes and creams for floors)
	Scouring pastes and powders and other scouring preparations	20414400	4	German Disseration / 2023GB Table 3-2 - Household products (polishes and creams for floors)
Car care products	Anti-freezing preparations and prepared de-icing fluids	20594350	20	German Disseration / 2023GB Table 3-2 - Car care products (antifreeze agents in windscreen wiper systems)
Perfumes	Perfumes	20421150	82.5	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (perfumes)
	Toilet waters	20421170	76.25	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (toilet waters)
Makeup products	Lip make-up preparations	20421250	30	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (general)
	Eye make-up preparations	20421270	5	German Disseration / 2023GB Table 3-2 - Cosmetics and toiletries (general)
	Powders, whether or not compressed, for cosmetic use (including talcum powder)	20421400	1	German Disseration / 2023GB Table 3-2 - Cosmetics and toiletries (general)
Preparations for the care of hands and feet	Manicure or pedicure preparations	20421300	81	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (body care)
Hair care and washing products	Shampoos	20421630	3.2	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (general)

	Preparations for permanent waving or straightening of hair	20421650	13.5	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (general)
	Hair lacquers	20421670	95	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (hair sprays)
	Hair preparations (excluding shampoos, permanent waving and hair straightening preparations, lacquers)	20421700	3.125	German Disseration Study from ARCADIS Belgique / 2023GB Table 3-2 - Cosmetics and toiletries (general)
Shaving, olfaction, personal hygiene and beauty products prepared	Pre-shave, shaving and after-shave preparations (excluding shaving soap in blocks)	20421945	5	German Disseration / 2023GB Table 3-2 - Cosmetics and toiletries (general)
	Personal deodorants and anti-perspirants	20421960	50	2023GB Table 3-3 - Cosmetics and toiletries, Personal deodorants and antiperspirants / 2023GB Table 3-2 - Cosmetics and toiletries (personal deodorants and antiperspirants)
	Perfumed bath salts and other bath preparations	20421975	1	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (general)
	Dentifrices (including toothpaste, denture cleaners)	20421850	5	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (general)
	Preparations for oral or dental hygiene (including denture fixative pastes; powders and tablets, mouth washes and oral perfumes, dental floss) (excluding dentifrices)	20421890	5	RIVM 2006 / 2023GB Table 3-2 - Cosmetics and toiletries (general)
Essential oils	Essential oils	20531020	0.135	French centralized platform / 2023GB Table 3-2 - Cosmetics and toiletries (general)

Table 60: PRODCOM codes utilized and the corresponding EF used for the Tier 2B calculation.

Categories	Prodcom Label	Prodcom Code	EF from GB (Kg nmVOCs per Kg Product)	Data Source
Washing, cleaning and rinsing	Washing preparations and cleaning preparations, with or without soap, p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations	20413250	0.016	2023GB Table 3-4 -Household products (all)
	Soap and organic surface-active products in bars, etc., n.e.c.	20413120	0.016	2023GB Table 3-4 -Household products (all)
	Soap in forms excluding bars, cakes or moulded shapes, paper, wadding, felt and non-wovens impregnated or coated with soap/detergent, flakes, granules or powders	20413180	0.016	2023GB Table 3-4 -Household products (all)
	Surface-active preparations, whether or not containing soap, p.r.s. (excluding those for use as soap)	20413240	0.016	2023GB Table 3-4 -Household products (all)
	Anionic organic surface-active agents (excluding soap)	20412020	0.016	2023GB Table 3-4 -Household products (all)
	Cationic organic surface-active agents (excluding soap)	20412030	0.016	2023GB Table 3-4 -Household products (all)
	Non-ionic organic surface-active agents (excluding soap)	20412050	0.016	2023GB Table 3-4 -Household products (all)
	Organic surface-active agents (excluding soap, anionic, cationic, non-ionic)	20412090	0.016	2023GB Table 3-4 -Household products (all)
Car care products	Polishes and similar preparations, for coachwork (excluding artificial and prepared waxes, metal polishes)	20414370	0.18	2023GB Table 3-4 - Car care products (all)

Other preparations for beauty treatments	Beauty, make-up and skin care preparations including suntan (excluding medicaments, lip and eye make-up, manicure and pedicure preparations, powders for cosmetic use and talcum powder)	20421500	0.127	2023GB Table 3-4 - Cosmetics and toiletries (all)
Shaving, olfaction, personal hygiene and beauty products prepared	Other personal preparations (perfumeries, toilet, depilatories...)	20421990	0.127	2023GB Table 3-4 - Cosmetics and toiletries (all)

Equation 7 and Equation 8 are utilized to calculate the final emissions emerging from this sector.

NMVOC emissions (Kg)=
Weight of product total (Kg) * Solvent content of product (%) * Kg NMVOC per Kg solvent [EF]

Equation 7: Formula to calculate NMVOC emissions through the Tier 2A methodology.

NMVOC emissions (Kg)=
Weight of product total (Kg) * Kg NMVOC per Kg product [EF]

Equation 8: Formula to calculate NMVOC emissions through the Tier 2B methodology.

5.3.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using GDP as a proxy. The resulting values are then distributed across all categories based on the product distribution from the most recent five years (2019 to 2023).

Table 61: Projected product total for each PRODCOM code for reporting year, 2025 and 2030

Product Total	Units	2023	2025	2030
20421915	Kg	567976	523249	582246
20421930	Kg	1089515	976872	1087016
20413150	Kg	54366	47174	52493
20413250	Kg	9515910	10329652	11494344
20413120	Kg	293785	237337	264098
20413180	Kg	632314	456812	508319
20413240	Kg	2371253	2613036	2907661
20412020	Kg	224578	238242	265104
20412030	Kg	22226	26914	29949
20412050	Kg	146526	154281	171676
20412090	Kg	67927	72981	81209
20414100	Kg	0	0	0
20414330	Kg	10898	12216	13593

20414350	Kg	29350	26226	29183
20414389	Kg	23909	20981	23347
20414383	Kg	18682	22417	24944
20414400	Kg	53406	73155	81403
20414370	Kg	50576	51402	57198
20594350	Kg	247506	259693	288974
20421150	Kg	0	0	0
20421170	Kg	0	0	0
20421945	Kg	0	0	0
20421250	Kg	0	0	0
20421270	Kg	0	0	0
20421400	Kg	0	0	0
20421500	Kg	0	0	0
20421300	Kg	0	0	0
20421630	Kg	0	0	0
20421650	Kg	0	0	0
20421670	Kg	0	0	0
20421700	Kg	0	0	0
20421960	Kg	0	0	0
20421975	Kg	0	0	0
20421990	Kg	0	0	0
20421850	Kg	0	0	0
20421890	Kg	0	0	0
20531020	Kg	7095	7218	8032

5.3.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. The trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

5.3.5 Sector-specific recalculations

A minor change in the methodology for projections was included in this submission. The distribution of products was carried out based on the last 5 years of historical data rather than only using the latest reporting year as was the case in the previous projections submission.

5.3.6 Sector-specific planned improvements

Efforts will be made to include emissions from the use of sanitizers should the activity data become available.

5.4 Sector 2D3b: Road paving with asphalt

Table 62: Sector 2D3b general characteristics

NFR Code	**2D3b**
Sub-Category	Road paving with asphalt
Method	2023GB
Activity Data	Transport Malta & Infrastructure Malta
Emission Factors	Tier 2
Key Category	$PM_{2.5}$, PM_{10} & TSP
Year of Last Update	2025 submission

5.4.1 Sector description

This sector covers the emissions emerging from asphalt road surfacing. Shares of emissions of the particular pollutants from 2D3b in 2023 are shown in Figure 24.

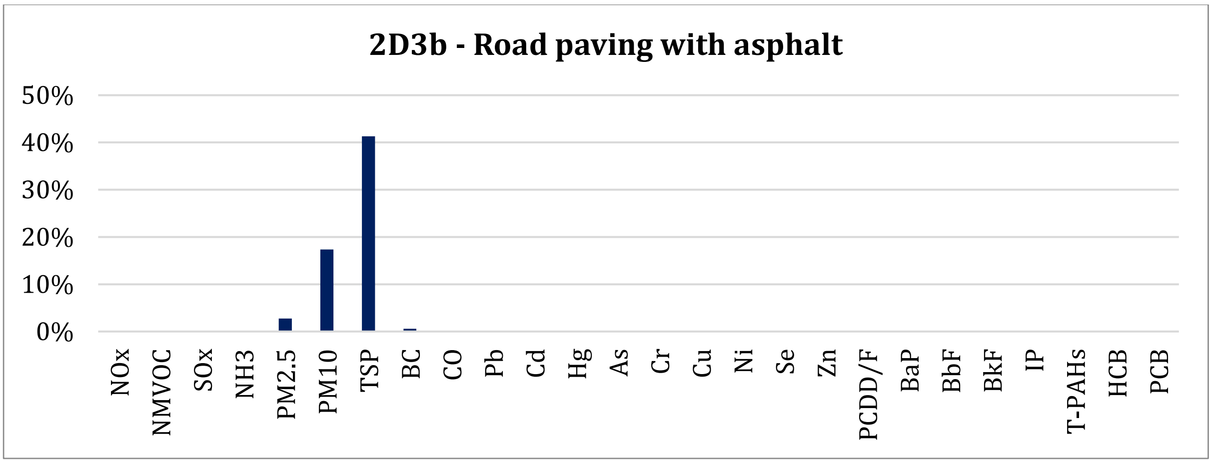

Figure 24: Shares of emissions from the NFR 2D3b category in percentage of the national total

5.4.2 Methodology & activity data - Historical

Emissions were estimated through the use of the Tier 2 hot mix emission factors directly taken from the 2023GB as suggested within the 2023 historical inventory TERT review.

Infrastructure Malta provided activity data from 2018 to 2023 in the form of a dataset including the name of road, surface area asphalted as well as the thickness of the base, binder, wearing and base wearing layers. As a result Malta was then able to calculate the total thickness of the asphalting layer for every road, multiply that by the surface area and a standard factor of 2.50 tons/m^3, yielding the final activity data expressed in terms of tonnes of asphalt laid. The below equation was used.

$$Weight\ (tonnes) = Area\ (m^2) * \left(\frac{Thickness\ of\ layers\ (mm)}{1000}\right) * 2.50$$

Equation 9: Formula used to estimate the weight of asphalt used in tonnes

Data for years 2000 to 2010 was provided by Transport Malta who at the time were in charge of Malta's road infrastructure. As suggested by external consultants, activity data for years 2011 to 2017 were estimated using interpolation. Additionally, the external consultants further suggested to make use of a static value for 1990 to 1999, which was utilized based on the average from 2000 to 2003. Excerpts from the activity data can be found in Table 63.

Table 63: Asphalt laid for years 2005 and the latest 3 data years.

	Units	2005	2021	2022	2023
Asphalt Laid	Tonnes	137,931	230,230	159,094	85,468

5.4.3 Methodology & activity data – Projections

The projections for the road paving with asphalt sector were derived using a five-year running average to estimate the annual tonnes of asphalt used. This approach smooths out year-to-year fluctuations and provides a more stable and representative trend for future estimations. By averaging data over five years, the methodology ensures that short-term variations do not overly influence long-term projections, leading to a more reliable assessment of asphalt consumption and its associated emissions.

5.4.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. The trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

5.4.5 Sector-specific recalculations

Malta incorporated newly refined activity data, enabling the calculation of asphalt thickness and the corresponding weight of asphalt used. This methodological enhancement resulted in adjustments to the actual activity data from 2018 onwards, significantly improving the accuracy of emission estimates. By leveraging more precise measurements, Malta has strengthened the reliability of its reporting and as a result ensured that projections better reflect real-world asphalt consumption.

5.4.6 Sector-specific planned improvements

Malta would like to acquire refined data and enhance the comprehension of country-specific information, with the ultimate goal of elevating the quality standards within this sector.

5.5 Sector 2D3d: Coating applications

Table 64: Sector 2D3d general characteristics

NFR Code	**2D3d**
Sub-Category	Coating applications
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 2
Key Category	NMVOC
Year of Last Update	2025 submission

5.5.1 Sector description

This sector covers the emissions emerging from the use of paints within the industrial and domestic sectors. Shares of emissions of the particular pollutants from 2D3d in 2023 are shown in Figure 25.

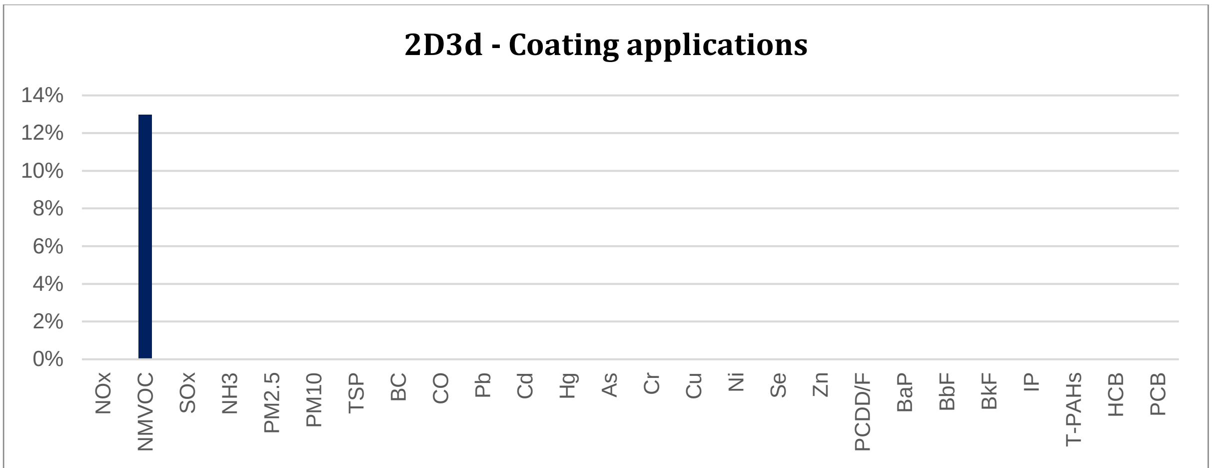

Figure 25: Shares of emissions from the NFR 2D3d category in percentage of the national total

5.5.2 Methodology & activity data – Historical

The Tier 2 approach employed in the previous submission, has been retained for this submission. This approach involves utilizing import and export data of paint products, categorized by PRODCOM codes, and complemented by STS as activity data. Eurostat has made available data starting from 2004. For previous years (1990 to 2003), the activity data was estimated using a five-year moving average for both imports and exports. Equation 10 is used to calculate the products utilized by MT for each data year.

$$\text{Total products per annum (Kg)} = \text{Products imported (Kg)} + \text{Products produced locally (Kg)} - \text{Products exported (Kg)}$$

Equation 10: 2D3d total products utilized by MT calculation.

Table 65: Quantity of paints used under the 2D3d sector for 2005 and the latest 3 data years

Product Total	Units	2005	2021	2022	2023
Paints	Kg	2300020	6113874	6738865	7173480

Equation 10 is utilized to estimate the apparent consumption; however, it is documented that the results of this calculation can be unreliable due to a range of factors. An assumption is required in this methodology for cases where the above formula produced a negative value (i.e. the number of products exported were higher than imported and produced combined), the weight of products for that year was assumed to be zero. Therefore, it was assumed that such products were not consumed locally. It is likely that this is caused by a discrepancy between the coverage of production statistics and trade statistics.

This methodology assumes that all the product destined for use in Malta will be sold and utilized within a five-year period. Consequently, any emissions resulting from the use of these products are evenly distributed over the data year and the following four years. All paints disposed of in landfills were excluded from the total product utilization. These reductions in activity data was directly attributing to the year of disposal.

Table 66: PRODCOM codes for sector 2D3d

PRODCOM Label	PRODCOM Codes
Paints and varnishes, based on acrylic or vinyl polymers dispersed or dissolved in an aqueous medium (including enamels and lacquers)	20301150
Other paints, varnishes dispersed or dissolved in an aqueous medium	20301170
Paints and varnishes, based on polyesters dispersed/dissolved in a non-aqueous medium, weight of the solvent > 50 % of the weight of the solution including enamels and lacquers	20301225
Paints and varnishes, based on polyesters dispersed/dissolved in a non-aqueous medium including enamels and lacquers excluding weight of the solvent > 50 % of the weight of the solution	20301229
Paints and varnishes, based on acrylic or vinyl polymers dispersed/dissolved in non-aqueous medium, weight of the solvent > 50 % of the solution weight including enamels and lacquers	20301230
Other paints and varnishes based on acrylic or vinyl polymers	20301250
Paints and varnishes: solutions n.e.c.	20301270
Other paints and varnishes based on synthetic polymers n.e.c.	20301290
Glaziers putty, grafting putty, resin cements, caulking compounds and other mastics	20302253
Painters fillings	20302255

The emission factors for this sector were the solvent content per product, which varies at regular intervals in accordance with an EGTEI study through a TFTEI EU-wide study. The solvent content in paints has experienced a steady decrease since 1990 due to the introduction of EU legislation, mainly through the Paints Directive (Directive 2004/42/EC). As previously mentioned, products are assumed to be utilized over a five-year period. Consequently, if the emission factor changes, the higher previous EF will still be applied to the remaining stock of older paints until they are completely phased out over the following years.

Table 67: Emission factors utilized for 2D3d as per 2023GB

Year	Total paint & cleaning solvent (g/kg)
1990	165.46
2000	137.58
2007	61.08
2010	54.83

5.5.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using population as a proxy.

Table 68: Projected quantity of paints used under the 2D3d sector for reporting year, 2025 and 2030

Product Total	Units	2023	2025	2030
Paints	Kg	7173480	7484759	9002567

5.5.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. The trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

5.5.5 Sector-specific recalculations

A major change in the emission factors was included in this submission. When a change in EF occurred, the higher previous EF was still applied to the remaining stock of older paints until they were completely phased out over the following years.

5.5.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

5.6 Sector 2D3e: Degreasing

Table 69: Sector 2D3e general characteristics

NFR Code	**2D3e**
Sub-Category	Degreasing
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1
Key Category	NMVOC
Year of Last Update	2025 submission

5.6.1 Sector description

This sector covers the emissions emerging from the degreasing sector. Shares of emissions of the particular pollutants from 2D3e in 2023 are shown in Figure 26.

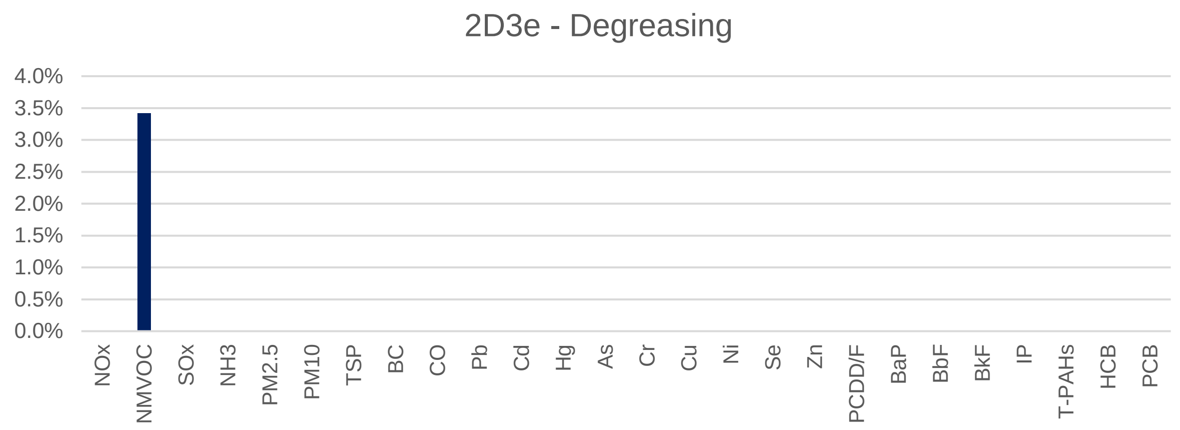

Figure 26: Shares of emissions from the NFR 2D3e category in percentage of the national total

5.6.2 Methodology & activity data - Historical

The methodology utilised for this sector is based on TERT recommendations emerging from the 2023 review. Activity data for this sector is based upon Eurostat import, export and production data for years 2004 to 2023. For previous years (1990 to 2003), the activity data was estimated using a five-year moving average for both imports and exports. The products being considered can be found in Table 70.

Table 70: Products being considered within the degreasing sector.

PRC Label	PRC Codes
o-Xylene	20141243
p-Xylene	20141245
m-Xylene and mixed xylene isomers	20141247
Dichloromethane (methylene chloride)	20141315
Benzol (benzene), toluol (toluene) and xylol (xylenes)	20147320

It was projected that the entire quantity of product intended for use in Malta would be sold and utilized within a five-year timeframe. As a result, any emissions arising from the use of these products are evenly distributed over the course of the data year and subsequent four years.

$$\text{Total products per annum} = \text{products imported (kg)} + \text{products produced (kg)} - \text{products exported (kg)}$$

Equation 11: 2D3e total products utilized by MT calculation.

The emission factor for this sector was taken directly from Table 3-1 of the 2D3e chapter of the 2023GB.

Table 71: Quantity of all degreasing products used under the 2D3e sector for 2005 and the latest 3 data years

Product Total	Units	2005	2021	2022	2023
All Degreasing Products	Kg	128941	210792	211675	182132

5.6.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using population as a proxy.

Table 72: Projected quantity of all degreasing products used under sector 2D3e for reporting year, 2025 and 2030

Product Total	Units	2023	2025	2030
All Degreasing Products	Kg	182132	187687	224491

5.6.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. The trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission

5.6.5 Sector-specific recalculations

No recalculations were carried out in this year's submission.

5.6.6 Sector-specific planned improvements

Capacity building efforts are planned in the near future which will hopefully lead to the estimation of this sector at a Tier 2 level.

5.7 Sector 2D3f: Dry cleaning

Table 73: Sector 2D3f general characteristics

NFR Code	**2D3f**
Sub-Category	Dry cleaning
Method	2023GB
Activity Data	Eurostat
Emission Factors	Tier 1
Key Category	Not Applicable
Year of Last Update	2025 submission

5.7.1 Sector description

This sector covers the emissions emerging from the dry cleaning sector. Shares of emissions of the particular pollutants from 2D3f in 2023 are shown in Figure 27.

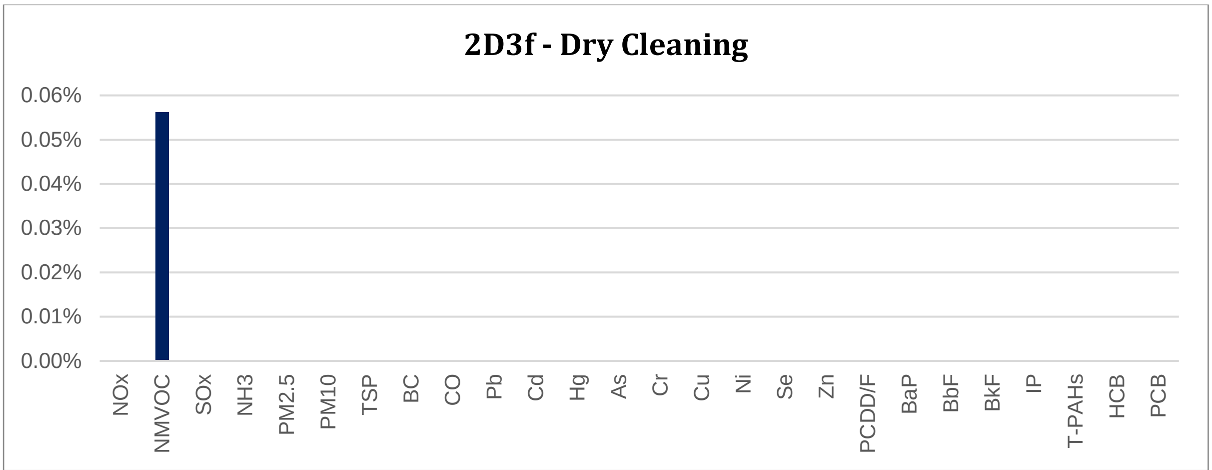

Figure 27: Shares of emissions from the NFR 2D3f category in percentage of the national total

5.7.2 Methodology & activity data - Historical

The methodology utilised for this sector is based on TERT recommendations emerging from the 2023 review. Activity data for this sector is based upon Eurostat import, export and production data for years 2003 to 2023 for trichloroethylene; tetrachloroethylene (perchloroethylene) [20141374]. For previous years (1990 to 2002), the activity data was estimated using a five-year moving average for both imports and exports.

Total product per annum =
product imported (kg) + products produced (kg) - product exported (kg)

Equation 12: 2D3f total products utilized by MT calculation.

The emission factors used for this sector are sourced from the 2023GB. Machinery operating prior to 2000 is assumed to be open-circuit, while machinery installed after 2007 is assumed to be closed-circuit, in accordance with the EU Solvents Directive. A linear replacement of machinery is assumed for the period between 2000 and 2007.

Table 74: Quantity of trichloroethylene used under the 2D3f sector for 2005 and the latest 3 data years

Product Total	**Units**	**2005**	**2021**	**2022**	**2023**
Trichloroethylene	Kg	49633	3029	4005	4885

5.7.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using a 5 year rolling average.

Table 75: Projected quantity of trichloroethylene used under the 2D3f sector for reporting year, 2025 and 2030

Product Total	Units	2023	2025	2030
Trichloroethylene	Kg	4885	3516	3785

5.7.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. The trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission

5.7.5 Sector-specific recalculations

A significant update to the emission factors was introduced in this submission, transitioning from a static emission factor based on the assumption of solely open-circuit machinery to a more dynamic approach. In this approach, machinery operating prior to 2000 is assumed to be open-circuit, while machinery installed after 2007 is considered closed-circuit, in line with the EU Solvents Directive. A linear replacement of machinery is assumed for the period between 2000 and 2007. Additionally, this sector has been projected for the first time in this year's submission.

5.7.6 Sector-specific planned improvements

No improvements are planned for this sector.

5.8 Sector 2D3h: Printing

Table 76: Sector 2D3h general characteristics

NFR Code	**2D3h**
Sub-Category	Printing
Method	2023GB
Activity Data	Eurostat & UN data
Emission Factors	Tier 2
Key Category	NMVOC
Year of Last Update	2025 submission

5.8.1 Sector description

This sector covers the emissions emerging from the printing sector. Shares of emissions of the particular pollutants from 2D3h in 2023 are shown in Figure 28.

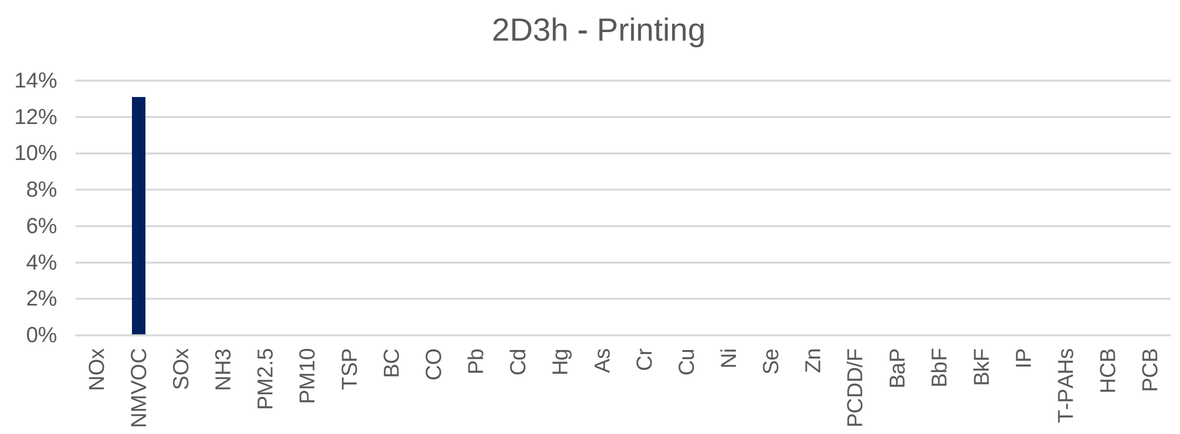

Figure 28: Shares of emissions from the NFR 2D3h category in percentage of the national total

5.8.2 Methodology & activity data - Historical

The methodology utilised for this sector is based on TERT recommendations emerging from the 2022 review. Activity data for this sector is based upon Eurostat import, export and production data for years 2003 to 2023. However, it should be noted that 2010, 2015, 2017 and 2018 were identified as clear outliers and hence for these respective years an interpolation was utilized. UN data was then utilized for years 1994 to 2002 whilst extrapolation was utilized for years 1990 to 1993. It was projected that the entire quantity of product intended for use in Malta would be sold and utilized within a five-year timeframe. As a result, any emissions arising from the use of these products are evenly distributed over the course of the data year and subsequent four years. Furthermore, it has been ensured that any printing ink disposed of in landfills have been excluded from the total product utilized. This printing ink has been duly attributed to the year in which it was discarded.

$$\text{Total products per annum} = \text{products imported (kg)} + \text{product produced (kg)} - \text{products exported (kg)}$$

Equation 13: 2D3h total products utilized by MT calculation.

Table 77: Quantity of printing ink used under the 2D3h sector for 2005 and the latest 3 data years

Product Total	**Units**	**2005**	**2021**	**2022**	**2023**
Printing Ink	Kg	569	996	966	867

The emission factors for this sector were taken directly from Table 26 of the additional guidance document, which is part of the 2023GB. As previously mentioned, products are assumed to be utilized over a five-year period. Consequently, if the emission factor changes, the higher previous EF will still be applied to the remaining stock of older printing inks until they are completely phased out over the following years.

5.8.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using population as a proxy.

Table 78: Projected quantity of printing ink used under the 2D3h sector for reporting year, 2025 and 2030

Product Total	Units	2023	2025	2030
Printing Ink	Kg	867	983	1132

5.8.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

5.8.5 Sector-specific recalculations

A major change in the emission factors was included in this submission. When a change in EF occurred, the higher previous EF was still applied to the remaining stock of printing ink until they were completely phased out over the following years. Additionally, a modification in the projection methodology has been implemented, shifting from a five-year rolling average to a proxy approach based on population trends.

5.8.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

5.9 Sector 2G: Other product use

Table 79: Sector 2G general characteristics

NFR Code	**2G**
Sub-Category	Other product use: fireworks & tobacco combustion
Method	2023GB
Activity Data	AFM (fireworks) & Eurostat (fireworks & tobacco)
Emission Factors	Tier 2
Key Category	$PM_{2.5}$, BC, Pb, Cd, PCDD/PCDF
Year of Last Update	2025 submission

5.9.1 Sector description

This sector covers the emissions emerging from the use of fireworks and tobacco combustion. Shares of emissions of the particular pollutants from 2G in 2023 are shown in Figure 29.

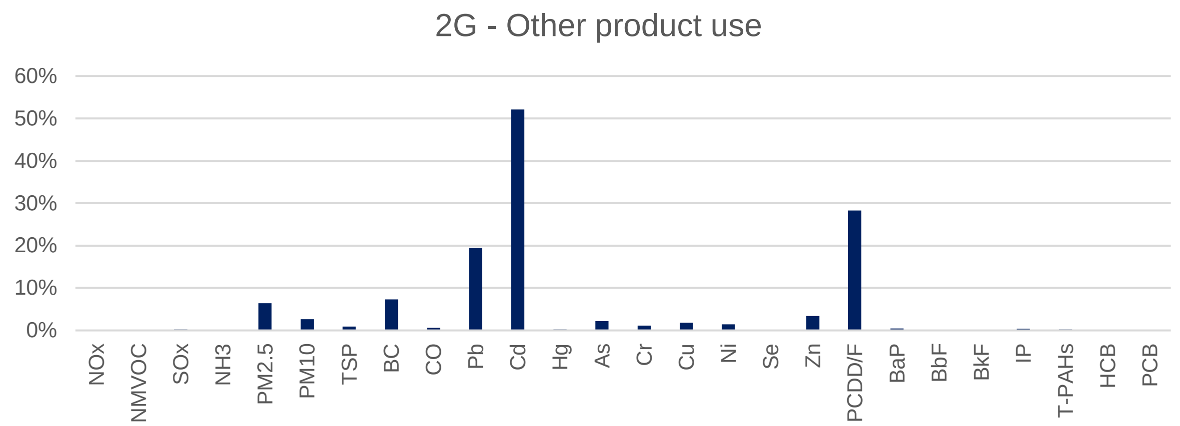

Figure 29: Shares of emissions from the NFR 2G category in percentage of the national total

5.9.2 Methodology & activity data - Historical

The same Tier 2 approach utilized within the previous submission was employed. Emissions were estimated through the use of the Tier 2 emission factors taken directly from the 2023GB.

Table 80: Quantity of cigarettes, tobacco in cigarettes and cigars, firework products and manufactured products used under sector 2G for 2005 and the latest 3 data years

Product Total	**Units**	**2005**	**2021**	**2022**	**2023**
No. of cigarettes	-	93350000	471989500	515421000	468665500
Tobacco in cigarettes and cigars	Kg	107814	480997	525013	479114
Firework products	t	3	6	3	1
Manufactured product	t	110	117	117	120

5.9.2.1 Fireworks

The majority of fireworks utilized within the region are locally manufactured, with raw materials procured from the Armed Forces of Malta. However, a small percentage of fireworks are sourced from foreign countries through importation.

The total mass of materials used was calculated by subtracting the mass of exports by the total imports of CN codes 36041000 (fireworks) and 36049000 (Signalling flares, rain rockets, fog signals and other pyrotechnic articles excl. fireworks and cartridge blanks).

The information regarding imported fireworks and flares was obtained from Eurostat, rather than the NSO. Upon further inquiry with the NSO, it was discovered that general trade statistics are provided by the organization, while Eurostat furnishes special trade statistics. Considering that general trade statistics may include products that have not yet been introduced to the market or may never be, the utilization of specialized trade statistics was considered more suitable.

The quantity of locally produced fireworks was not ascertainable. Consequently, the volume of raw materials employed in their production, as provided by the Armed Forces of Malta, had to be employed instead. To estimate this figure, the methodology employed in a national study conducted by Camilleri and Vella (2016) was adopted. The data for potassium chlorate and potassium nitrate was available from 2011 to 2017. Data for previous years, and for 2018-2023, was extrapolated. Missing quantities for aluminium powder were replaced with the two-year annual average available in the study by Camilleri and Vella (2016), and this value was applied for the entire time series.

Table 81: Annual average of imported oxidants & fuels in firework manufacturing from 2012 to 2014.

Potassium Chlorate (Kg)	Q1	15050
Aluminium (Kg)	Q2	2035
Potassium Nitrate (Kg)	Q3	60325

Table 82: Calculations utilised to estimate the yearly average quantities of flash crackers, coloured stars and black powder from 2012 to 2014.

Type of firework	**Equation to determine annual quantities (Kg each firework type)**
Flash Crackers (Kg)	Q4=Q2/0.3
OX used for flash comp in kg	Q5=0.7*Q4
OX used for star comp in kg	Q6=Q1-Q5
OX used for red STARS in kg	Q7= Q6/3
OX used for blue STARS in kg	-
OX used for green STARS in kg	-
Red stars in kg	Q8=Q7/0.7
Blue stars in kg	Q9=Q7/0.65
Green stars in kg	Q10=Q7/0.833
Black Powder	Q11=Q3/0.75
OX used for flash comp in kg	Q5=0.7*Q4
OX used for star comp in kg	Q6=Q1-Q5
OX used for red STARS in kg	Q7= Q6/3
OX used for blue STARS in kg	
OX used for green STARS in kg	Q8=Q7/0.7
Red stars in kg	Q9=Q7/0.65
Blue stars in kg	Q10=Q7/0.833
Green stars in kg	Q11=Q3/0.75

5.9.2.2 Tobacco

The information regarding imported tobacco was obtained from Eurostat, rather than the NSO. As with fireworks and flares, upon further inquiry with the NSO, it was discovered that general trade statistics are provided by the organization, while Eurostat furnishes special trade statistics. Given that, general trade statistics may encompass products that are yet to be or may not be placed on the market, the utilization of special trade statistics was deemed more appropriate. The CN codes related to this activity were 24022090 (cigarettes, containing tobacco excl. containing cloves), 24021000 (cigars, cheroots and cigarillos containing tobacco), 24022000 (cigarettes containing tobacco) and 24029000 (cigars, cheroots, cigarillos and cigarettes consisting wholly of tobacco substitutes). A 5-year moving average is employed to extrapolate pre-2005 data not available from Eurostat. The total amount of exports was subtracted from the total imports, and the result was presumed to be equal to the amount of tobacco combusted locally.

5.9.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using a 5 year rolling average.

Table 83: Projected quantity of cigarettes, tobacco in cigarettes and cigars, firework products and manufactured products used under 2G sector for reference year, 2025 and 2030

Product Total	Units	2023	2025	2030
No. of cigarettes	-	468665500	487138320	489499949
Tabacco in cigarettes and cigars	Kg	479114	497026	499297
Firework products	t	1	3	4
Manufactured product	t	120	119	119

5.9.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

5.9.5 Sector-specific recalculations

No adjustments were made for this sector through recalculations.

5.9.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

5.10 Sector 2H2: Food & beverages industry

Table 84: Sector 2H2 general characteristics

NFR Code	**2H2**
Sub-Category	Food & beverages industry
Method	2023GB
Activity Data	NSO & Local Brewery
Emission Factors	Tier 2
Key Category	NMVOC
Year of Last Update	2025 submission

5.10.1 Sector description

This sector covers the emissions emerging from food and beverages manufacturing. Shares of emissions of the particular pollutants from 2H2 in 2023 are shown in Figure 30. The calculations made for this sector encompass all locally occurring categories, as confirmation has been received from the NSO indicating that Malta does not engage in the manufacturing of spirits, sugar, margarine, and solid edible oils.

Figure 30: Shares of emissions from the NFR 2H2 category in percentage of the national total

5.10.2 Methodology & activity data - Historical

The NSO provided the necessary activity data required to calculate the following categories:

- Production of meat, fish and poultry
    - Production of home killed meat (1995 to 2023)
    - Fish and seafood landed (1995 to 2023)
    - Production of poultry meat (1995 to 2023)
- Production of animal feed (2003 to 2023)
- Production of red wine (2004 to 2023)
- Production of white wine (2004 to 2023)
- Production of coffee – Based on:
    - Coffee [excluding roasted and decaffeinated] (2005 to 2023)
    - Decaffeinated coffee [excluding roasted] (2005 to 2023)
- Production of bread – Based on:
    - Flour of common wheat and spelt (2004 to 2023)
    - Rye flour (2004 to 2023)
- Agricultural products (1995 to 2023)

Data on beer production spanning from 2013 to 2023 was supplied by a local brewery.

Table 85: Quantity of total meat, fish and poultry, production of animal feed, bread, red wine, white wine, coffee, beer (including de-alcoholized) and total weight of agricultural products used under the 2H2 sector for 2005 and the latest 3 data years

Product Total	Units	2005	2021	2022	2023
Total meat, fish and poultry	t	16212	12272	12453	12014
Production of animal feed	t	33243	33025	30961	30230
Total bread produced	t	1464	9998	10502	10712
Red wine produced	hl	6530	5770	8104	5202
White wine produced	hl	5619	5338	8235	7010
Total coffee production	t	43	70	66	151
Beer (including de-alcoholized) produced	t	156333	178072	207435	0
Total weight of agricultural products	t	87331	57441	59133	60840

5.10.2.1 Methodology

The same Tier 2 approach utilized within the previous submission was employed. The data utilized for the years with missing data across all NSO sourced categories is estimated through the application of a 5-year moving average.

5.10.2.1.1 Bread production

The quantity of bread produced is determined by aggregating the imported flour of common wheat, spelt, and rye. The Malta Bakers' Cooperative had stated that a 50kg sack of flour is capable of producing an estimated 100 loaves, and each individual baked loaf weighs approximately 540g. The resultant calculations can be visualised below:

First, the weight of flour per loaf is calculated:

$$1 \text{ sack} = \frac{50\text{Kg of flour}}{100 \text{ loaves}} = 500\text{g of flour per loaf}$$

Equation 14: Equation to calculate the weight of flour per loaf.

Then, the number of loaves is calculated:

$$\text{Number of loaves} = \frac{x \text{ Kg of flour}}{500\text{g of flour}}$$

Equation 15: Equation to calculate the number of loaves

Finally, the mass of bread is calculated:

$$\text{Mass of bread produced} = \text{Number of loaves} * 540\text{g (mass per loaf)}$$

Equation 16: Equation to calculate the total mass of bread produced

5.10.2.1.2 Beer production

Beer production was added in the 2024 submission. The relevant data spanning from 2013 to 2023 was supplied by a local brewery. For the period prior to 2013, population data was utilised as a proxy to estimate the quantity of beer produced from 1990 to 2012.

5.10.3 Methodology & activity data – Projections

Regarding the projected emissions, these are estimated using the same methodology applied for the historical calculations. Annual product totals for the projection years are determined using a 5 year rolling average.

Table 86: Projected quantity of total meat, fish and poultry, production of animal feed, bread, red wine, white wine, coffee, beer (including de-alcoholized) and total weight of agricultural products used under the 2H2 sector for reporting year, 2025 and 2030

Product Total	Units	2023	2025	2030
Total meat, fish and poultry	t	12014	12145	12160
Production of animal feed	t	30230	32229	31883
Total bread produced	t	10712	10645	10665
Red wine produced	hl	5202	6270	6281
White wine produced	hl	7010	6671	6847
Total coffee production	t	151	116	111
Beer (including de-alcoholized) produced	t	0	136302	127018
Total weight of agricultural products	t	60840	60034	60082

5.10.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

5.10.5 Sector-specific recalculations

Minor recalculations were prepared as NSO had revised data for the year 2022 pertaining to coffee (excluding roasted and decaffeinated) and revised values for years 2021 and 2022 for flour of common wheat, and spelt.

5.10.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

6 Agriculture (NFR 3)

Chapter Updated: 2025

6.1 Category overview

Emissions from the following sectors are estimated:

- 3B (Manure management)
- 3D (Crop production and agricultural soils)
- 3F (Field burning of agricultural residues)

Table 87 shows the detailed source categories for agriculture. The relevant pollutant trends for key categories, as well as the methodologies used are explained in the sections below.

Table 87: Coverage of NFR 3 categories in 2023

NFR Code	Pollutants			Method	KC
	Covered	Exceptions			
		NE	NA		
3B1a	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✓
3B1b	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✓
3B2	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B3	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✓
3B4a	Not Occurring				✕
3B4d	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B4e	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B4f	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B4gi	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B4gii	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✓
3B4giii	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B4giv	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3B4h	NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✓
3Da1	NO_x, NH_3	-	Rest of Pollutants	Tier 1	✓
3Da2a	NO_x, NH_3	-	Rest of Pollutants	Tier 2	✓
3Da2b	Not Occurring				✕
3Da2c	Included Elsewhere (reported in 3Da1)				✕
3Da4	NH_3	-	Rest of Pollutants	Tier 1	✕
3Db	Not Applicable (no methodology)				✕
3Dc	$PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Tier 2	✕
3Dd	Not Applicable (no methodology)				✕
3De	NMVOC	-	Rest of Pollutants	Tier 2	✕
3Df	Not Estimated				✕
3F	Rest of Pollutants	-	HCB, PCBs	Tier 1	✓
3I	Not Occurring				✕

NE: Not Estimated, NA: Not Applicable, KC: Key Category.

Shares of emissions from this NFR sector for all pollutants in 2023 are shown in Figure 31. NH_3 emissions originate primarily from NFR 3.

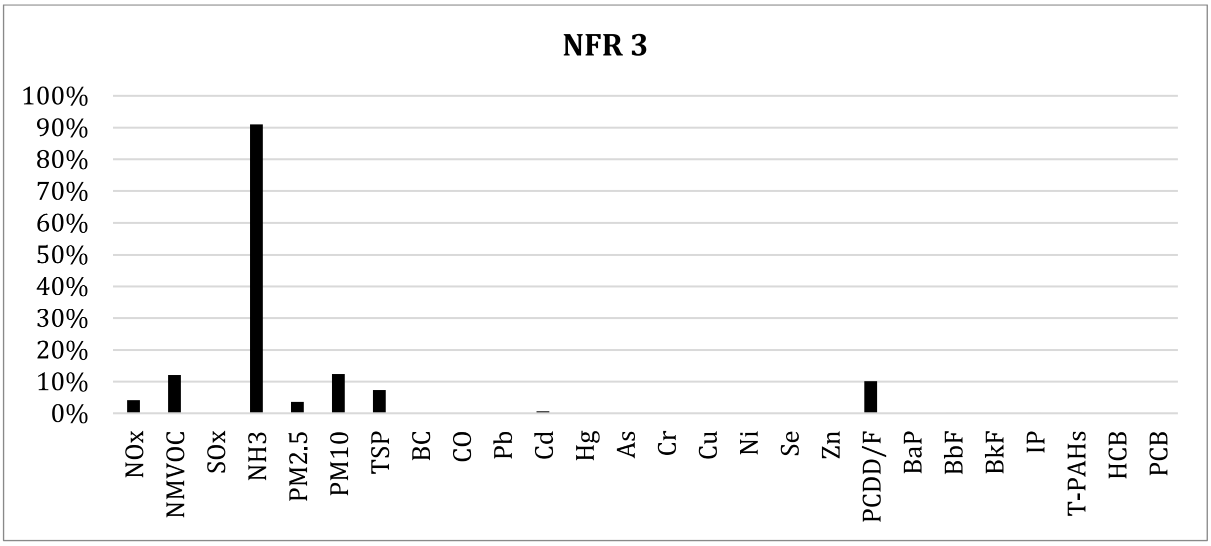

Figure 31: Shares of emissions from the NFR 3 category in percentage of national total

6.2 Sector 3B: Manure Management

6.2.1 Sector category description

Sector 3B 'Manure Management' accounts for emissions generated from the various stages of manure management, such as from livestock housing, open yard areas, and manure stores. Emissions from the application of manure are included within NFR 3Da2a, whereas emissions from grazing are assumed to be '0', following communication with the Agricultural Directorate.

The methodology for estimating emissions is the same for all sub-sectors within this sector. Therefore, all the activity data will be presented collectively within this section. Nevertheless, since the methodological notes and the recalculations may differ, these will be included within each sub-sector.

The different activity data parameters used can be found below.

6.2.1.1 Number of animal heads

The number of animal heads was provided by the NSO and is in line with the climate change (CAA) model. The total number of animal heads, as well as the change in animal heads compared to the previous submission, can be observed in the Table 88 and

Table 89 below.

Table 88: Number of animal heads

Livestock type	1990	2005	2022	2023	2025	2030
Dairy cattle	9,175	7,832	6,119	5,929	6,084	6,026
Non-dairy cattle	6,290	6,285	3,735	3,917	3,783	3,784
Non-dairy cattle (calves)	5,535	5,625	4,346	4,385	4,370	4,320
Sheep	16,000	14,641	14,465	13,986	14,533	13,804
Swine – Fattening pigs	35,667	26,884	10,123	11,256	10,124	11,240
Swine – sows	65,533	46,141	19,431	24,529	20,222	22,297
Goats	6,200	6,273	6,519	6,564	6,658	6,181
Horses	944	1,322	4,629	5,410	4,755	5,054
Mules and Asses	800	800	777	777	777	777
Laying hens	517,555	469,188	405,690	402,333	409,634	391,531
Broilers	994,144	575,152	598,451	643,239	619,982	583,558
Turkeys	18,000	10,000	12000	12,000	0	0
Other Poultry	14,993	7,673	NO	0	0	411
Other animals (Rabbits)	51,104	85,660	76,492	76,492	76,492	76,492

Table 89: Number of animal heads recalculations

Livestock type	1990	2005	2022	2023
Dairy cattle	0	0	0	0
Non-dairy cattle	0	0	0	0
Non-dairy cattle (calves)	0	0	0	0
Sheep	0	0	0	0
Swine - Sows	0	0	0	0

Swine - Fattening pigs	0	0	0	0
Goats	-52	0	0	0
Horses	0	0	0	0
Mules and Asses	0	0	0	0
Laying hens	0	0	0	0
Broilers	0	0	0	0
Turkeys	0	0	0	0
Other Poultry	0	0	0	0
Other animals (Rabbits)	0	0	0	0

6.2.1.2 Weight

Table 90 shows country-specific activity data for animal weight, compared with the default factors in the EEA Guidebook. The weight was assumed to be constant across all historical and projected years.

Table 90: Animal weight per livestock type

Livestock type	Animal weight (kg)	MT: Data source
Dairy cattle	550	KPH (Milk breeders co-operative)
Non-dairy cattle	513	KPH (Milk breeders co-operative)
Non-dairy cattle (calves)	200	KPH (Milk breeders co-operative)
Sheep	47	KPH (Milk breeders co-operative)
Swine (finishing pigs)	62	Pig Breeders Co-operative
Swine (sows)	60	Pig Breeders Co-operative
Goats	35	KPH (Milk breeders co-operative)
Horses	550	EEA Guidebook
Mules and asses	350	EEA Guidebook
Laying hens	1.9	Climate Action Authority (CAA)
Broilers	1.2	Climate Action Authority (CAA)
Turkeys	6.8	EEA Guidebook
Other poultry	1.2	Climate Action Authority (CAA)
Other animals (fur animals)	2	Climate Action Authority (CAA)

6.2.1.3 Housing period and excretion on yards

Following communication with the Agricultural Directorate, it was assumed that according to S.L. 549.66, all animal holdings and passageways are to be covered at all times, indicating that livestock is constantly kept under housing. However, 9% of beef cattle, and 35% of sheep and goats, are exempt from the Regulation, and are thus kept in yards. To reflect this policy in the N-flow tool, the total housing period was assumed to be 365 days for all livestock types. Following communication with the Ministry responsible for agriculture (MAFA), it was determined that Horses and Mules & Asses are not covered by this particular provision in S.L. 549.66. Hence, a value of 180 days was taken as a default value for both livestock. Further discussions with MAFA will take place in order to determine a more accurate housed period. In contrast, the proportion of manure excreted in yards was modified to reflect the excretion period on yards for non-dairy cattle, sheep, and goats. In view of this, the following assumptions were carried out:

- 1990 onwards Horses: An assumption was taken that horses spend 12 hours outside, taken as a halfway mark in a study focusing on influence of daily free time spent outside in a paddock on horse behaviour (Eklund, 2008) This will be further discussed with the Animal Welfare Department to assess whether this can be further improved.
- 1990 onwards Mules & Asses: An assumption was taken that mules and asses spend 16 hours outside, using the same halfway mark rationale from a study published by the voluntary initiative group on equines under the EU Platform on Animal Welfare (Voluntary Initiative group on equines under the EU Platform on Animal Welfare, 2018). This will be further discussed with the Animal Welfare Department to assess whether this can be further improved.
- 1990 onwards Non-dairy cattle: 9% are exempt from the housing requirement, as per feedback from MAFA.
- 1990 onwards Sheep & Goats: 35% are exempt from the housing requirement, as per feedback from MAFA.
- 1990 onwards Other livestock: A value of 1 was used as livestock is housed at all times.

The housing period and excretion on yards was assumed to be constant across all historical and projected years. The parameters used can be observed in Table 91 Table 91 and
Table 92.

Table 91: Housing period per livestock type

Livestock type	MT: Housing period (days)	2023GB: Housed period (days)	MT: Data source
Dairy cattle	365	180	Agricultural Department
Non-dairy cattle	365	180	Agricultural Department
Sheep	365	30	Agricultural Department
Swine (finishing pigs)	365	365	Agricultural Department
Swine (sows)	365	365	Agricultural Department
Goats	365	30	Agricultural Department
Horses	180	180	Agricultural Department
Mules and asses	180	365	Agricultural Department
Laying hens	365	365	Agricultural Department
Broilers	365	365	Agricultural Department
Turkeys	365	365	Agricultural Department
Other poultry	365	365	Agricultural Department
Other animals (fur animals)	365	365	Agricultural Department

Table 92: Proportion of manure excreted on yards

Livestock type	2024	2025	MT: Data source
Dairy cattle	0	0	Agricultural Department
Non-dairy cattle	0.09	0.09	Agricultural Department
Sheep	0.35	0.35	Agricultural Department
Swine (finishing pigs)	0	0	Agricultural Department
Swine (sows)	0	0	Agricultural Department
Goats	0.35	0.35	Agricultural Department

Horses	0	0.5	Study in text above
Mules and asses	0	0.66	Study in text above
Laying hens	0	0	Agricultural Department
Broilers	0	0	Agricultural Department
Turkeys	0	0	Agricultural Department
Other poultry	0	0	Agricultural Department
Other animals (fur animals)	0	0	Agricultural Department

6.2.1.4 Proportion of solid/slurry manure

Moreover, the manure type produced per livestock type was determined following consultation with the Department of Agriculture and is shown in

Table 93. The values were assumed to be constant across all historical and projected years.

Table 93: Proportion of manure type by livestock

Livestock	Manure type	Proportion by manure type
Cattle	Solid	50%
	Slurry	50%
Fattening pigs	Solid	5%
	Slurry	95%
Sows	Solid	5%
	Slurry	95%
	Outdoor	Not Applicable
Layers	(Semi) Solid	100%

6.2.1.5 Proportion of manure stored, applied, and entering the digester

Following communication with the Agricultural Directorate, it was assumed that according to S.L. 549.66, slurry could not be applied, whereas solid manure could only be applied from the 15th March until the 15th October. It was also assumed that the Nitrates Directive started applying from 2005 and not 1990, following Malta's accession to the EU in May 2004. Thus, from 1990-2004 all livestock manure was assumed to be spread immediately without storage, apart from swine manure.

A report published by Sustech Consulting (2008) regarding Agricultural Waste Management Plan for the Maltese Islands, provided values of compliance for Cattle in 2007 & 2008. Based on such values, it was assumed that the values for 2007 were equal to the values in 2005. Similarly, this approach was also applied to values of compliance provided for hens and broilers. From 2008 onwards, it was assumed that Cattle & Poultry became fully compliant immediately whereas all other livestock (except for Swine) were assumed to be fully complaint from 2005 onwards due to lack of data. Such assumptions will be looked into further in future submissions. Based on data reported by NSO, from 1990 onwards, manure was not applied in Malta, and thus the values are listed as '1' for the entire time series. (NSO, 2007). The results of such calculations are highlighted in Table *95* and Table 96.

Furthermore, from 2018 until 2021 manure from cows and chickens entered the anaerobic digester (AD) at the Malta North Waste Treatment Plant. The annual quantities of manure from cows and chickens was provided by Wasteserv. However, no disaggregated data was available, and therefore manure generated by cows had to split equally into dairy and non-dairy cattle. Similarly, manure from chickens was split equally into manure from laying hens, broilers, and other poultry

The share of manure entering the AD, was calculated by first multiplying the quantity of manure in tonnes by the N content of manure as can be seen in Equation 17. Table 94 provides the percentage of nitrogen in manure taken from the Nitrates Action Programme (Government of Malta, 2011).

$$Mass\ of\ manure * nitrogen\ content = Mass\ of\ nitrogen\ manure$$

Equation 17: Convert mass of manure to mass of nitrogen manure

Table 94: Nitrogen content in manure by livestock category

Livestock type	N content in manure
Dairy Cattle	0.56%
Non-dairy Cattle	0.56%
Average for Chicken	2.07%

The share of manure entering the Anaerobic Digester was then calculated through

Equation 18. The Nitrogen excreted by cows/chickens was calculated through the N-flow tool.

$$\frac{Mass\ of\ nitrogen\ maure}{Nitrogen\ excreted\ by\ cows/chickens} = Percentage\ of\ manure\ entering\ the\ anerobic\ digester$$

Equation 18: Calculation to obtain the share of manure entering the anaerobic digester

For projected data, it was assumed that all livestock manure will be collected and treated through an anaerobic digestion process to produce bio fertiliser as from 2027 onwards, as per feedback from MAFA.-RAM.

Table 95: Proportion of manure stored - slurry

Livestock type	Scenario	Storage	Application	Anaerobic Digester
Dairy cattle	2005	0.13	0.87	0.00
	2018	0.98	0.00	0.02
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Non-dairy cattle	2005	0.13	0.87	0.00
	2018	0.98	0.00	0.02
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Non-dairy cattle (calves)	2005	0.13	0.87	0.00
	2018	0.98	0.00	0.02
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Sheep	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Swine (finishing pigs)	2005	1.00	0.00	0.00

	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Swine (sows)	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Goats	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	1.00
	2030	0.00	0.00	1.00
Horses	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Mules and asses	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Laying hens	2005	0.09	0.91	0.00
	2018	0.93	0.00	0.07
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Broilers	2005	0.04	0.96	0.00
	2018	0.93	0.00	0.07
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Turkeys	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Other poultry	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.06
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Other animals (rabbits)	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00

Table 96: Proportion of manure stored - solid

Livestock type	Scenario	Storage	Application	Anaerobic Digester
Dairy cattle	2005	0.05	0.95	0.00
	2018	0.41	0.57	0.02
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Non-dairy cattle	2005	0.05	0.95	0.00
	2018	0.41	0.57	0.02
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Non-dairy cattle (calves)	2005	0.05	0.95	0.00
	2018	0.41	0.57	0.02
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Sheep	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Swine (finishing pigs)	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Swine (sows)	2005	1.00	0.00	0.00
	2018	1.00	0.00	0.00
	2023	1.00	0.00	0.00
	2030	0.00	0.00	1.00
Goats	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Horses	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Mules and asses	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Laying hens	2005	0.04	0.96	0.00

	2018	0.39	0.54	0.07
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Broilers	2005	0.02	0.98	0.00
	2018	0.39	0.54	0.07
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Turkeys	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Other poultry	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00
Other animals (rabbits)	2005	0.42	0.58	0.00
	2018	0.42	0.58	0.00
	2023	0.42	0.58	0.00
	2030	0.00	0.00	1.00

6.2.1.6 Nitrogen excretion

The table below compares the Nex values provided in the N-flow tool and the revised data as used in the 2024 submission, which is in line with the updated values utilized by the CAA. The changes in Nex values can be observed Table 97. The values were assumed constant across all historical and projected years.

Table 97: Changes in Nex values in kg N/1000 kg animal mass day^{-1}

Animal type	2024 submission	2025 submission
Dairy cattle	0.66	0.67
Non-dairy cattle	0.36	0.36
Non-dairy cattle (calves)	0.40	0.40
Sheep	0.20	0.20
Swine (finishing pigs)	0.75	0.75
Swine (sows)	0.64	0.64
Goats	0.46	0.46
Horses	0.26	0.26
Mules and asses	0.26	0.26
Laying hens	0.87	0.87
Broilers	0.82	0.82
Turkeys	0.74	0.74
Other poultry	0.82	0.82
Other animals (rabbits)	8.1	11.1

6.2.1.7 Straw

The table below compares the Straw values provided in the 2024 submission and the revised data as used in the 2025 submission. The value of cattle was changed to 0, due to Sustech report (2008), as it states that shredded paper and rubber mats are often used as opposed to straw. The changes in Nex values can be observed Table 97. The values were assumed constant across all historical and projected years.

Table 98: Changes in annual straw use in litter-based manure management systems in kg/year

Animal type	2024 submission	2025 submission
Dairy cattle	3041.67	0
Non-dairy cattle	1013.89	0
Non-dairy cattle (calves)	1013.89	0
Sheep	243.33	243.33
Swine (finishing pigs)	200	200
Swine (sows)	600	600
Buffalo	1500	1500
Goats	243.3333	243.3333
Horses	1013.889	1013.889
Mules and asses	1013.889	1013.889
Laying hens	0	0
Broilers	0	0
Turkeys	0	0
Other poultry	0	0
Other animals (rabbits)	0	0

6.2.1.8 Other parameters

- No activity data on silage was available, and thus it was assumed to be zero
- National Statistics Office provided total cow and milk produced
- Malta Dairy Products (MDP) provided the cow milk fat content (%)
- The Gross Feed Intake (GE) for cattle was provided by the NSO, while the Volatilized Solids (VS) for the remaining livestock types were taken from the UNFCCC guidelines. Both these values were in line with the values used by the Climate Action Authority.

6.2.1.9 Projections

Following communication with MEEC and MAFA-RAM, projections were carried out for Policy Measure 'Manure and slurry management'. This measure was included under both the WM and WaM scenarios within the NECP. As stated in Section 6.2.1.5, it was assumed that all livestock manure will be collected and treated through an anaerobic digestion process to produce bio fertiliser as from 2027 onwards. The following steps were taken to project this measure;

All solid and slurry manure was assumed to be going to the anaerobic digester. The emissions from storage were assumed to take place since manure would need to be stored prior to being transported to the anaerobic digester facility. Following storage, no slurry or solid manure would be applied to soils. The manure would be reported under 'mmdig_TAN'. This parameter is then multiplied by the emission factor for 'mapplic_slurry_TAN'. The emissions from the anaerobic digestion process for the pre-storage phase were estimated through the N-flow tool and reported under NFR 5B2.

No slurry was assumed to be applied in the model, however, within the N-flow tool, the emission factors from the application of the biofertiliser were the same as those for the application of slurry. For most livestock types, there were no emission factors for the application of slurry, therefore, the emission factor from the application of solid manure was used to estimate the emissions from the application of this biofertiliser.

MAFA-RAM confirmed that the biofertiliser would be injected within the soil through the use of metal rods, thus, this measure corresponds to 'Field Measure 7: Slurry Injection' of the UNECE guidance document on Integrated Sustainable Nitrogen Management which states that such a practice reduces emissions of NH3, by 70 to 90%. When considering that Maltese soils are relatively shallow (Sultana, 2017), an abatement factor of 70% was applied.

Since all the manure was utilised following the introduction of this measure, excess N was applied to soils from the processing of manure. This excess application of nitrogen was subtracted from the application rate of synthetic fertilisers estimated within NFR 3Da1.

6.2.2 Sub-sector 3B1a: Dairy cattle

Table 99: Sector 3B1a general characteristics

NFR Code	**3B1a**
Sub-Category	Manure management - Dairy cattle
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	NH_3
Year of Last Update	2025 submission

6.2.2.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of dairy cows and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 32.

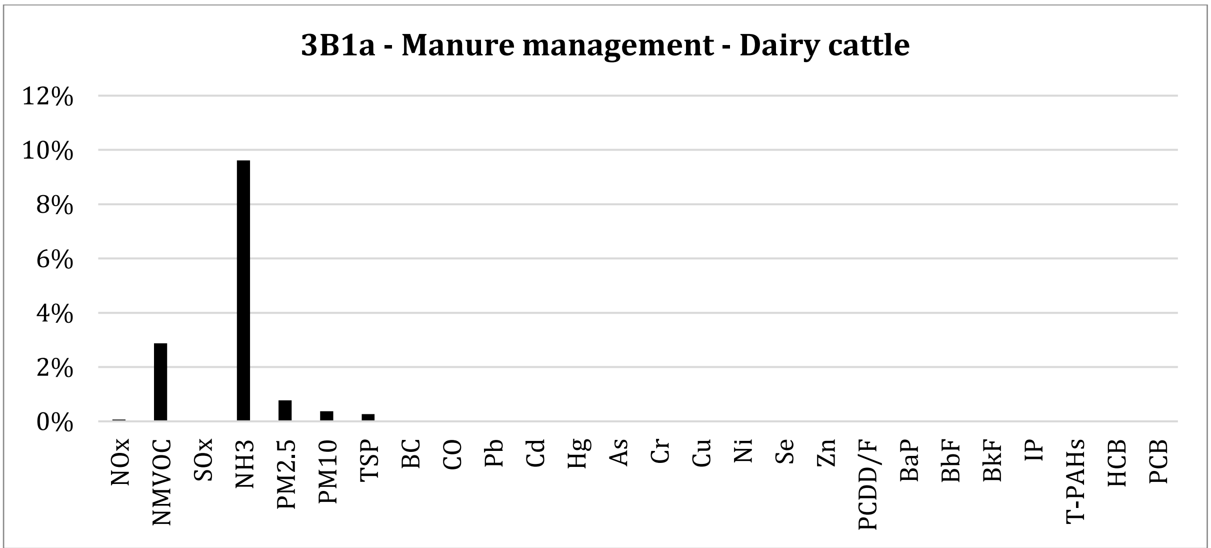

Figure 32: Shares of emissions from the NFR 3B1a category in percentage of national total

6.2.2.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.2.3 Activity data

The source of the activity data is explained in Section 6.2.1.

6.2.2.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model,

were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were properly converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.2.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure and slurry applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96.
- For NO_x, and NH_3 the Nitrogen excretion (Nex) rate was also updated in line with the values provided by the Climate Action Authority, with the updated value being shown in Table 97.
- For NO_x, and NH_3 the annual straw use was updated in line with Table 98
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.2.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the Nex, as well as the share of manure application and storage across the time series

6.2.3 Sub-sector 3B1b: Non-dairy cattle

Table 100: Sector 3B1b general characteristics

NFR Code	3B1b
Sub-Category	Manure management – Non-dairy cattle
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	NH_3
Year of Last Update	2025 submission

6.2.3.1 Sector category description

This subcategory includes emissions of air pollutants from the feeding of non-dairy cows and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 33.

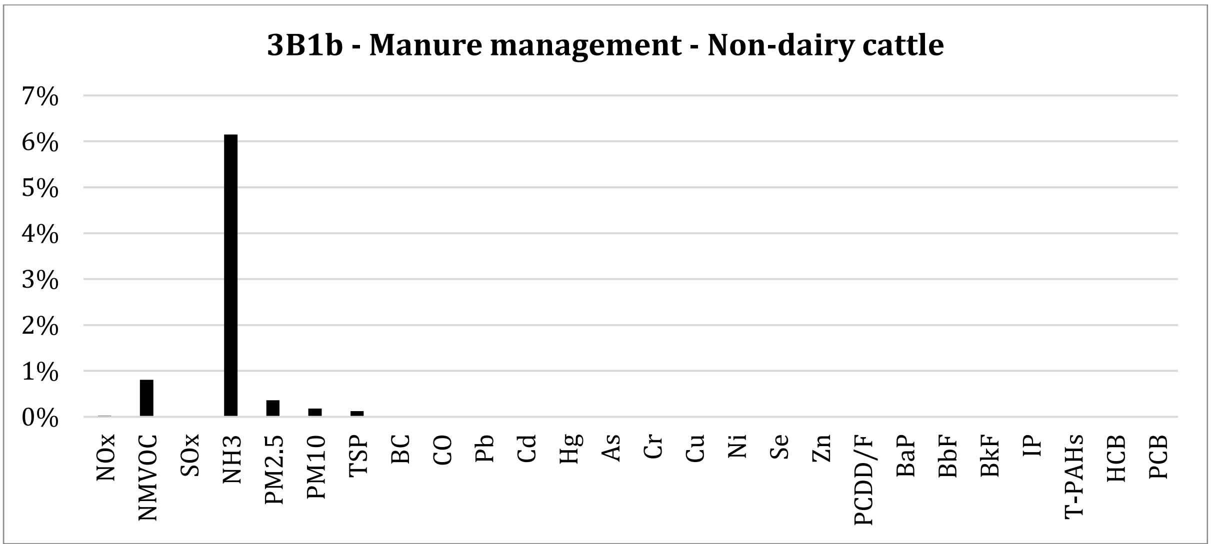

Figure 33: Shares of emissions from the NFR 3B1b category in percentage of national total

6.2.3.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.3.3 Activity data

The sources of the activity data are explained in Section 6.2.1. As can be observed through the table below, the number of animal heads and the weight was provided at a sub-division level, rather than for non-dairy cattle as a whole. Concerning animal heads, the categories in the table below were summed together. The animal weight for non-dairy cattle was calculated annually by taking a weighted average of the weights from growing cattle, bulls, and non-lactating cows. The weight for calves was taken directly from the table below.

Table 101: Categorized weight

Livestock type	Detailed classification	Weight (kg)
Calves	Male Cattle (<1 Year)	200
	Female Cattle (<1 Year)	
Growing Cattle	Male Cattle (1 to 2 Years)	480
	Female Cattle [Not Yet Mated] (1 to 2 Years)	
	Heifers [For Slaughter] (1 to 2 Years)	
	[Other] Heifers (1 to 2 Years)	
Bulls	Male Cattle (>2 Years)	630
Non-lactating Cows	Heifers [For Slaughter Cattle] (>2 Years)	640
	[Other] Heifers Cattle (>2 Years)	
	[Other] Cows Cattle (>2 Years)	

6.2.3.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.3.5 Sub-sector-specific recalculations

- For NO_x and NH_3 the share of solid manure and slurry applied, stored, and sent to the digester was updated with the values shown in Table *95* andTable 96.
- For NO_x, and NH_3 the Nitrogen excretion (Nex) rate was also updated in line with the values provided by the Climate Action Authority, with the updated value being shown in Table 97.
- For NO_x, and NH_3 the annual straw use was updated in line with Table 98
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.3.6 Sector-specific planned improvements

Efforts will be made to better represent local practices across the time series such as by obtaining more representative figures for the Nex, as well as the share of manure application and storage across the time series

6.2.4 Sector 3B2: Sheep

Table 102: Sector 3B2 general characteristics

NFR Code	**3B2**
Sub-Category	Manure management – Sheep
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.4.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of sheep and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 34.

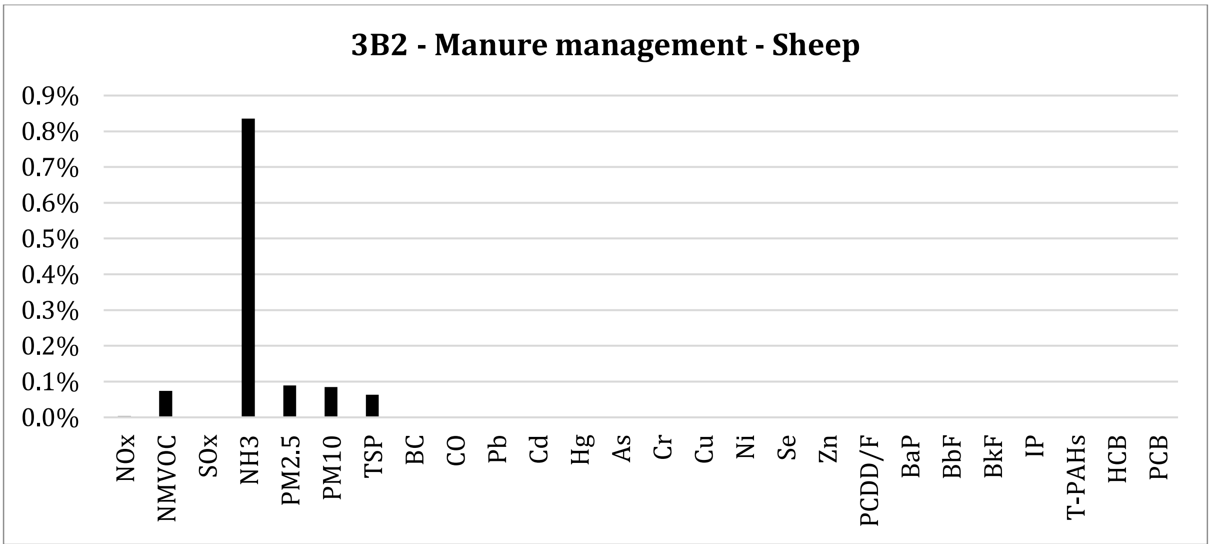

Figure 34: Shares of emissions from the NFR 3B2 category in percentage of national total

6.2.4.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.4.3 Activity data

The sources of the activity data are explained in Section 6.2.1. As can be observed through the table below, the number of animal heads and the weight was provided at a sub-division level, rather than for sheep as a whole. Concerning animal heads, the categories in the table below were summed together. The animal weight for sheep was calculated annually by taking a weighted average of the weights from growing lambs, breeding females, and other mature sheep (>1 Year).

Table 103: Categorized weight

Livestock type	Detailed classification	Weight (kg)
Growing lambs	Female Lambs	20
	Male Lambs	
Breeding females	Ewe Lambs	50
	Ewes	
Other mature sheep (>1 Year)	Male Sheep (Ram)	60

6.2.4.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.4.5 Sub-sector-specific recalculations

- For NO_x and NH_3 the share of solid manure and slurry applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96.
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.4.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series such as by obtaining more representative figures for the Nex, as well as the share of manure application and storage across the time series.

6.2.5 Sub-sector 3B3: Swine

Table 104: Sector 3B3 general characteristics

NFR Code	**3B3**
Sub-Category	Manure management – Swine
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	NH_3
Year of Last Update	2025 submission

6.2.5.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of swine and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 35.

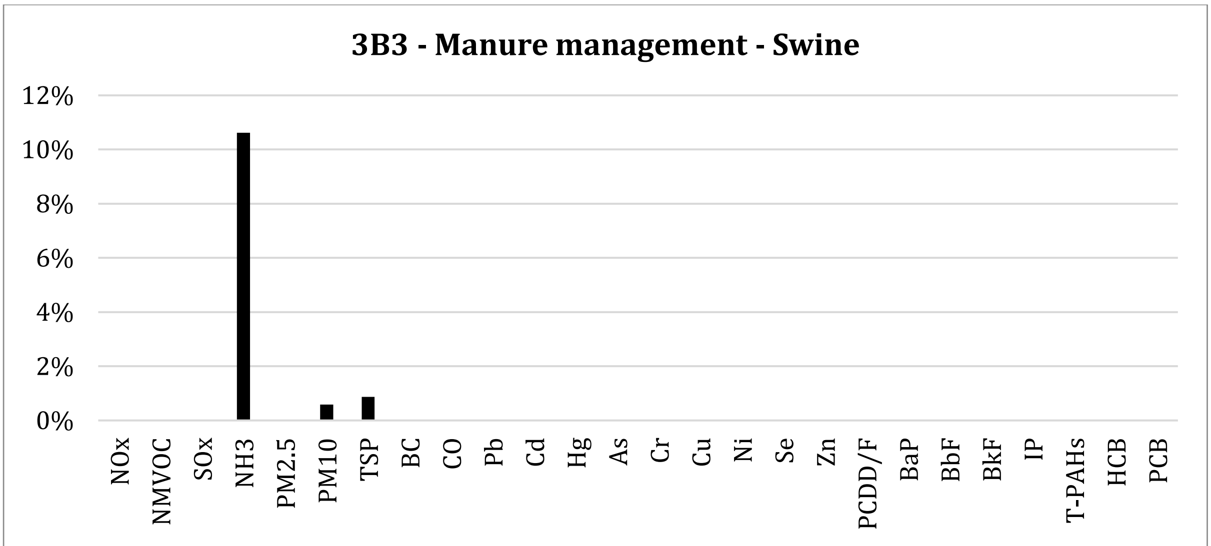

Figure 35: Shares of emissions from the NFR 3B3 category in percentage of national total

6.2.5.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. Emissions from ‘sows’ and ‘fattening pigs’ were calculated separately within the N-flow tool, and were then summed up within NFR 3B3. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. ‘ENMVOC,appl.’ were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.5.3 Activity data

The sources of the activity data are explained in Section 6.2.1. As can be observed through the table below, the number of animal heads and the weight was provided at a sub-division level, rather than for swine as a whole. Additionally, these categories were further sub-divided into ‘sows’ and ‘fattening pigs’. Concerning animal heads, the categories in the table below were summed together. The animal weight for sows and fattening pigs was calculated annually by taking a weighted average of the weights from piglets (<20kg) and breeding sows, and young piglets (20 to 50kg), fattening pigs (>51kg), gilts, and breeding boars respectively.

Table 105: Categorized weight

Livestock type	Detailed classification	Weight (kg)
Sows	Piglets (<20kg)	10.5
	Breeding Sows	175
Fattening pigs	Young Piglets (20 to 50kg)	35
	Fattening pigs (>51kg)	75
	Gilts	120
	Breeding boars	250

6.2.5.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.5.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1

6.2.5.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.2.6 Sub-sector 3B4d: Goats

Table 106: Sector 3B4d general characteristics

NFR Code	**3B4d**
Sub-Category	Manure management – Goats
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.6.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of goats and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 36.

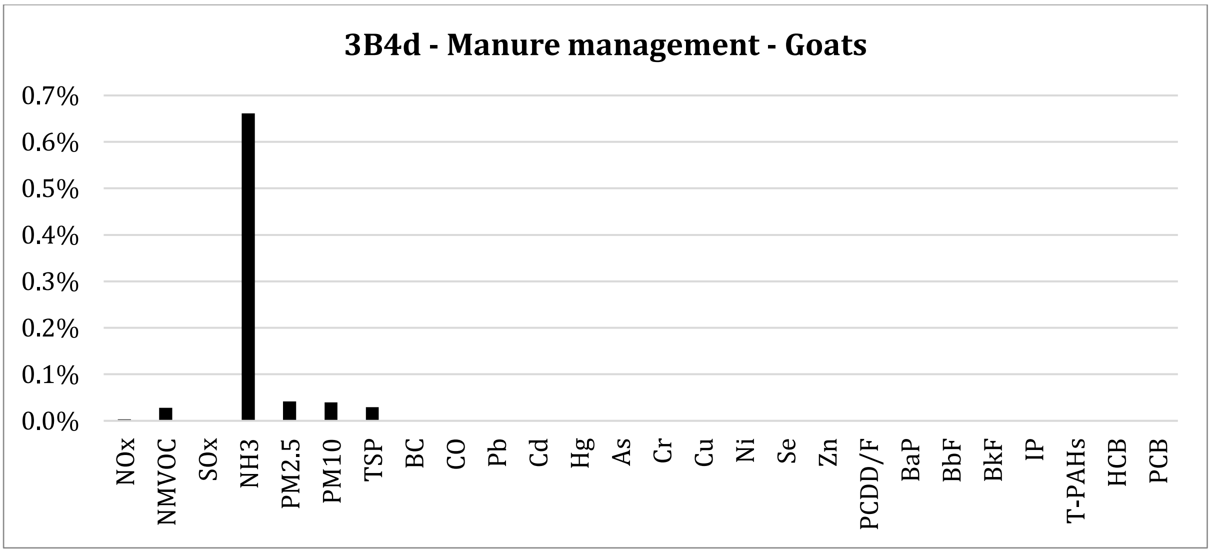

Figure 36: Shares of emissions from the NFR 3B4d category in percentage of national total

6.2.6.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.6.3 Activity data

The sources of the activity data are explained in Section 6.2.1. As can be observed through the table below, the number of animal heads was provided at a sub-division level, rather than for goats as a whole. The number of animal heads per category was summed together. In contrast, there was only one value for weight.

Table 107: Categorized weight

Livestock type	Detailed classification	Weight (kg)
Goats	Female Kids	35
	Male Kids	
	Goats [Mated for the First Time]	
	Goats [That Have Already Kidded]	
	Male Goats	

6.2.6.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.6.5 Sub-sector-specific recalculations

- All pollutants were recalculated due to change in animal heads as per Table 89
- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.6.6 Sector-specific planned improvements

Efforts will be made to better represent local practices across the time series such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.2.7 Sector 3B4e: Horses

Table 108: Sector 3B4e general characteristics

NFR Code	**3B4e**
Sub-Category	Manure management – Horses
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.7.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of horses and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 37.

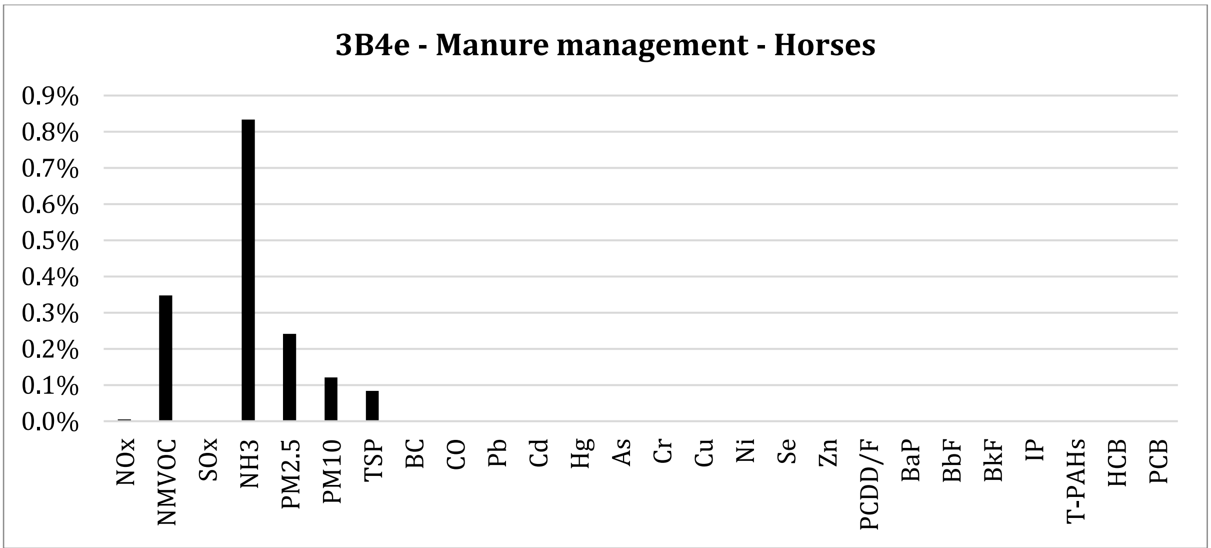

Figure 37: Shares of emissions from the NFR 3B4e category in percentage of national total

6.2.7.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.7.3 Activity data

The sources of the activity data are explained in Section 6.2.1.

6.2.7.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by Climate Action Authority), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.7.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.
- NO_x, NMVOC and NH_3 were recalculated due to the changes applied to the housing period for Horses as per Table 91 and Table 92.

6.2.7.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series. Further discussions with MAFA will take place in order to determine a more accurate Housed period.

6.2.8 Sub-sector 3B4f: Mules and Asses

Table 109: Sector 3B4f general characteristics

NFR Code	**3B4f**
Sub-Category	Manure management – Mules and Asses
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.8.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of mules and asses, and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 38.

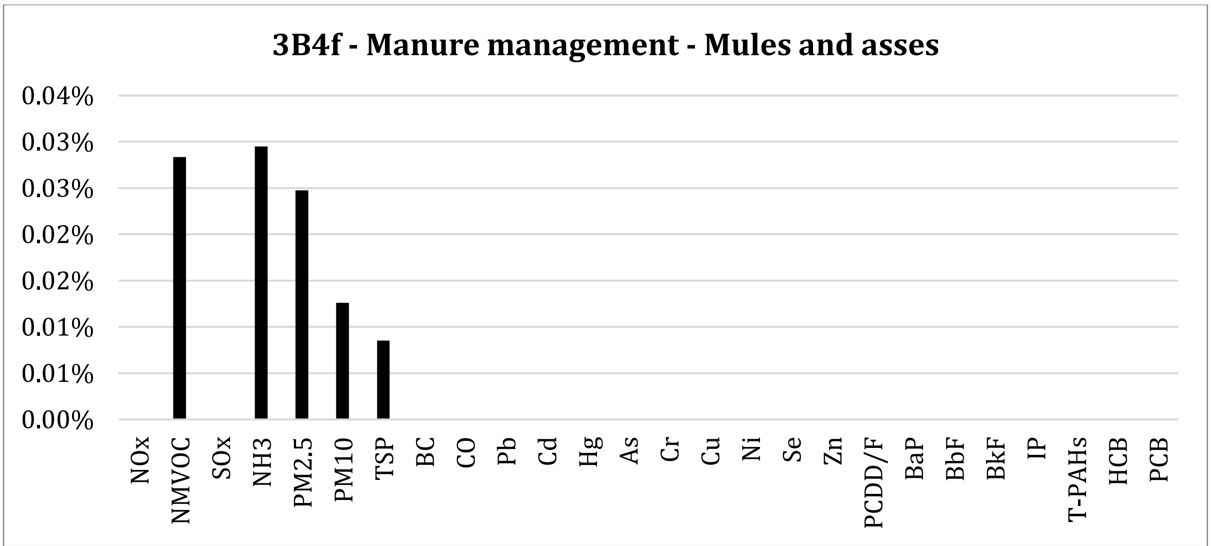

Figure 38: Shares of emissions from the NFR 3B4e category in percentage of national total

6.2.8.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.8.3 Activity data

The sources of the activity data are explained in Section 6.2.1.

6.2.8.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house.

Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.8.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.
- NO_x, NMVOC and NH_3 were recalculated due to the changes applied to the housing period for Horses as per Table 91 and Table 92.

6.2.8.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series such as by obtaining more representative figures for the share of manure application and storage across the time series. Further discussions with MAFA will take place in order to determine a more accurate Housed period.

6.2.9 Sub-sector 3B4gi: Laying Hens

Table 110: Sector 3B4gi general characteristics

NFR Code	**3B4gi**
Sub-Category	Manure management – Laying hens
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.9.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of laying hens and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 39.

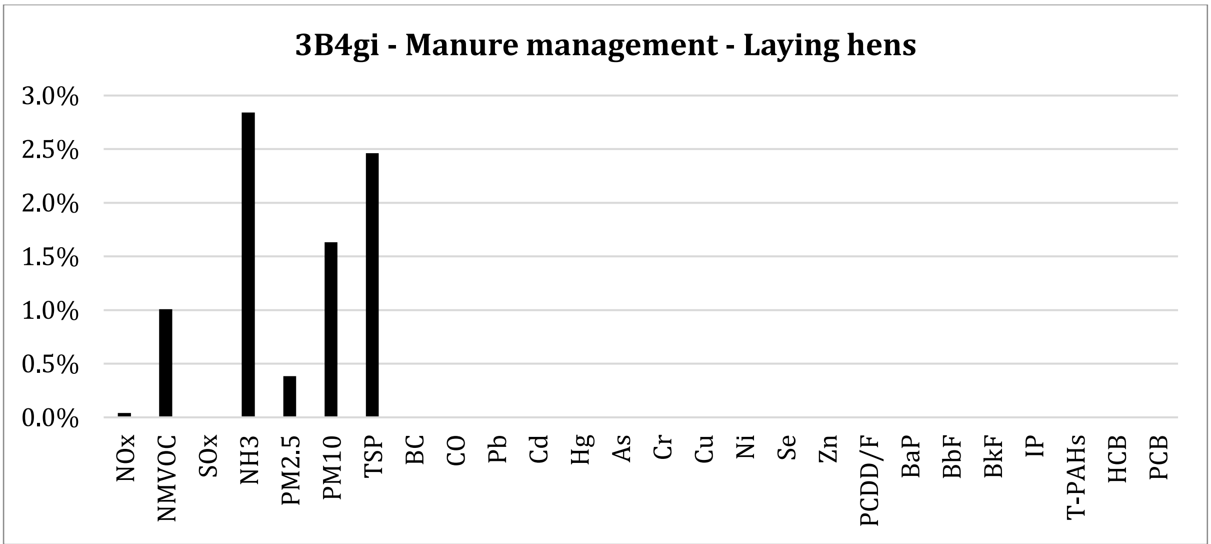

Figure 39: Shares of emissions from the NFR 3B4gi category in percentage of national total

6.2.9.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.9.3 Activity data

The sources of the activity data are explained in Section 6.2.1. The local values for Nex were taken from the Sustech (2008) report.

6.2.9.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model,

were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.9.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.9.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.2.10 Sub-sector 3B4gii: Broilers

Table 111: Sector 3B4gii general characteristics

NFR Code	**3B4gii**
Sub-Category	Manure management – Broilers
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not applicable
Year of Last Update	2025 submission

6.2.10.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of broilers and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 40.

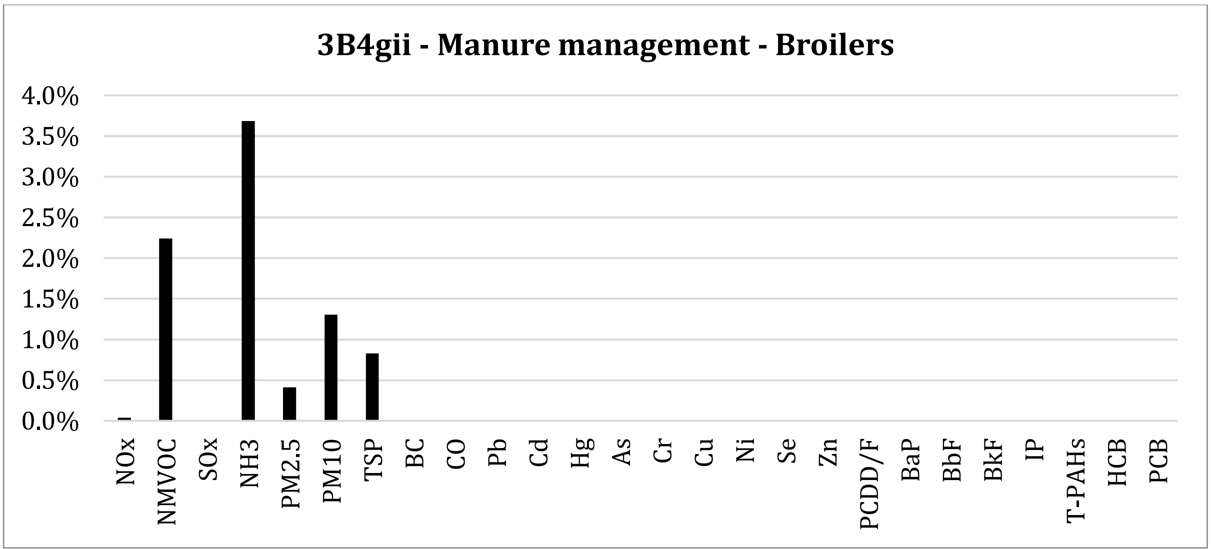

Figure 40: Shares of emissions from the NFR 3B4gii category in percentage of national total

6.2.10.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.10.3 Activity data

The sources of the activity data are explained in Section 6.2.1. The Sustech report (Sustech, 2008) provided a range of Nex from 0.35kgN/place to 0.82kgN/place. The highest value of 0.82kgN/place was taken as a worst-case scenario.

6.2.10.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.10.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.10.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.2.11 Sub-sector 3B4giii: Turkeys

Table 112: Sector 3B4gii general characteristics

NFR Code	**3B4giii**
Sub-Category	Manure management – Turkeys
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.11.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of turkeys and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 41.

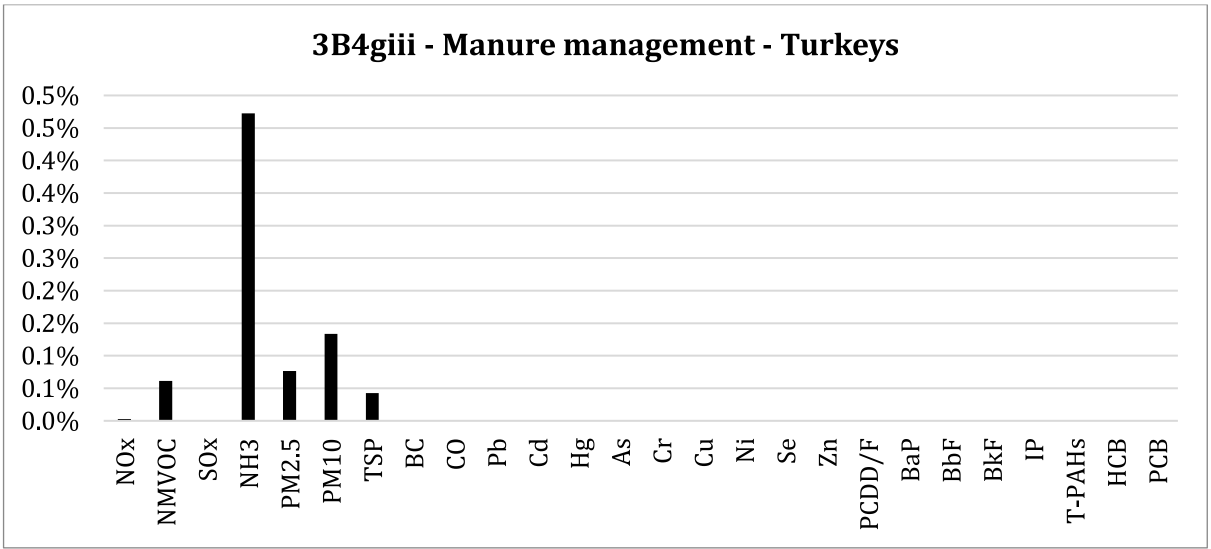

Figure 41: Shares of emissions from the NFR 3B4e category in percentage of national total

6.2.11.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.11.3 Activity data

The sources of the activity data are explained in Section 6.2.1.

6.2.11.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house.

Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.11.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.11.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.2.12 Sub-sector 3B4giv: Other Poultry

Table 113: Sector 3B4giv general characteristics

NFR Code	**3B4giv**
Sub-Category	Manure management – Other Poultry
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.2.12.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of other poultry and the generation and storage of their manure. The number of animal heads in 2023 was zero, and therefore, no emissions were registered.

6.2.12.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.12.3 Activity data

The sources of the activity data are explained in Section 6.2.1.

6.2.12.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.12.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.

6.2.12.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.2.13 Sub-sector 3B4h: Other animals (rabbits)

Table 114: Sector 3B4h general characteristics

NFR Code	**3B4h**
Sub-Category	Manure management – Other animals (rabbits)
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1 & 2
Key Category	NH_3
Year of Last Update	2025 submission

6.2.13.1 Sub-sector category description

This subcategory includes emissions of air pollutants from the feeding of rabbits and the generation and storage of their manure.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 42.

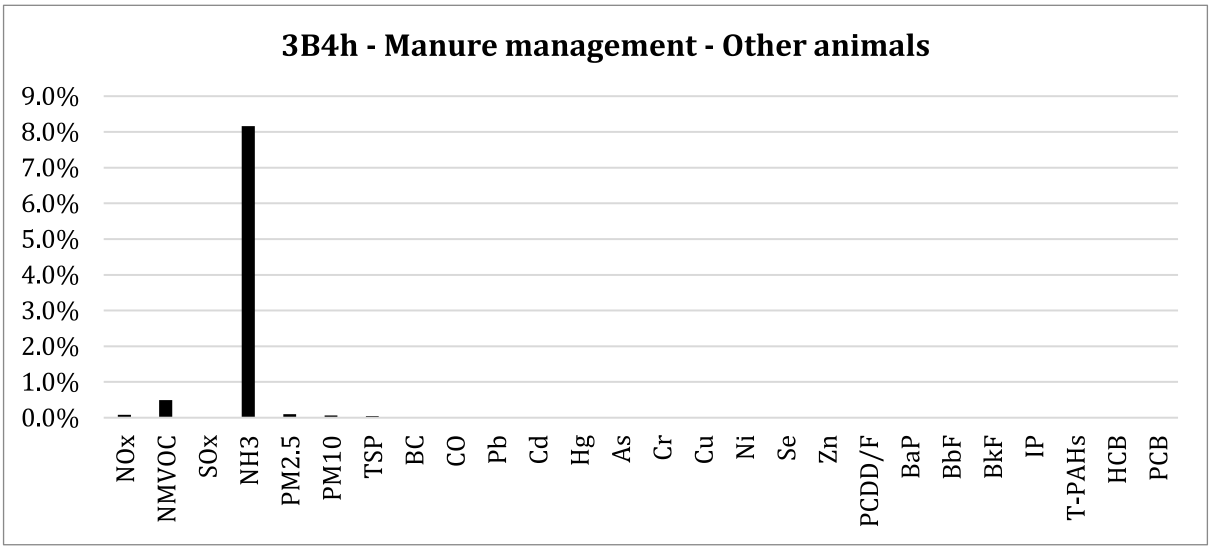

Figure 42: Shares of emissions from the NFR 3B4h category in percentage of national total

6.2.13.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB. Emissions from the application of manure, i.e. 'ENMVOC,appl.' were subtracted from the calculation. Emissions of $PM_{2.5}$, PM_{10}, and TSP were estimated through a Tier 1 methodology. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.2.13.3 Activity data

The sources of the activity data are explained in Section 6.2.1.

6.2.13.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model,

were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.2.13.5 Sub-sector-specific recalculations

- For NO_x, and NH_3 the share of solid manure applied, stored, and sent to the digester was updated with the values shown in Table *95* and Table 96
- For NMVOC the values of ENH3,storage, ENH3,hous, and ENH3,appl were updated in line with the updated activity data presented within section 6.2.1.
- NO_x. NMVOC and NH_3, were recalculated due to changes in nitrogen excretion as per Section 6.2.1

6.2.13.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series, such as by obtaining more representative figures for the share of manure application and storage across the time series.

6.3 Sector 3D: Crop Production and Agricultural Soils

6.3.1 Sub-Sector 3Da1: Inorganic N fertilisers (Includes Urea)

Table 115: Sector 3Da1 general characteristics

NFR Code	**3Da1**
Sub-Category	Inorganic N fertilisers (Includes Urea)
Method	2023GB
Activity Data	Climate Action Authority
Emission Factors	Tier 1
Key Category	NH_3
Year of Last Update	2025 submission

6.3.1.1 Sub-sector description

This subcategory includes emissions of air pollutants that arise during and after the application of inorganic N fertilisers to land.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 43.

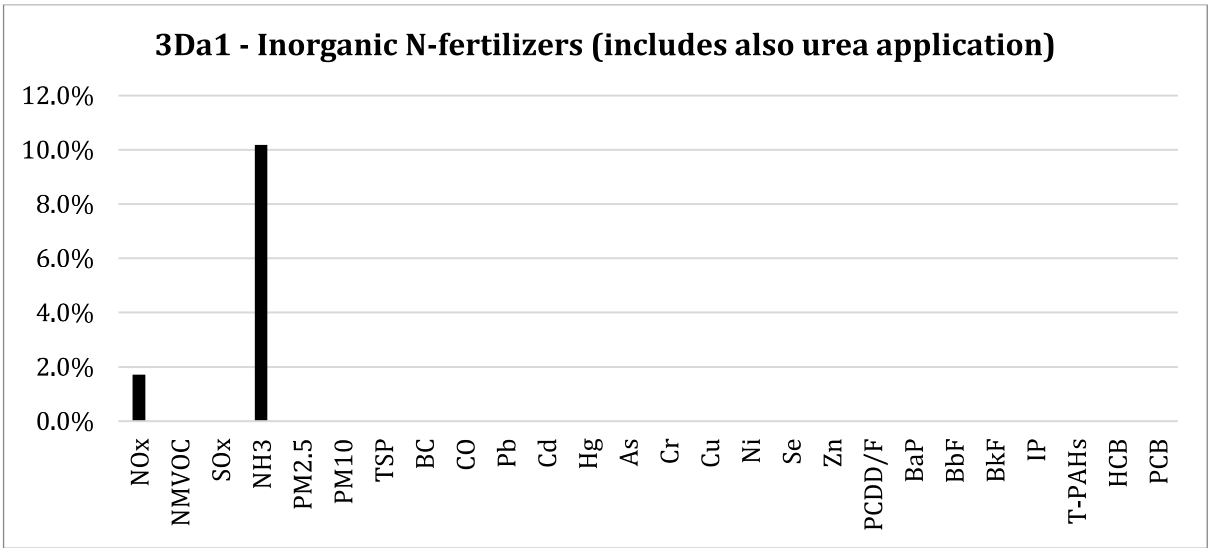

Figure 43: Shares of emissions from the NFR 3Da1 category in percentage of national total

6.3.1.2 Methodology

This sector was calculated through a Tier 1 methodology provided within the 2023GB. The nitrogen input to soil from synthetic fertilisers was required as activity data, and the main pollutants emitted from this sub-category were NH_3 and NO_x.

6.3.1.3 Activity Data

The quantity of synthetic fertilizers applied has been recalculated by the CAA in 2022. Synthetic fertilizer application rates were not available over a time series. However, a methodology was developed by the CAA to obtain a representative estimate by making use of two indicators.

Import data per type of fertilizer from 2017-2021 was provided by the NSO. This data served to inform a study conducted by the MAFA on the quantities of inorganic fertilizers imported. Additionally, the NSO study on the Gross Nitrogen Balance for Malta conducted in 2007 served to provide the N input per hectare from synthetic fertilizers for that year, which was of 60.3 kgN/ha. The import data from 2017-2021 was used to estimate the N input to soils per hectare from 2017 onwards. The N input to soils per hectare pre-2007 was assumed to correspond to 60.3 kgN/ha. Whereas an interpolation was carried out to obtain values from 2008-2016. The N input to soils per hectare was then multiplied by the Utilised Agricultural Area (UAA). The excess N applied through Policy Measure 'Manure and slurry management' reported and described in Section 6.2.1.9 was subtracted from the synthetic fertilizer N applied from 2027-2030.

The table below presents the total N input to soils, which shows the steady increase in fertilizer application across the years, followed by a decrease from 2027 onwards.

Table 116: Total fertilizer input to soils in kg N/ha of Nitrogen

	1990	2005	2022	2023	2025	2030
Fertilizer N applied in kg of N/ha	60.3	60.3	183.5	183.5	186.2	158.5

6.3.1.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.3.1.5 Sub-sector-specific recalculations

No recalculations were carried out in this submission.

6.3.1.6 Sub-sector-specific planned improvements

Presently, no planned improvements are scheduled for this category.

6.3.2 Sub-sector 3Da2a: Animal manure applied to soils

Table 117: Sector 3Da2a general characteristics

NFR Code	**3Da2a**
Sub-Category	Animal manure applied to soils
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 2
Key Category	NH_3
Year of Last Update	2025 submission

6.3.2.1 Introduction

This subcategory includes emissions of air pollutants that arise during and after the application of animal manure to soils.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 44.

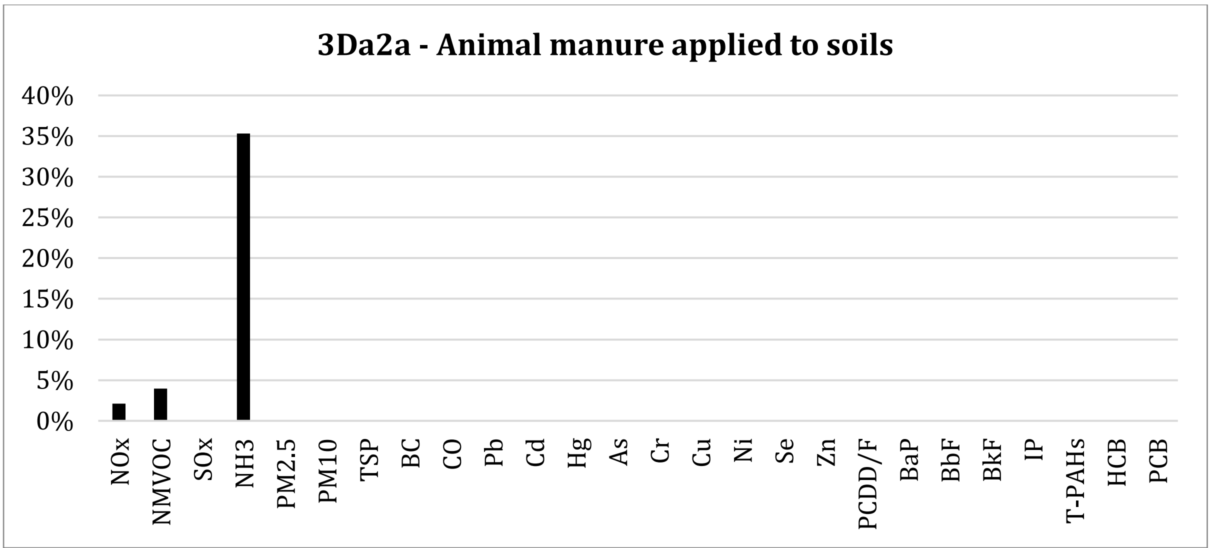

Figure 44: Shares of emissions from the NFR 3Da2a category in percentage of national total

6.3.2.2 Methodology

NH_3 and NO_x emissions are calculated through the Manure Management N-flow tool, as provided within the 2023GB. The tool was updated in January 2021, and this version of the tool was used for this submission. NMVOC emissions were estimated through the Tier 2 methodology provided within the 2023GB, by summing up the manure applied by all livestock. This manure is classified as 'ENMVOC,appl.' in the 2023GB. The projected emissions were estimated through the methodology outlined in Section 6.2.1.9.

6.3.2.3 Activity data

The sources of the activity data are explained in Section 6.2.1. Concerning projections, as shown in Table *95* and Table 96, the rate of solid and slurry manure applied to soils is 0, noting that following communication with MAFA-RAM, all manure will be collected and processed into biofertiliser through the anaerobic digestion process as from 2027. The emissions reported under this sector for both WM and WaM scenarios in 2030 reflect the application of biofertiliser. The quantities of biofertiliser applied correspond to the 'mmdig_TAN' parameter, which is calculated through the N-flow tool.

6.3.2.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.3.2.5 Sub-sector-specific recalculations

- The recalculations for each livestock type are explained under the 'Recalculations' section of each sector under Chapter 3B.

6.3.2.6 Sub-sector-specific planned improvements

Efforts will be made to better represent local practices across the time series.

6.3.3 Sub-sector 3Da4: Crop residues applied to soils

Table 118: Sector 3Da4 general characteristics

NFR Code	**3Da4**
Sub-Category	Crop residues applied to soils
Method	2023GB
Activity Data	Climate Action Authority
Emission Factors	Tier 1
Key Category	Not Applicable
Year of Last Update	2025 submission

6.3.3.1 Introduction

This subcategory includes emissions of air pollutants that arise from crop residues left on fields. Crop residues are defined as those parts of the crop left on the soil surface following harvest or after another management action such as cutting grass for silage or hay, or trimming pasture to stimulate fresh growth.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 45.

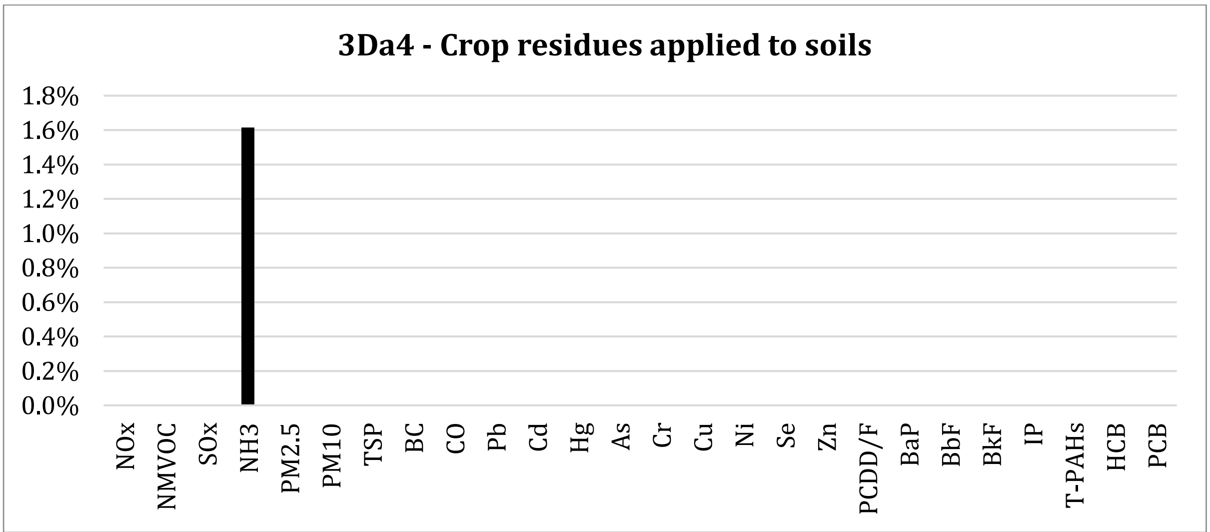

Figure 45: Shares of emissions from the NFR 3Da4 category in percentage of national total

6.3.3.2 Methodology

NH_3 emissions from this sector were calculated through the tier 1 methodology provided by the 2023GB.

6.3.3.3 Activity data

The total mass of crop residues left on soils was provided by the CAA. This value was calculated by multiplying the area in ha for each crop type, as provided by the NSO, with the methodology and the default parameters provided within the IPCC 2019 refinement to the 2006 Guidelines. The mass of crop residues is provided in the table below:

Table 119: Crop residues in kg of N

Parameter	1990	2005	2022	2023	2025	2030
Crop residues	878182	722806	785776	780757	783031	783212

6.3.3.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.3.3.5 Sub-sector-specific recalculations

No recalculations were carried out in this submission.

6.3.3.6 Sub-sector-specific planned improvements

Presently, no planned improvements are scheduled for this category.

6.3.4 Sub-sector 3Dc: Farm-level agricultural operations including storage, handling and transport of agricultural products

Table 120: Sector 3Dc general characteristics

NFR Code	**3Dc**
Sub-Category	Farm-level agricultural operations including storage, handling and transport of agricultural products
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 2
Key Category	PM_{10}
Year of Last Update	2025 submission

6.3.4.1 Introduction

This subcategory includes emissions of air pollutants that arise from the handling and storage of agricultural products on farms, such as grain, and during the handling and storage of products produced elsewhere to be used on the farm, such as fertilisers and livestock feeds.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 46.

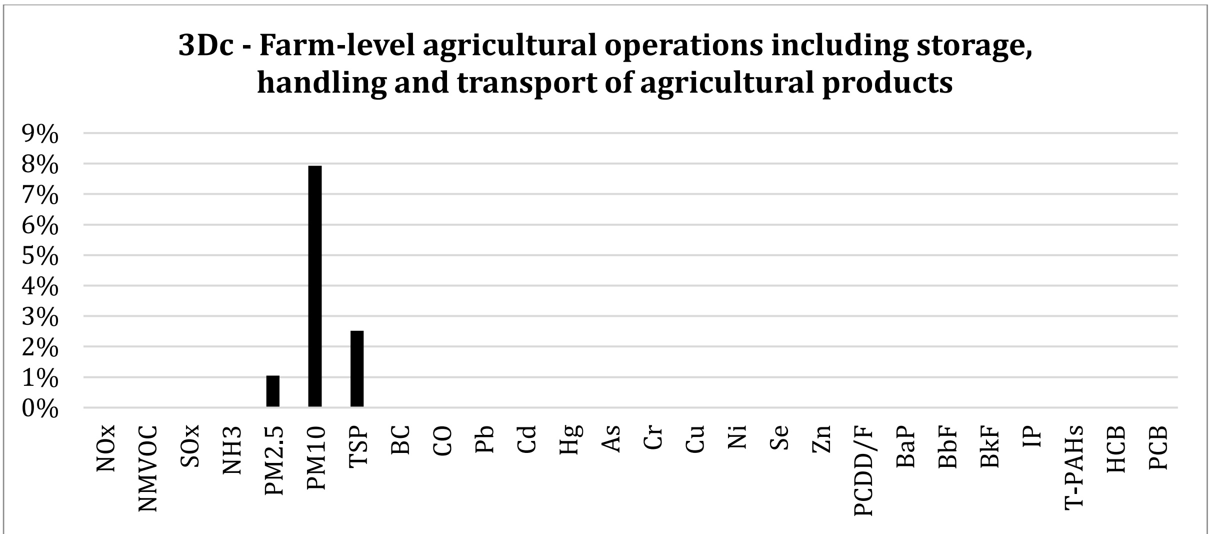

Figure 46: Shares of emissions from the NFR 3Dc category in percentage of national total

6.3.4.2 Methodology

$PM_{2.5}$, PM_{10}, and TSP emissions from this sector were calculated through the Tier 2 methodology provided by the 2023GB. The $PM_{2.5}$ and PM_{10} EFs for 'other arable' were not provided for the 'Harvesting' and 'Cleaning' operations. Therefore, an emission factor was obtained by averaging the emission factors from wheat, barley, and rye. TSP emissions were assumed to be equal to those of PM_{10}, since no Tier 2 EF for TSP was available.

6.3.4.3 Activity data

The land area by crop type was provided by NSO & FAOSTAT, and is in line with the values used by theClimate Action Authority. The table below shows how local crop types are classified according to the categories provided within the 2023GB. The dry climate EFs were used, as Malta has a semi-arid climate (Galdies, 2011).

Table 121: Crop type for each category under 3DC

Category in 2023GB	Crop type
Wheat	Land area under wheat
Barley	Land area under barley
Other arable	Land area under bean, potato, carrot, clover & vetch (sulla)
Grass	Land area under fodder & other fodder

Additionally, the change in crop area across the time series is presented below:

Table 122: Crop area in ha for sector 3Dc

Crop type	1990	2005	2022	2023	2025	2030
Wheat	2381	2618	3186	3155	3185	3183
Rye	0	0	0	0	0	0
Barley	542	550	520	515	520	520
Oat	0	0	0	0	0	0
Other arable	3135	1662	1533	1538	1515	1519
Grass	6755	4626	5313	5312	5265	5275

The number of agricultural operations were assumed to remain unchanged across the entire time series. The number of operations is presented below:

Table 123: Number of agricultural operations by crop type

Crop type	Soil cultivation	Harvesting	Cleaning
Wheat	4	1	1
Rye	4	1	1
Barley	4	1	1
Oat	4	1	1
Other arable	4	1	1
Grass	4	1	1

6.3.4.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.3.4.5 Sub-sector-specific recalculations

No recalculations were carried out in this submission

6.3.4.6 Sub-sector-specific planned improvements

Presently, no planned improvements are scheduled for this category.

6.3.5 Sub-sector 3De: Cultivated crops

Table 124: Sector 3De general characteristics

NFR Code	**3De**
Sub-Category	Cultivated crops
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 2
Key Category	Not Applicable
Year of Last Update	2025 submission

6.3.5.1 Introduction

This subcategory includes emissions of air pollutants that arise from standing or 'cultivated' crops.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 47.

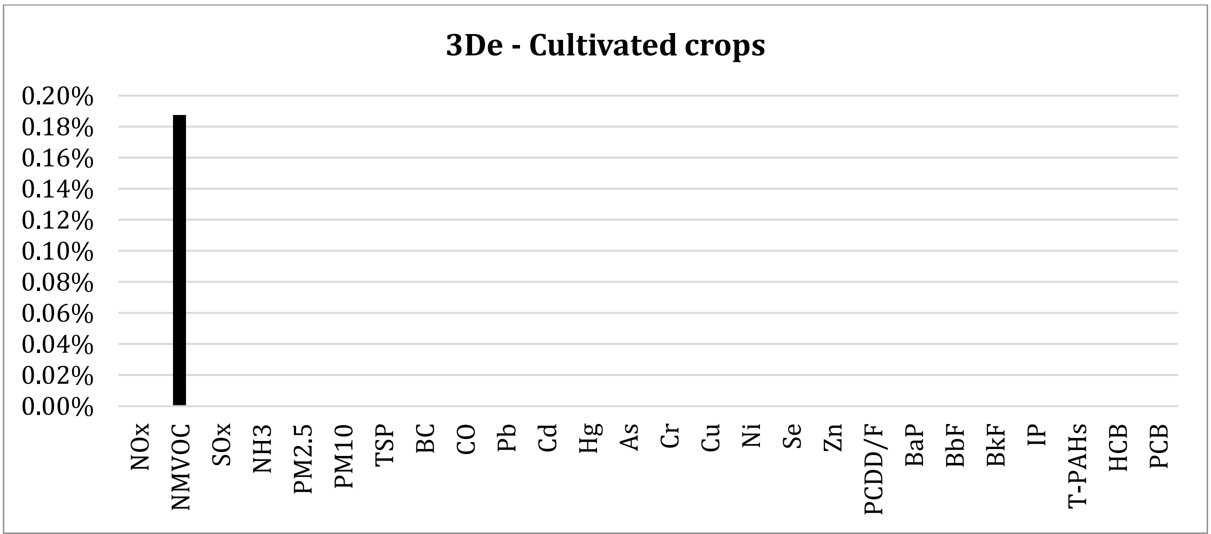

Figure 47: Shares of emissions from the NFR 3De category in percentage of national total

6.3.5.2 Methodology

NMVOC emissions from this sector were calculated through the Tier 2 methodology presented in the 2023GB. Following communication with IIASA, the emission factor for 'Other' crops was obtained by calculating a weighted average of the emission factors from 'Wheat', 'Rye', and 'Rapeseed', and considering the crop share provided within the 2023GB.

6.3.5.3 Activity data

The land area by crop type was provided by NSO & FAOSTAT and is in line with the values used by the Climate Action Authority. The table below shows how local crop types are classified according to the categories provided within the 2023GB. The country specific value of 4534.6kg of dry matter per ha, as provided by the Climate Action Authority, was used for wheat.

Table 125: Crop type for each category under 3DE

Category in 2023GB	Crop type
Wheat	Land area under wheat
Other arable	Land area under barley, bean, potato, carrot, clover & vetch (sulla), land area under fodder & other fodder

Additionally, the crop area across the time series is presented below:

Table 126: Area by crop type in ha

Crop type	1990	2005	2022	2023	2025	2030
Wheat	2381	2618	3186	3155	3185	3183
Rye	0	0	0	0	0	0
Rape	0	0	0	0	0	0
Grass (15C)	0	0	0	0	0	0
Grass (25C)	0	0	0	0	0	0
Other	10432	6838	7366	7365	7301	7314

6.3.5.4 Sub-sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.3.5.5 Sub-sector-specific recalculations

No recalculations were carried out in this submission.

6.3.5.6 Sub-sector-specific planned improvements

Presently, no planned improvements are scheduled for this category.

6.4 Sector 3F: Field burning of agricultural residues

Table 127: Sector 3F general characteristics

NFR Code	**3F**
Sub-Category	Field burning of agricultural residues
Method	2023GB
Activity Data	National Statistics Office
Emission Factors	Tier 1
Key Category	PCDD/PCDF
Year of Last Update	2025 submission

6.4.1 Introduction

This subcategory includes emissions of air pollutants that arise during the open burning of crop residue on arable land after harvesting.

Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 48.

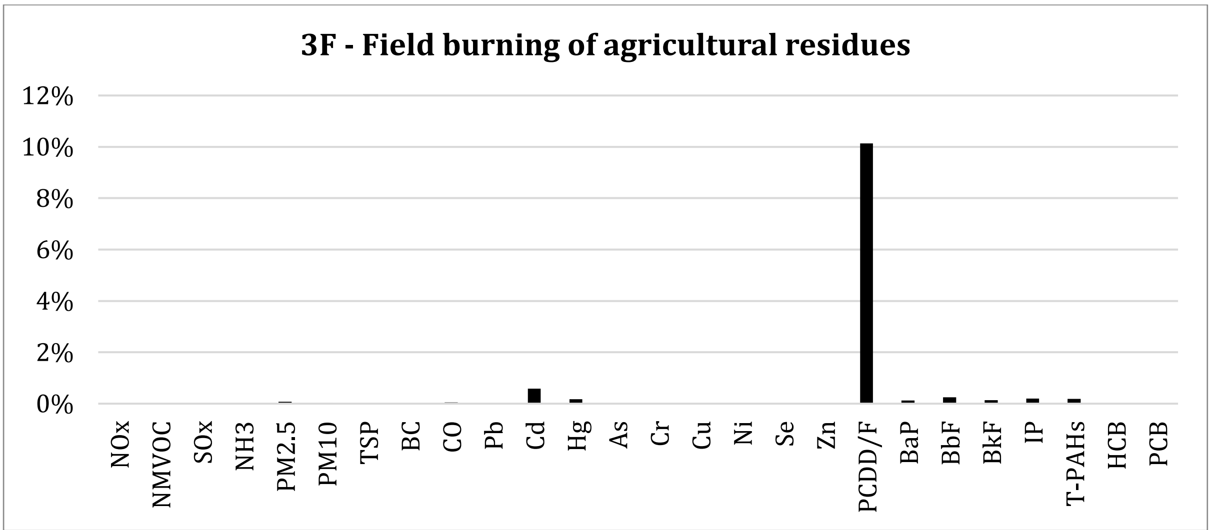

Figure 48: Shares of emissions from the NFR 3F category in percentage of national total

6.4.2 Methodology

Emissions from this sector were calculated through the Tier 1 methodology provided within the 2023GB.

6.4.3 Activity data

The total burnt area in ha was not available, therefore, the entire Utilized Agriculture Area (UAA) was assumed to be burnt. The UAA is provided by the NSO, and the table below provides the values across the time series:

Table 128: UAA in ha across the time series

Parameter	1990	2005	2022	2023	2025	2030
Utilised Agricultural Area (UAA)	9780	10250	10731	10731	10731	10731

The UAA is subdivided under the categories provided in Table 129.

Table 129: Subdivisions of Utilized Agriculture Area

Type of crop	Crops included
Wheat	Wheat, total land area under fodder, potato, carrot, clover (sulla) & vetch

Barley	Barley
Beans	Bean & other fodder (including green beans and chickpeas)

The remaining parameters, as taken from the 2023GB are presented in Table 130 (where no EF for beans or barley is available, the value for wheat was used).

Table 130: Remaining parameters

Parameter	Crop type	Value
Dry matter yield (y)	Wheat	3.6
Dry matter content (d)	Wheat	0.85
Ratio of residue mass to crop yield(s)	Wheat	1.3
	Barley	1.2
	Beans	2.1
Proportions of residues burned (Pb)	Wheat	1
	Barley	1
	Beans	1
Combustion Factor (Cf)	Wheat	0.9

6.4.4 Sector-specific QA/QC and verification

QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data (by being in line with those used by the CAA), the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

6.4.5 Sector-specific recalculations

The emissions from all pollutants were recalculated following the update of the crop area burnt.

6.4.6 Sector-specific planned improvements

Following communication with the Agricultural Directorate, it was determined that not all of the UAA is burnt locally. Nevertheless, no activity data on the area of fields burnt, or the quantities of crop residues burnt is currently available. Efforts will be made to obtain a more representative value than the one used at present.

7 Waste (NFR 5)

Chapter Updated: 2025

7.1 Category overview

Emissions from the following sectors are estimated:

- 5A (Solid waste disposal on land, including mineral waste handling)
- 5B1 (biological treatment of waste – composting)
- 5B2 (biological treatment of waste - anaerobic digestion at biogas facilities)
- 5C1bv (cremation)
- 5C2 (open burning of waste)
- 5D3 (other wastewater handling)
- 5E (other waste)

Table 131 provides details on the relevant pollutant trends covered under each waste sector including those that are of a key category, as well as the methodologies used.

Table 131: Coverage of NFR 5 categories in 2023

NFR Code	Pollutants			Method	KC
	Covered	Exceptions			
		NE	NA		
5A	NMVOC, $PM_{2.5}$, PM_{10}, TSP	-	Rest of Pollutants	Mixed Tier	✗
5B1	NH_3	-	Rest of Pollutants	Tier 2	✗
5B2	NH_3	-	Rest of Pollutants	Tier 2	✗
5C1a	Included Elsewhere (Reported in 5C1bv)				✗
5C1bi	Included Elsewhere (Reported in 5C1bv)				✗
5C1bii	Included Elsewhere (Reported in 5C1bv)				✗
5C1biii	Included Elsewhere (Reported in 5C1bv)				✗
5C1biv	Not Occurring				✗
5C1bv	All	-	-	Mixed Tier	✓
5C1bvi	Not Occurring				✗
5C2	Rest of Pollutants	-	NH_3, Hg, Ni, Indeno (1,2,3-cd) pyrene, HCB, PCBs	Tier 1	✗
5D1	Included Elsewhere (Reported in 5D3)				✗
5D2	Included Elsewhere (Reported in 5D3)				✗
5D3	NMVOC	-	Rest of Pollutants	Tier 1	✗
5E	$PM_{2.5}$, PM_{10}, TSP, Pb, Cd, Hg, As, Cr, Cu, PCDD/PCDF	-	Rest of Pollutants	Tier 2	✓

The shares of emissions from this NFR sector for all pollutants in 2023 are shown in Figure 49. Most pollutant emissions from this category are below 10% of the national total with the exception of Se, PCDD/PCDF, PCB and HCB.

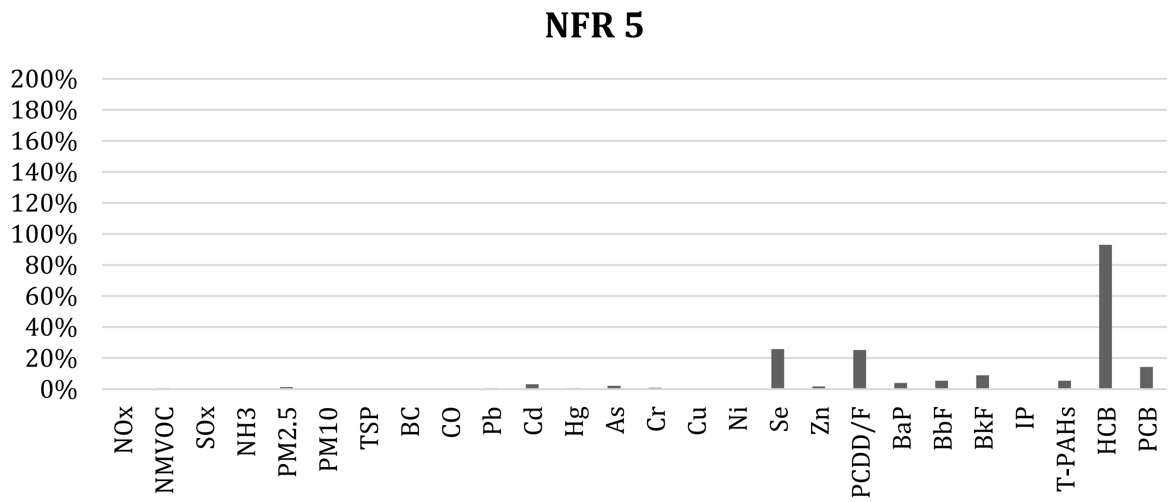

Figure 49: Shares of emissions from the NFR 5 category in percentage of the national total

7.2 Sector 5A: Solid waste disposal on land (including mineral waste handling)

Table 132: Sector 5A general characteristics

NFR Code	5A
Sub-Category	Solid waste disposal on land (including mineral waste handling)
Method	2023GB
Activity Data	CAA & ERA (Waste & CED teams)
Emission Factors	Mixed Tier
Key Category	Not applicable
Year of Last Update	2025 submission

7.2.1 Sector description

This subcategory includes emissions of air pollutants from organic waste degradation in landfills and from the handling of mineral waste during backfilling and its reuse as construction material. Shares of emissions of the various pollutants emitted from 5A in 2023 are shown in Figure 50.

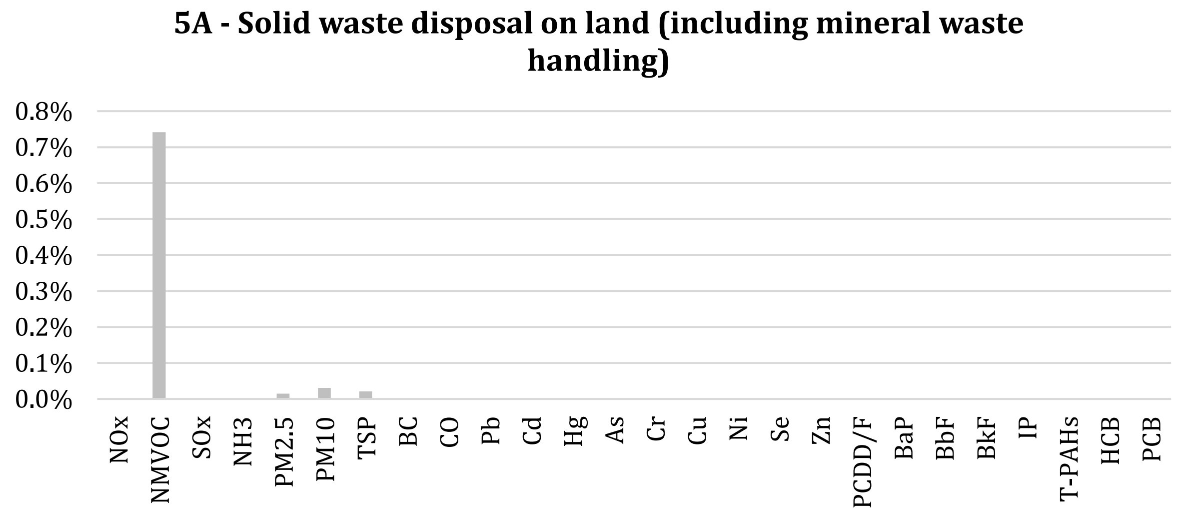

Figure 50: Shares of emissions from the NFR 5A category in percentage of the national total

7.2.2 Methodology & activity data - Historical

The calculation for NMVOC emissions followed a Tier 1 approach, taking into account the annual CH_4 emissions data provided by the CAA and utilizing the NMVOC EF from the 2023 guidebook in line with the equation below.

$$E_{NMVOC} = E_{CH4} * EF_{NMVOC} * 10^{-6}$$

Equation 19: Calculation of NMVOC emissions

Where:

- E_{NMVOC} = NMVOC emissions (kt)
- E_{CH4} = CH_4 emissions (Mg)
- EF_{NMVOC} = NMVOC emission factor (kg/Mg CH_4)

The table below presents the total CH_4 emissions in Mg for the year 2005 and the last 3 reporting years:

Table 133: CH_4 emissions for 2005 and 2021 to 2023.

Year	E_{CH4} (Mg)
2005	5804.90
2021	5967.14
2022	5997.42
2023	5870.13

Since the proportion of NMVOC per m³ of landfill gas remains unknown for Malta, the calculation suggested by the 2023GB, as outlined below, could not be applied.

$$E_{NMVOC} = V_{LG} * EF_{NMVOC}$$

Equation 20: Proposed calculation of NMVOC emissions

Where:

- E_{NMVOC} = NMVOC emissions (kg)
- V_{LG} = Volume of landfill gas (m^3)
- EF_{NMVOC} = NMVOC emission factor (kg/Mg CH_4)

With regard to the remaining pollutants, the calculation of $PM_{2.5}$, PM_{10}, and TSP emissions followed a Tier 3 approach, based on the methodology outlined in the 2023GB. The equation below was utilised:

$$E = k(0.0016)\frac{(\frac{U}{2.2})^{1.3}}{(\frac{M}{2})^{1.4}}$$

Equation 21: Calculation to obtain $PM_{2.5}$, PM_{10} and TSP emission factors

Where:

- E = emission factor (kg/Mg)
- k = particle size multiplier; k (PM_{TSP}) = 0.74, k (PM_{10}) = 0.35 & k ($PM_{2.5}$) = 0.053
- U = mean wind speed (m/s)
- M = material moisture content (%); M = 11%

The default factor provided in the 2023GB was used for the moisture content of the materials landfilled. Meanwhile, the mean wind speed specific to the country, expressed in meters per second, as reported by Malta's MET office, is presented for the year 2005 and the three most recent reporting years in the table below:

Table 134: Mean wind speed for 2005 and 2021 to 2023.

Year	U (m/s)
2005	4.05
2021	4.61
2022	4.28
2023	4.40

The resultant emission factor is multiplied by the activity data, which consists of all waste disposed of in landfills and by the total amount of mineral waste treated (backfilled, recycled and stored) within quarries. The waste team at ERA provided the total waste disposed in landfills as reported in the waste management facility reports. Meanwhile, the compliance & enforcement team at ERA provided data on mineral waste treated in tonnes from 2006 onwards.

7.2.3 Methodology & activity data – Projections

The same methodology applied to the historical time series was also used for the projections reporting.

The calculation of NMVOC emissions was based on Tier 1 calculations, as per Equation 19, but with different CH_4 emissions under the WM and WAM scenarios.

The projected 2025 and 2030 CH_4 emissions under the WM scenario were provided by the CAA, with a decrease in emissions expected from 2029 onwards. This reduction is attributed to the closure of the managed Għallis landfill in 2029 following the commissioning of the Waste-to-Energy (WtE) facility in 2028 and the implementation of the Differentiated Pricing Mechanism (DPM), a strategy that charges users based on the amount or type of waste they generate, aiming to reduce waste production.

The projected 2030 CH_4 emissions under the WAM scenario were provided by the Ministry for the Environment, Energy, and Public Cleanliness (MEEC), with a decrease in emissions expected from 2027 onwards. This reduction is due to the planned increase in landfill gas extraction points at the managed Għallis landfill, improving biogas collection efficiency for electricity generation. As a result, a higher percentage of CH_4 will be captured before escaping into the air.

Since the landfill must be non-operational when gas recovery begins in 2027, the Għallis landfill is expected to close in 2026 under the WAM scenario. However, a new landfill (Ghallis II, conversion of an unused existing hazardous cell into non-hazardous cell) will operate afterwards, with a very limited disposal intake until the commissioning of the WtE facility in 2028.

Table 135: CH_4 emissions and data providers for 2025 and 2030 under WM and WAM scenarios

Scenarios	Year	Data provider	E_{CH4} (Mg)
WM	2025	CAA	6038.95
	2030	CAA	5668.82
WAM	2025	CAA	6038.95
	2030	MEEC	3387.67

The calculations of $PM_{2.5}$, PM_{10}, and TSP emissions were based on Tier 3, as per Equation 21, with the mean wind speed (m/s) extrapolated using a five-year rolling average. The projected 2025 and 2030 waste disposal at the Għallis landfill was provided by the waste team at ERA with no waste being landfilled in 2030, while the total amount of mineral waste was also extrapolated using a five-year rolling average. Both the WM and WAM scenarios use the same input data for the emission calculation of these three pollutants.

7.2.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.2.5 Sector-specific recalculations

Recalculations in 5A incorporate updated data from CAA for CH_4 emissions, leading to a revision of NMVOC emissions from 2012 onwards. Additionally, updated figures from the Compliance & Enforcement team at ERA for the total mineral waste treated in 2022 required recalculations of $PM_{2.5}$, PM_{10}, and TSP emissions for that year.

Following communication with the contributing authors of the 2023GB, particularly Céline Guéguen, the sectoral expert identified an inconsistency in the default value provided in the guidebook for moisture content. The default value of 11% had been erroneously interpreted by Malta as 0.11 instead of 11%. This correction led to a modification in the entire time series of $PM_{2.5}$, PM_{10}, and TSP emissions.

7.2.6 Sector-specific planned improvements

Malta anticipates initiating the measurement of moisture content in upcoming characterization surveys.

7.3 Sector 5B1: Composting

Table 136: Sector 5B1 general characteristics

NFR Code	**5B1**
Sub-Category	Biological Treatment of Waste - Composting
Method	2023GB
Activity Data	Wasteserv
Emission Factors	Tier 2
Key Category	Not Applicable
Year of Last Update	2025 submission

7.3.1 Sector description

This subcategory includes NH_3 emissions from the composting of the output from the Sant'Antnin Solid Waste Treatment Facility.

The figure below illustrates the emissions of this pollutant during the years when the composting plant in Malta was operational, from 1993 until early 2007, when it was decommissioned.

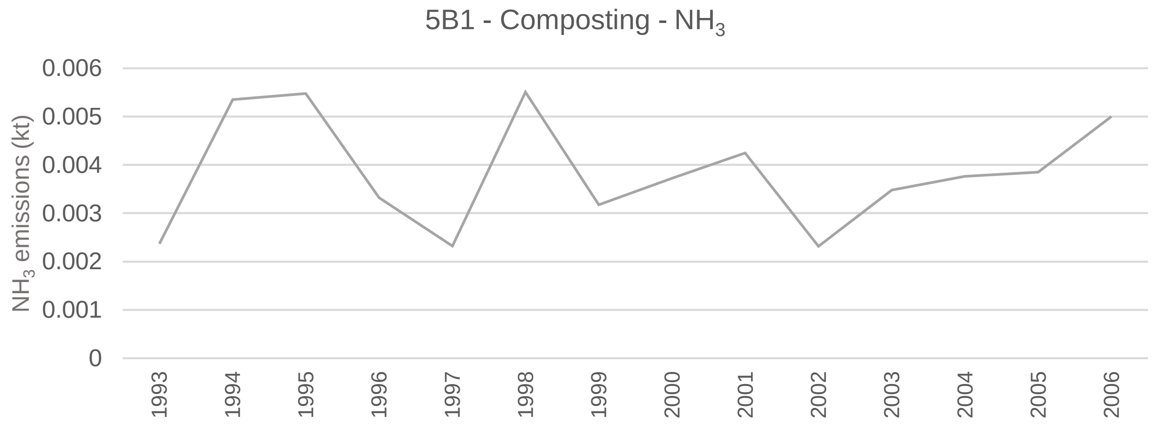

Figure 51: 5B1 emission throughout the time series

In 2010, this plant was upgraded and replaced with a Mechanical Biological Anaerobic Treatment Plant, operating as an Anaerobic Digester until 2019. However, the output from this process (digested material) was not composted but landfilled, as it did not meet composting standards.

Meanwhile, since 2016, the Malta North Anaerobic Digester (AD) has been providing biological treatment for organic waste. As stated in the 5B2 sector, the output from this process (digested material) is temporarily stored in sealed tanks before being transferred to the landfill for final disposal, as it still does not meet composting standards.

Between the decommissioning of the composting plant in 2007 and the commissioning of the new Anaerobic Digestion plant in 2010, no large-scale biological treatment of solid waste was operational in Malta. During this period, organic waste, as part of mixed municipal waste (collected without separation), was directly landfilled.

7.3.2 Methodology & activity data - Historical

NH_3 emissions were calculated through a tier 2 methodology using the following equation from the 2023GB.

$$E_{NH_3} = AR_{production} * EF_{technology\ pollutant}$$

Equation 22: Calculation of NH_3 emissions from composting

Where:

- $AR_{production}$ = amount of domestic and commercial organic waste being composed (t)
- $EF_{technology\ pollutant}$ = default value provided in 2023GB for NH_3 emissions

Data on the organic fraction being composted was provided for the years 1993 to 2006, which correspond to the period when this biological waste treatment plant was in operation. The data was reported to CAA in 2007 by Wasteserv and made available to ERA in 2023. The table below presents the total waste composted for the three most recent available years:

Table 137: Organic waste composted for 2004 to 2006.

Year	Organic waste (t)
2004	15685
2005	16030
2006	20846

7.3.3 Methodology & activity data – Projections

In 2025, the Malta North AD is expected to be updated, and as a result, the digested material is expected to reach composting standards.

In 2028, a new Organic Processing Plant (OPP) will become operational, while the current anaerobic digester at Malta North is expected to remain on standby. The OPP will utilize anaerobic digestion technology with a maximum capacity of 74,000 tons per year and will include a post-treatment unit for composting and maturation, along with a biofilter as an abatement technology.

From 2028 onwards, Malta plans to compost the material produced during the pre-treatment process (anaerobic digestion) at the OPP.

For the projections reporting, a similar methodology applied to the historical time series was used.

While NH_3 emissions were calculated using Equation 22, the technology-specific emission factor (EF), which accounts for the biofilter as an abatement technology, was estimated using the following equation:

$$EF_{technology,abated} = (1 - \eta_{abatement}) * EF_{technology,\text{unabated}}$$

Equation 23: Calculation of the technology-specific emission factor

The projected 2025 activity data for total organic waste treated at AD Malta North was provided by Wasteserv, while the 2030 data for waste treated at the OPP was provided by the waste team at ERA. Both the WM and WAM scenarios use the same input data.

7.3.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factor for NH_3, and the formula utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.3.5 Sector-specific recalculations

No recalculations were done for this sector.

7.3.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

7.4 Sector 5B2: Biological Treatment of Waste – Anaerobic Digestion at Biogas Facilities

Table 138: Sector 5B2 general characteristics

NFR Code	5B2
Sub-Category	Biological Treatment of Waste - Anaerobic Digestion at Biogas Facilities
Method	2023GB
Activity Data	ERA Waste Team and Wasteserv
Emission Factors	Tier 2
Key Category	Not Applicable
Year of Last Update	2025 submission

7.4.1 Sector description

This subcategory includes NH_3 emissions from the biological treatment of waste - anaerobic digestion (AD) at biogas facilities. There is currently only one AD facility in operation in Malta. This is the Malta North waste treatment facility in Maghtab. Up until the end of 2019, the Sant' Antnin waste treatment facility (SAWTP) was also in operation. The shares of emissions of the various pollutants emitted from 5B2 in 2023 are shown in Figure 52.

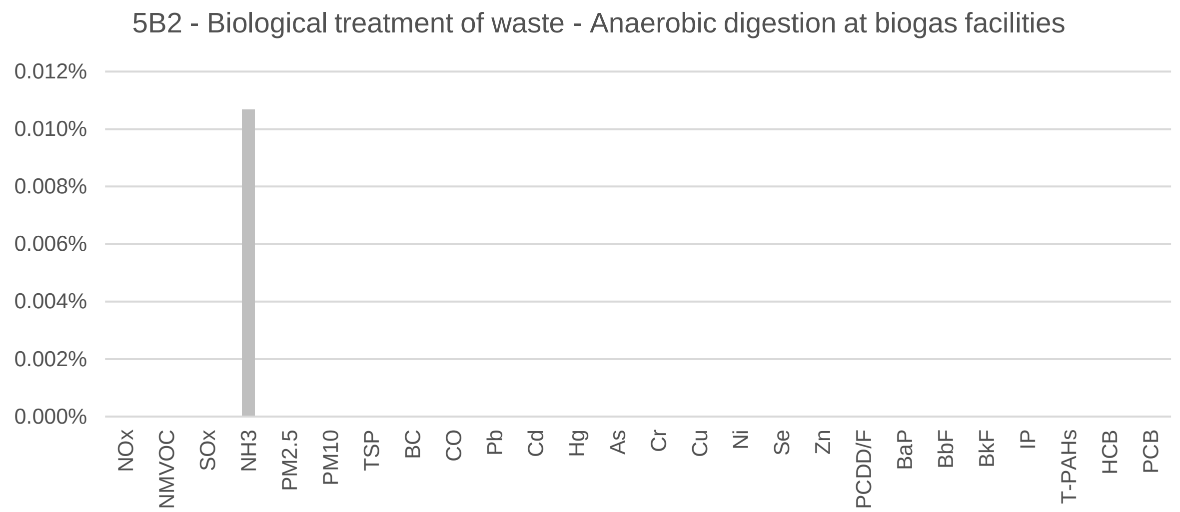

Figure 52: Shares of emissions from the NFR 5B2 category in percentage of the national total

7.4.2 Methodology & activity data - Historical

A tier 2 methodology based on the 2023GB was used to estimate NH_3 emissions. The following equation was used:

$$E_{\mathrm{NH3}} = \mathrm{AR}_{\mathrm{feedstock}} * \mathrm{EF}_{\mathrm{NH3-N,stage\ i}} * \frac{17}{14}$$

Equation 24: Calculation of NH_3 emissions from anaerobic digestion

The $AR_{feedstock}$ represents the yearly sum of nitrogen (N) in feedstock, considering both organic and manure fractions entering the biogas facility. Given that a specific N amount is provided exclusively from the 3B and 3D agricultural sectors for manure feedstock, $AR_{organic}$ was determined by multiplying the organic feedstock provided by Wasteserv with the corresponding N content default factor specified in the 2023GB.

Emission factors of NH_3 *stage I,* refer to NH_3 emission factors at different stages. Communication with Wasteserv revealed that the digested material is stored in sealed tanks briefly before being transferred to the landfill for ultimate disposal, therefore the pre-storage stage was considered the only relevant stage for local practices and thus ammonia emissions were considered negligible. This applies for both treatment facilities: SWATP and Malta North.

The organic fraction entering the Anaerobic Digester at Sant' Antnin waste treatment facility was provided for the years 2011 to 2017 and that entering the Malta North waste treatment facility from 2017 onwards. The 2018 and 2019 figures from Sant' Antnin facility were estimated by taking an average fraction of the total waste from the Dry Mechanical Treatment Plant that entered the AD for the years 2011 to 2017, and then applying that fraction to the total weight of waste entering the Dry MTP. The manure fraction was provided for the years 2018 to 2021, representing the sole period during which this feedstock was entering the AD Malta North waste treatment facility. However, this data was included in the 3B and 3D agricultural sectors to calculate N content.

Data pertaining to this sector was provided by the Waste Team within ERA for the years 2011 to 2017 through the annual environmental reports and through direct communications with Wasteserv from 2018 onwards. The SAWTP facility was established in 2010; however, no data for that year was made available, and therefore emissions were calculated as from 2011. The Malta North Waste treatment facility commenced operations in 2016; however, data was made available as from 2017.

7.4.3 Methodology & activity data – Projections

From 2027 onwards, it is expected that all livestock manure produced in Malta will be treated throughout a separate anaerobic digester technology. Similar to the current AD facility, this new manure AD will include enclosed storage for the digested material in sealed tanks, where it will be briefly stored before being used exclusively for agricultural purposes.

Additionally, in 2028, a new Organic Processing Plant (OPP) utilising anaerobic digestion as main technology will become operational, while the current anaerobic digester at Malta North is expected to remain on standby.

For the projections reporting, the same methodology applied to the historical time series was used. NH_3 emissions were calculated using Equation 24, where the 2025 $AR_{organic}$ at the AD MN facility was determined by multiplying the projected organic feedstock to be digested by the corresponding nitrogen (N) content default factor specified in the 2023GB. Meanwhile, the 2030 $AR_{feedstock}$ represents the yearly sum of nitrogen (N) in feedstock to be digested, considering both organic and manure fractions entering the two different biogas facilities (OPP and manure AD). The amount of N in livestock manure to be digested was derived from the corresponding N and TAN flows calculated in Chapter 3.B.

Both the WM and WAM scenarios use the same input data, provided in 2025 by Wasteserv and in 2030 by the waste team at ERA for organic feedstock and by Riżorsi Agrikoli Malta (RAM) for manure production.

7.4.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.4.5 Sector-specific recalculations

No recalculations were done for this sector.

7.4.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

7.5 Sector 5C1bv: Cremation

Table 139: Sector 5C1bv general characteristics

NFR Code	5C1bv
Sub-Category	Cremation
Method	2023GB
Activity Data	ERA Waste Team
Emission Factors	Mixed Tiers
Key Category	Se, Benzo(a)pyrene, Benzo(b)flouranthene, Benzo(k)flouranthene, Indeno (1,2,3-cd)pyrene, HCB & PCBs
Year of Last Update	2025 submission

7.5.1 Sector description

Waste covered in the following categories within the 2023GB: Municipal Solid Waste (5C1a), Industrial Waste (5C1b), Clinical waste (5C1biii), and Cremation (5C1bv) are incinerated together within the Marsa Thermal Treatment Facility (MTTF). Thus, the emissions were all added to the Cremation sector (5C1bv). For this reason, categories 5C1a, 5C1b, and 5C1biii are all classified as IE as marked in Table 131. This category also covers the Island Sanctuary Crematorium that cremates deceased pets.

Shares of emissions of the particular pollutants from 5C1bv in 2023 are shown in Figure 53.

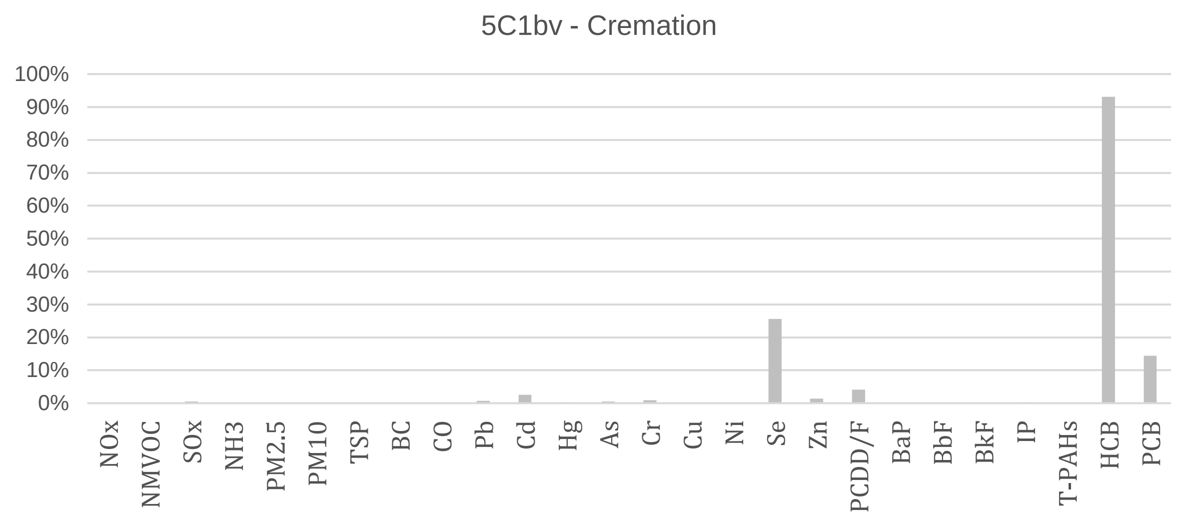

Figure 53: Shares of emissions from the NFR 5C1bv category in percentage of the national total

7.5.2 Methodology & activity data - Historical

7.5.2.1 Marsa Thermal Treatment Facility

This facility commenced its operation in late 2007; however, the first activity data available is from 2009. The Waste Team at ERA provided the activity data including the emissions from continuous and periodic monitoring through the annual environmental reports.

A Tier 3 methodology was used for the following pollutants, as the emissions were directly measured at the site: NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni and PCDD/PCDF. Certain pollutants had missing data for some years, as also experienced in this reporting year for NMVOC. In these cases, a country-specific emission factor was calculated, by obtaining an average emission load per mass of waste entering the facility. The mass of waste entering the facility in a year was then multiplied by the country-specific emission factor.

No direct emissions data was available for BC, Se, Zn, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB, and PCBs, and thus these emissions had to be calculated through the Tier 1 methodology provided in the 2023GB.

The total waste entering the facility was classified according to the EWC codes. The EWC codes were then used as a guidance, to separate the waste into four categories: Municipal solid waste (5C1a), Industrial waste (5C1b), Clinical waste (5C1biii), and Cremation (5C1bv). The mass of waste from each category was then multiplied by the relevant Tier 1 emission factor, as provided within the 2023GB. The emissions from the four categories were summed to obtain a single emission load per pollutant. The table below presents the total waste entering the facility, classified into the specified categories for the last three reporting years:

Table 140: Waste incinerated at MTTF for 2021 to 2023.

Waste incinerated at MTTF	2021	2022	2023
Animal by-products (t)	5169.24	5336.24	5257.34
Municipal solid waste (t)	19.84	5.10	51.86
Industrial waste (t)	19.70	45.88	8.36
Clinical waste (t)	476.98	264.12	200.80
Total (t)	5685.77	5651.34	5518.36

Figure 54 shows the total waste entering the MTTF, categorized into four groups. The predominant fraction of waste entering the MTTF is animal by-products. Since there is no specific emission factor (EF) for the cremation of animal by-products, the EF for the cremation of human bodies has been utilized to calculate emissions for this sector. Clinical waste constitutes the second-largest source of waste, while municipal solid waste and industrial waste represent significantly smaller proportions. The overall trend indicates a slight decrease in waste entering the facility in 2023, primarily attributed to animal by-products and clinical waste.

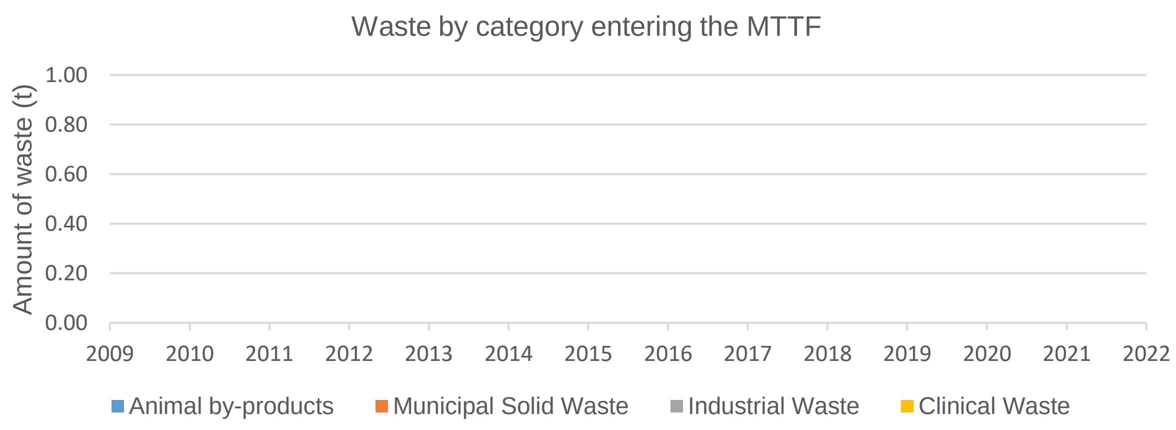

Figure 54: Waste entering the MTTF from 2009 to 2022 classified by category

7.5.2.2 Island Sanctuary Crematorium

This facility commenced its operation in late 2018; however, the first activity data available is from 2019. The Waste Team at ERA provided the activity data. The total waste entering this facility was classified according to the EWC codes. The two EWC codes cremated within this facility are: 20 02 01 (Excrement from the on-site keeping of dogs) classified as Animal by-product and 18 02 03 (Pet remains) classified as Municipal Solid Waste. The mass of waste from each category was then multiplied by the relevant Tier 1 emission factors, as provided within the 2023GB. The emissions from the two categories were summed to obtain a single emission load per pollutant.

7.5.3 Methodology & activity data – Projections

Concerning projected emissions from the MTTF, these are worked out using a mixture of country specific EFs (where available) and Tier 1 EFs. The projected waste that will enter the thermal treatment facility for both WM and WaM was based on a 5 year rolling average. The distribution of waste between the four categories (5C1a, 5C1b, 5C1biii and 5C1bv) was estimated based on the 2023 distribution.

With regards to the Island Sanctuary Crematorium the projected emissions are worked out using Tier 1 EFs similar to the historical calculations. The amount of waste entering the facility was assumed to be the same as that of 2023 for all projected years.

7.5.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.5.5 Sector-specific recalculations

Country specific emission factors of pollutants; CO, SO_x, TSP, NH_3, NO_x, Hg, PCDD/F, PM_{10}, $PM_{2.5}$, As, Cd, Cr, Cu, Ni, Pb, PCBs and Total 4 PAHs have been updated to include latest data year within the calculation.

During the compilation of the 2023 activity data and the revision of annual loads reported by the operator, obtained through the Continuous Emissions Monitoring System (CEMS), the sectoral expert noticed that, since 2016, the following pollutants had been erroneously considered as periodic monitoring instead of continuous monitoring: CO, SO_x, NO_x, TSP and NH_3.

This means that emission calculations were previously based on one or two instances of flue gas monitoring per year rather than on average monthly readings from the continuous monitoring system. To better reflect accurate trends and improve emission estimates, recalculations for this sector were carried out from 2016 onwards for CO, SO_x, NO_x and NH_3 and from 2020 onwards for TSP. The revised methodology uses the monthly average concentration per pollutant (as reported by the operator, in mg/m^3), multiplied by the flow rate (m^3/h) and the operating hours per year, resulting in total emission loads expressed in kg/year.

7.5.6 Sector-specific planned improvements

Presently, no improvements are planned for this sector.

7.6 Sector 5C2: Open Burning of Waste

Table 141: Sector 5C2 general characteristics

NFR Code	**5C2**
Sub-Category	Open Burning of Waste
Method	2023GB
Activity Data	EUROSTAT, NSO, MAFA
Emission Factors	Tier 1
Key Category	Not Applicable
Year of Last Update	2025 submission

7.6.1 Sector description

This category estimates emissions from the open burning of small-scale forestry, orchard (permanent crops), and farmland waste. The shares of emissions for specific pollutants from 5C2 in 2023 are shown in Figure 55.

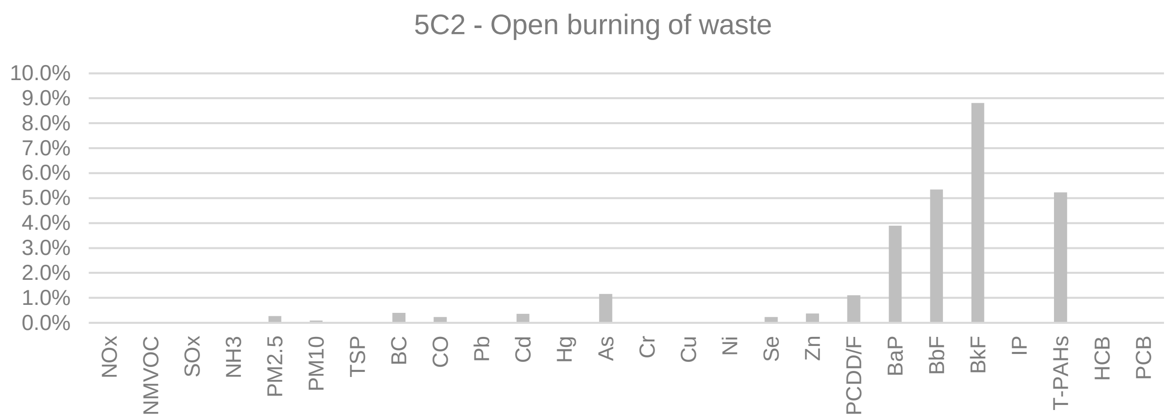

Figure 55: Shares of emissions from the NFR 5C2 category in percentage of the national total

7.6.2 Methodology & activity data - Historical

Given that the annual quantity of agricultural waste produced and incinerated in Malta is not currently available, a Tier 1 methodology, using Equation 25, is applied to this sector. Communication with various entities confirms that forest residues do not occur in Malta and that not all orchard and arable farmland residues are burned. Instead, these residues are managed in various ways, including disposal in landfills under EWC 20 02 01, on-site shredding and reincorporation into the soil (e.g., prunings from vines), and provision to fireworks factories for conversion into explosive powder, which is subsequently burned. However, since these activities occur on a small scale and are not subject to formal approvals or reporting obligations, no reliable data is currently available.

$$E_{\text{pollutant}} = \text{AR}_{\text{production}} * \text{EF}_{\text{pollutant}}$$

Equation 25: Calculation of emissions from open burning of small-scale agricultural waste.

The 2003 hectares of **arable farmland** were obtained from EUROSTAT archives, while data for 2010 and 2020 were sourced from the only two available agricultural censuses in Malta. A linear trend was applied to estimate the missing years between these data points for the entire historical time series from 1990 to 2023.

Similarly, the 2003 hectares of **orchards (permanent crops)** were obtained from EUROSTAT archives, while data for 2010 and 2020 came from the same agricultural censuses. A linear trend was applied to estimate the missing years in the historical time series, except for 2023, which was provided by the Ministry for Agriculture, Fisheries and Animal Rights (MAFA).

Table 142: National Forestry and Orchard land area in hectares.

Year	Arable farmland (ha)	Orchards (ha)
2010	9082	1248
2020	7783	953
2023	7393	841

To estimate the average amount of waste burned, the 2023 GB default value of 25 kg of waste burned per hectare of arable farmland was also applied to orchard areas. This approach was taken because no country-specific data is currently available on the amount of waste produced and burned per hectare of orchard area.

7.6.3 Methodology & activity data – Projections

For projections reporting, the same methodology applied to the historical time series was used. Emissions were calculated using Equation 25, where the projected arable farmland and orchard areas were estimated using a linear trend based on available data from 2003, 2010, and 2020. Both the WM and WAM scenarios use the same input data.

7.6.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.6.5 Sector-specific recalculations

The breakdown of UAA into arable farmland and orchards (permanent crops) resulted in improved activity data and recalculations for the entire time series of all pollutants

7.6.6 Sector-specific planned improvements

ERA is currently preparing a Non-Disclosure Agreement (NDA) with the Agriculture and Rural Payments Agency (ARPA) to obtain available data from 2004 onwards on arable farmland and orchard land registrations in Malta.

7.7 Sector 5D3: Other Wastewater Handling

Table 143: Sector 5D3 general characteristics

NFR Code	**5D3**
Sub-Category	Other Wastewater Handling
Method	2023GB
Activity Data	Water Services Corporation
Emission Factors	Tier 1
Key Category	Not Applicable
Year of Last Update	2025 submission

7.7.1 Sector description

This subcategory covers emissions from treated wastewater. Shares of emissions of the particular pollutants from 5D3 in 2023 are shown in Figure 56.

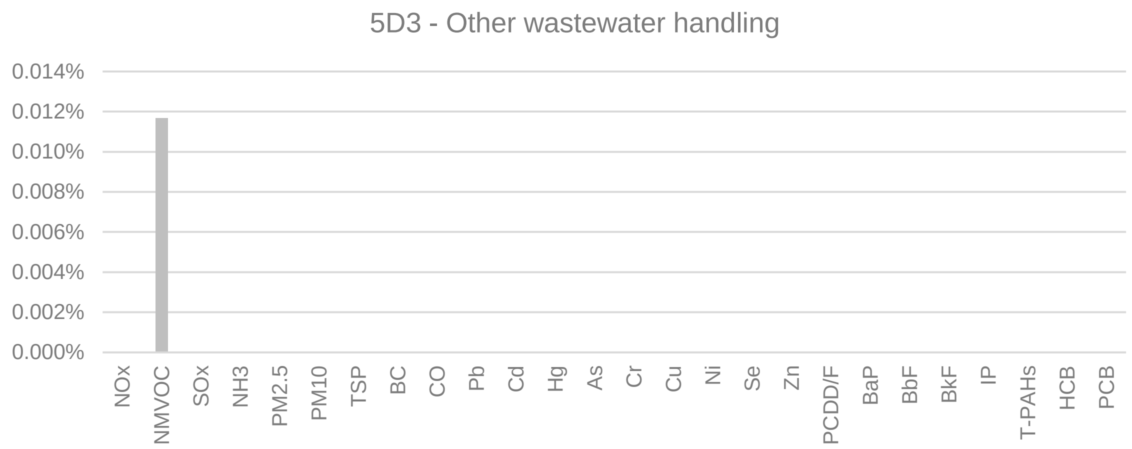

Figure 56: Shares of emissions from the NFR 5D3 category in percentage of the national total

7.7.2 Methodology & activity data – Historical

A tier 1 methodology, based on the 2023GB, was utilized to estimate NMVOC emissions for this subcategory given that wastewater is not distinguished by sector (i.e. domestic, commercial and industrial). The activity data, encompassing the annual cubic meters of wastewater treated at four facilities, was provided by the Water Services Corporation (WSC) for 1990 to 2023:

- Ta' Barkat Sewage Treatment Plant (Malta south)
- Iċ-Ċumnija Sewage Treatment Plant (Malta north)
- The Sant'Antnin Mechanical and Biological Treatment Plant (in operation until 2018)
- Ras il-Ħobż Sewage Treatment Plant (Gozo)

7.7.3 Methodology & activity data – Projections

Regarding projected emissions, these are calculated using the same methodology employed for the historical calculations. The annual total of wastewater treated for the projected years is determined using GDP as a proxy. Both the WM and WAM scenarios use the same input data.

7.7.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.7.5 Sector-specific recalculations

No recalculations were performed for this sector.

7.7.6 Sector-specific planned improvements

Presently, no planned improvements planned for this sector.

7.8 Sector 5E: Other Waste

Table 144: Sector 5E general characteristics

NFR Code	**5E**
Sub-Category	Other Waste
Method	2023GB
Activity Data	Civil Protection Department
Emission Factors	Tier 2
Key Category	PCDD/PCDF
Year of Last Update	2025 submission

7.8.1 Sector description

This category covers the emissions originating from car and building fires. Shares of emissions of the particular pollutants from 5E in 2023 are shown in Figure 57.

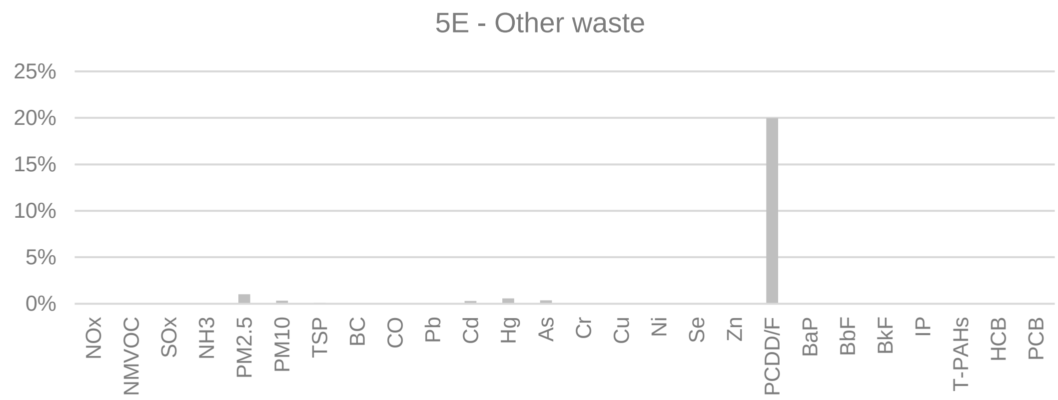

Figure 57: Shares of emissions from the NFR 5E category in percentage of the national total

7.8.2 Methodology & activity data - Historical

The Civil Protection Department (CPD) provided the activity data for the years 2000 to 2023. Data for the remaining historical years was extrapolated from the aforementioned data.

The activity data was provided for the following parameters: houses/apartments, hotels/guest houses, industrial buildings, and vehicles/trucks for the years 2000 to 2015. Starting from the year 2016 onwards, the CPD provided all calls received from their end without specific categorization. Categorization of the various call descriptions was carried out to enable successful calculation of emissions. The Table 145 presents the reported fires categorized for 2005 and the last three reporting years. The occurrences of houses and apartments in 2005 were categorized by multiplying the uncategorized total of houses/apartments (204) by the share of dwellings in Malta according to the NSO Census 2011, as shown in Table 146.

Table 145: Total fires per category for the years 2005 and 2021 to 2023.

Category	**Occurrences**			
	2005	**2021**	**2022**	**2023**
Houses	79	65	56	52
Apartments	125	79	79	90
Hotel/Guest houses	13	13	13	3
Industrial buildings	33	34	27	35
Vehicles/Trucks	210	188	147	157

Since the number of house fires did not differentiate between different types of dwellings, the proportion of dwellings outlined in NSO's 2011 and 2021 censuses were utilized to determine the distribution of detached houses, undetached houses, and apartments in Malta, as illustrated in Table 146. This was then multiplied by the total reported fires within this category.

Table 146: Share of dwellings in Malta

NSO Census 2011		
House Type	**% Share Dwellings**	**% share detached/undetached**
Apartment	61.5	-
Detached house	7.0	18.2
Undetached house	31.5	81.8
NSO Census 2021		
House type	**% share dwellings**	**% share detached/undetached**
Apartment	72.5	-
Detached house	4.6	16.9
Undetached house	22.9	83.1

The tier 2 approach provided in the 2023GB was utilized for this submission. It is important to note that no EFs were provided for hotels, therefore the EFs for apartments were used, since hotels tend to comprise of small rooms that are most similar to apartments. The CPD indicated that when a fire takes place, only one or two rooms in reality catch fire. Additionally, the entire car tends to be burnt in the event of a fire, whereas 60% of an industrial building tends to catch fire. Considering this information, and taking the average number of rooms as provided by the 2011 and 2021 NSO census, the average area percentage of cars and buildings burnt during a fire, was calculated as shown in Table 147.

Table 147: Share of vehicles and buildings burnt

Parameter	Rooms burnt	No. of rooms	% of structure
Car	N/A	N/A	100.0%
Undetached house	2	9	22.2%
Detached house	2	12	16.6%
Apartment	2	5	40.0%
Hotel/Guest house	2	112	1.8%
Industrial building	N/A	N/A	60.0%

7.8.3 Methodology & activity data – Projections

Regarding projected emissions, these are calculated using the same methodology employed for the historical calculations. Each fire per category was extrapolated separately for the projection years using a 5 year rolling average. Both the WM and WAM scenarios use the same input data.

7.8.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

7.8.5 Sector-specific recalculations

Recalculation in 5E involved an activity data verification exercise, which revealed that some fire events were not being included in the total calculations. This correction led to a modification in emissions from 2021 onwards for all pollutants listed under this category.

7.8.6 Sector-specific planned improvements

Presently, no planned improvements are scheduled for category 5E.

8 Other sources (NFR 6)

Chapter Updated: 2024

8.1 Category overview

In terms of the emission inventory, emissions from the following NFR sectors are estimated:

- 6A Other

8.2 Sector 6A: Other

Table 148: Sector 6A general characteristics

NFR Code	**6A**
Sub-Category	Other
Method	2023GB
Activity Data	Department of Animal Health and Welfare
Emission Factors	Tier 1
Key Category	Not Applicable
Year of Last Update	2025 submission

8.2.1 Introduction

This subcategory includes emissions of air pollutants that arise from the excretion of cats and dogs. Shares of emissions of the particular pollutants from this sector in 2023 are shown in Figure 58.

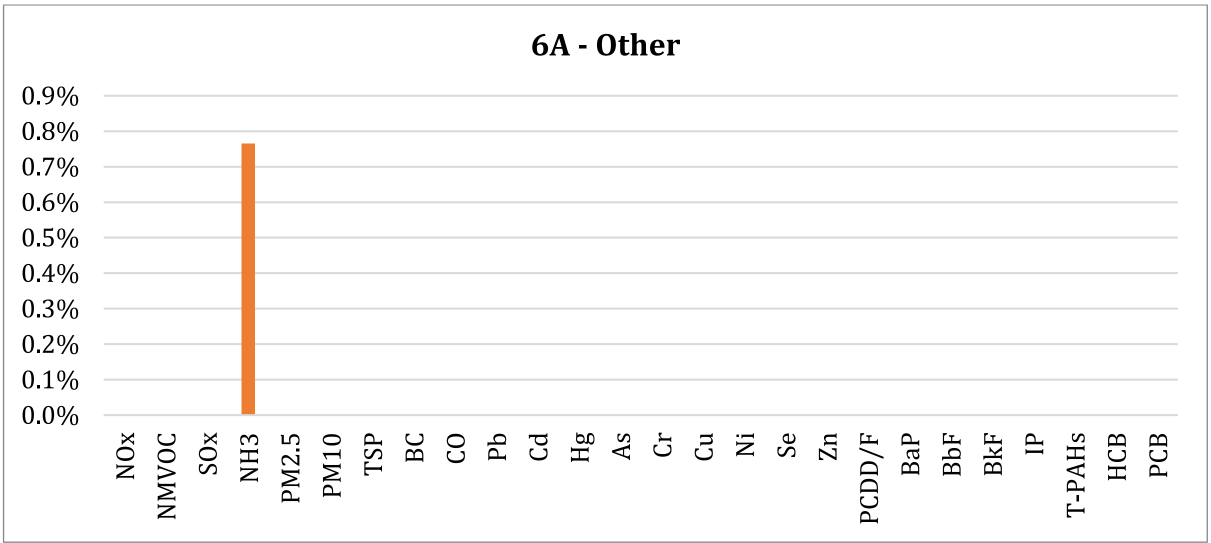

Figure 58: Shares of emissions from the NFR 6A category in percentage of national total

8.2.2 Methodology

NH_3 emissions from this sector were calculated through the Tier 1 methodology provided by the 2023GB.

8.2.3 Activity data

The annual number of cats and dogs was not available. However, the Department of Animal Health and Welfare had provided an estimate on the population of cats and dogs in August 2021, following a parliamentary question (TVM News, 2021). Considering that no other information was available, the values of 85,079 dogs and 11,673 cats in August 2021 was applied for all years.

8.2.4 Sector-specific QA/QC and verification

A QA/QC exercise was carried out for this sector. The sector compiler ensured that input activity data, the emission factors, and the formulas utilized within the model, were correct. All assumptions and criteria relevant to any of the activity data are checked in house. Furthermore, checks were made to ensure that units were converted correctly throughout the model. Trends for each pollutant are analysed through a trend checker model, which considers both the year-on-year variance, as well as the change in emissions compared to the previous submission.

8.2.5 Sector-specific recalculations

No recalculations were carried out in this submission.

8.2.6 Sector-specific planned improvements

Presently, no planned improvements are scheduled for this category.

9. Projections

Chapter Updated: 2025

The projections for this submission are based on the projections used in the National Energy and Climate Plan (NECP) for Malta, released in December 2024. As stated in the NECP, more recent macro-economic drivers have become available and were used as inputs in the analytical basis of this NECP update. The forecasts suggest a projected rise in energy demand that surpasses the forecasts used in the 2019 NECP (The Energy & Water Agency, 2024) and therefore, the projections reports in the last projections submission. Each sector-specific chapter provides an explanation of what is included in the two scenarios for 2025 and 2030.

The below subchapters provide an insight on Malta's projected emissions compared to 2020 and 2030 ceilings.

9.1 Trends in Nitrogen oxides (NO_x)

Malta is projecting non-compliance for both WM and WaM scenarios compared to the 2030 ceiling for NO_x. Meeting this emission reduction commitment is considered to be very challenging for Malta due to the level of ambition of the ceiling, also noting that the major contributor is the transportation sectors. The NO_x projected emissions for WM and WaM scenarios for 2025 are at 4.76kt whereas the projected emissions for WM for 2030 is at 3.96kt and WaM is at 3.97kt. Noting the 2030 ceiling of 2kt, this implies that Malta would need to deduct emissions by at least 1.97kt.

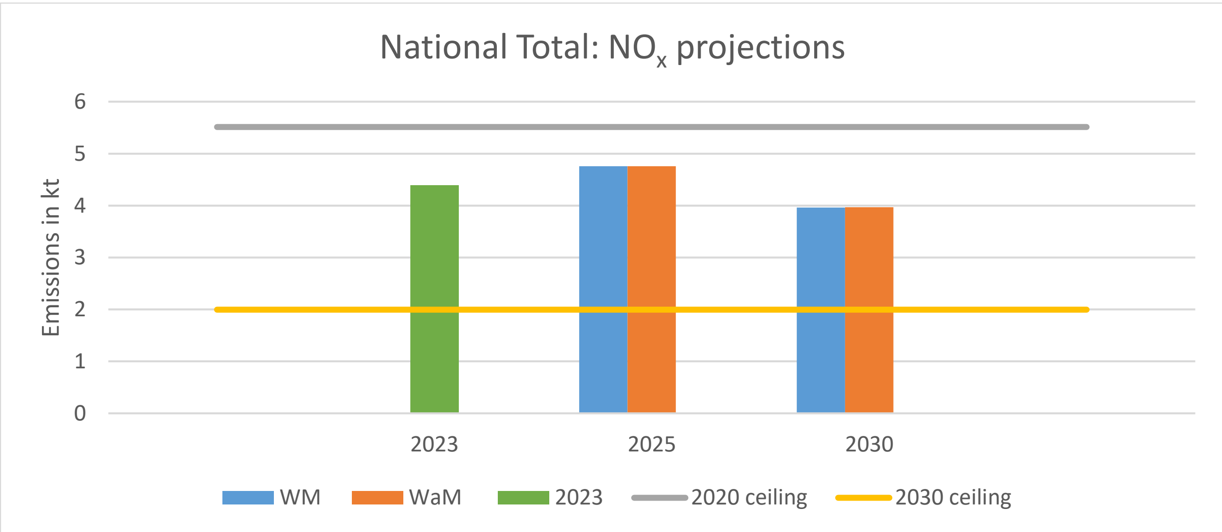

Figure 59: Graph showing how the NOx projected emission for the WM and WaM scenarios for 2025 and 2030 compare to the 2020 and 2030 ceilings.

9.2 Trends in nmVOC

The figure below demonstrates that although it is being projected that Malta's 2030 projected emissions are close to 2030 ceiling, compliance is still being envisaged for both the WM and WaM scenarios for the 2020 and 2030 ceilings, which are 2.83kt and 2.69kt respectively. Malta's 2025 projected emissions for nmVOC for the WM scenario is at 2.54kt and for the WaM scenario projected emissions are 2.53kt whereas for 2030, projected emissions for WM scenario are 2.64kt and 2.63kt for WaM scenario.

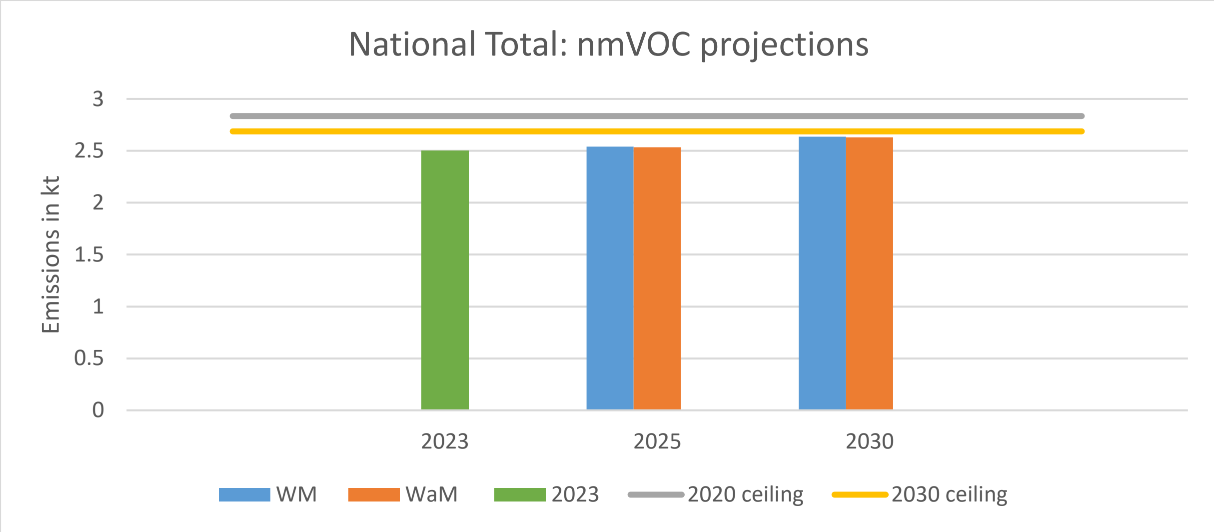

Figure 60: : Graph showing how the NMVOC projected emission for the WM and WaM scenarios for 2025 and 2030 compare to the 2020 and 2030 ceilings

9.3 Trends in Sulphur oxides (SOx)

As evidently seen in the figure below, Malta is projecting compliance for both the 2020 and 2030 ceilings for SO_x. The 2025 projected SOx emissions are at 0.18kt for the WM and WaM scenarios, whereas for 2030, the projected SO_x emissions for the WM scenario and WaM scenario are at 0.21kt. Noting that the 2020 and 2030 ceilings are at 2.82kt and 0.61kt respectively, SO_x is no longer considered as a pollutant of concern for Malta.

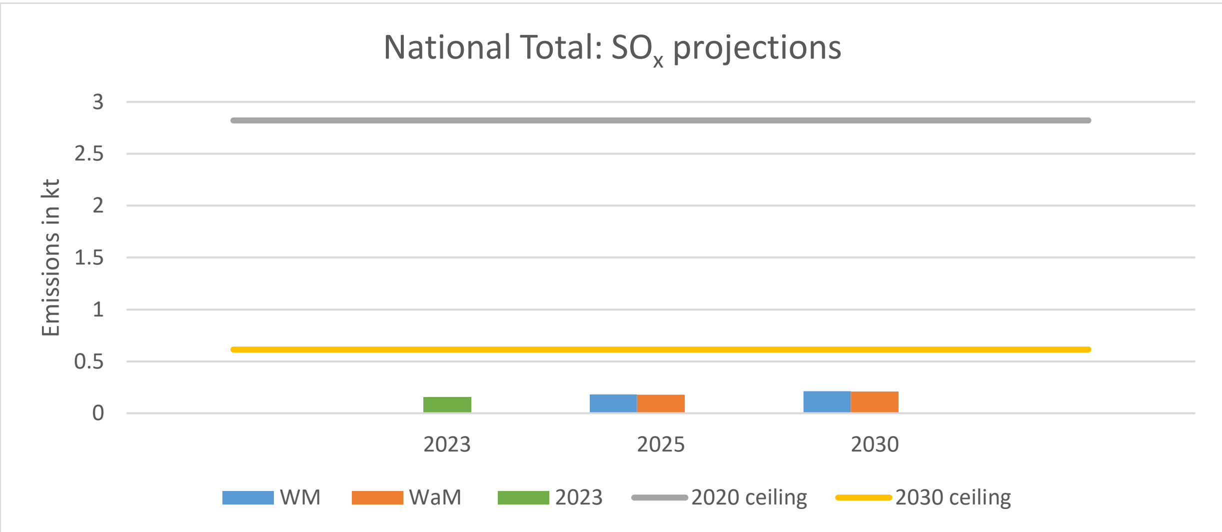

Figure 61: Graph showing how the SOx projected emission for the WM and WaM scenarios for 2025 and 2030 compare to the 2020 and 2030 ceilings

9.4 Trends in Ammonia (NH_3)

Projections show that Malta will be in compliance with the 2020 and 2030 ceilings for Ammonia of 1.73kt and 1.37kt respectively. In 2025, NH_3 emissions for the WM and WaM scenarios are at 1.61kt whereas in

2030, the projected emissions are at 1.16kt. The considerable projected decrease of NH_3 emissions is attributable to the number of measures mentioned in Section 6.2.1.9

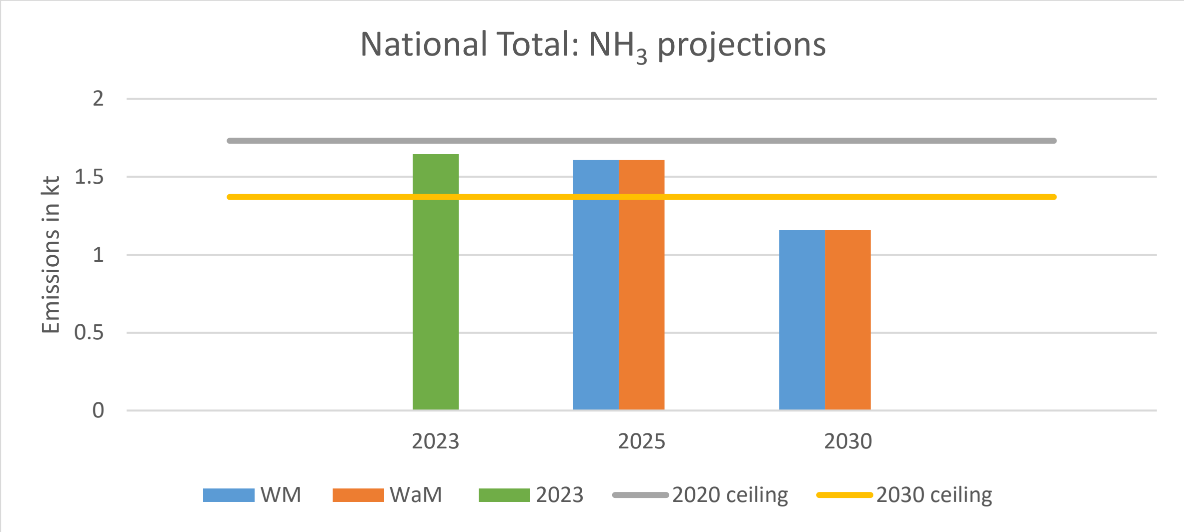

Figure 62: Graph showing how the NH_3 projected emission for the WM and WaM scenarios for 2025 and 2030 compare to the 2020 and 2030 ceilings

9.5 Trends for Particulate Matter 2.5 (PM2.5)

$PM_{2.5}$ emission projections show compliance with the 2020 and 2030 ceilings. In 2025, the projected $PM_{2.5}$ emissions are at 0.3kt for both the WM and WaM scenario and in 2030, projected $PM_{2.5}$ emissions for the WM and WaM scneario are 0.35kt. Once again, Malta's projections are close to the 2030 ceiling, however, as noted above, projections still show compliance for 2030.

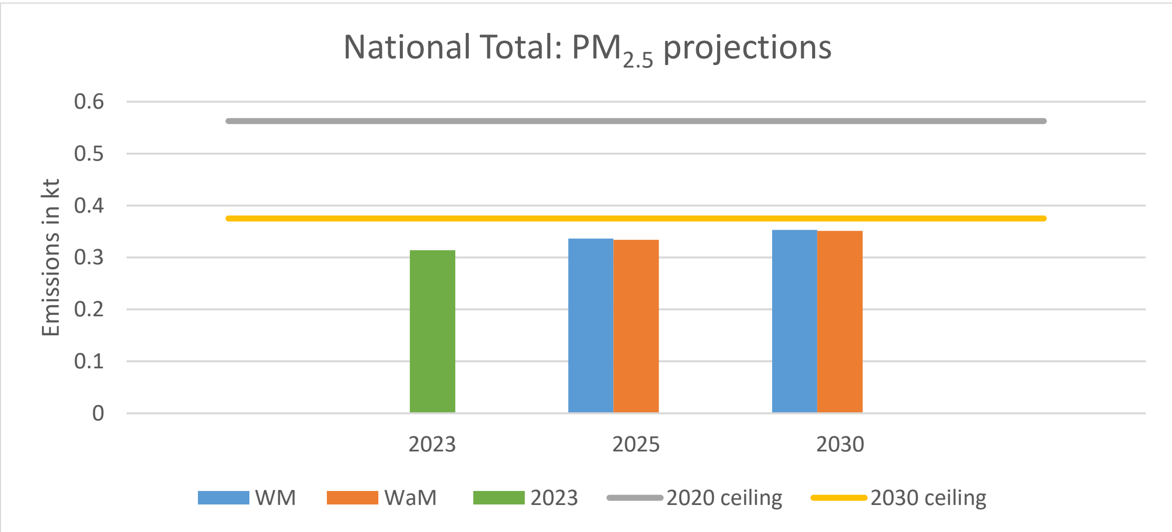

Figure 63: Graph showing how the $PM_{2.5}$ projected emission for the WM and WaM scenarios for 2025 and 2030 compare to the 2020 and 2030 ceilings

10. Trends

Chapter Updated: 2025

This chapter provides a description of the trends of the main air pollutant emissions, which Malta is bound to report pursuant to Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants and the Long-Range Transboundary Air Pollution Convention.

10.1 Nitrogen oxides (NO_x)

The energy sector is the dominant source of this pollutant. This is seen throughout the entire time-series from 1990 to 2023. In 1990, the total NO_x emissions were at 7.27kt, which have since decreased to 4.39kt in 2023. The period with the highest NO_x emissions was between 2005 to 2010 with the highest load recorded in 2008 at 9.73kt. Reduced NO_x emissions were recorded especially after the decommissioning of the Marsa Power Station in 2015 as well as the inauguration of the Malta-Sicily interconnector cable, which took place in the same year. The lowest levels recorded to date, were in 2020 with a record of 4.04kt, primarily due to the COVID-19 restrictions, which were in place for almost half a year and impacted major sectors such as road transport, navigation, and aviation.

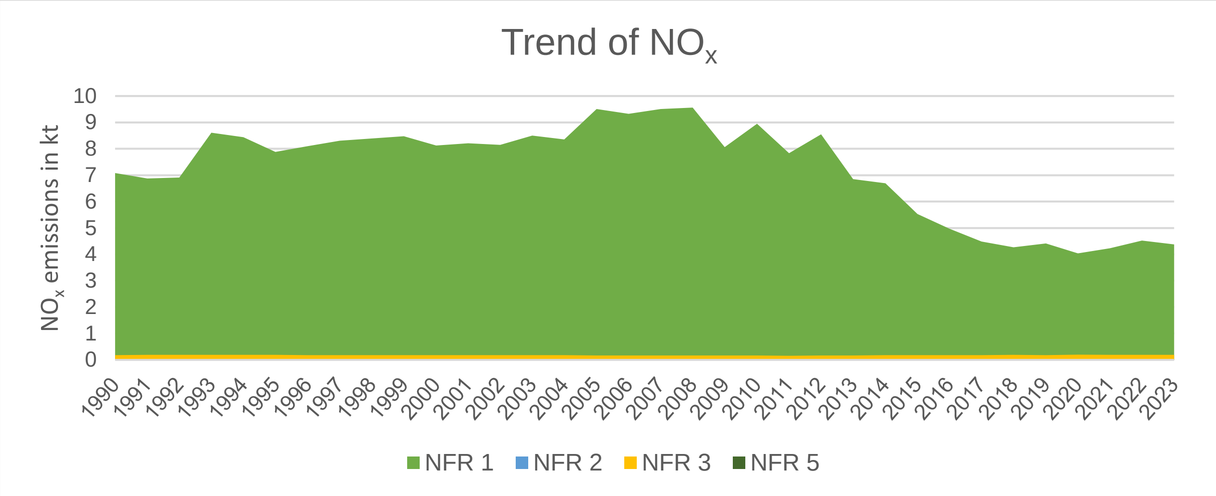

Figure 64: NO_x trends throughout the time series

In 2023, the major contributor to NO_x emissions within the Energy sector was Road Transport, particularly emissions from Heavy Duty Vehicles incl. buses (1A3biii) which amounted to 17.7% followed by Passenger Cars (1A3bi) representing 14.8% of the total NO_x emissions respectively. National Navigation (1A3dii) is the third largest source of NO_x emissions at 13.6%, followed by Public Electricity and Heat Production (1A1a) at 11.9%, Light Duty Vehicles within the Road Transport (1A3bii) sector at 9.1%, and Other, Mobile Machinery (1A5b) at 5.8%. Together, these six sectors make up 73% of the NO_x emissions. The below table provides a summary of the top ten sources of NO_x emissions in 2023.

Table 149: Table summarising the top 10 contributors of NO_x emissions in 2023

Rank	NFR Code	Long name	% share	% sum
1	1A3biii	Road transport: Heavy duty vehicles and buses	17.7%	17.7%
2	1A3bi	Road transport: Passenger cars	14.8%	32.5%
3	1A3dii	National navigation (shipping)	13.6%	46.1%
4	1A1a	Public electricity and heat production	11.9%	58.0%
5	1A3bii	Road transport: Light duty vehicles	9.1%	67.1%
6	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	6.0%	73.1%
7	1A5b	Other, Mobile (including military, land based and recreational boats)	5.8%	78.9%

8	1A4ciii	Agriculture/Forestry/Fishing: National fishing	5.2%	84.1%
9	1A3ai(i)	International aviation LTO (civil)	4.5%	88.6%
10	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	3.4%	92.0%

10.2 Non-Methane Volatile Organic Compounds (nmVOC)

nmVOC emissions are mainly split in two main categories: (i) those considered to be evaporative emissions and (ii) those originating from incomplete combustion. The main contributors to nmVOCs are the energy and IPPU sectors. The years with the highest emissions recorded were between 1993 and 1999, with 1995 recording the highest emissions on record at 6.09kt. A decreasing trend is visible from the early 2000s with the lowest load recorded in 2020 at 2.19kt.

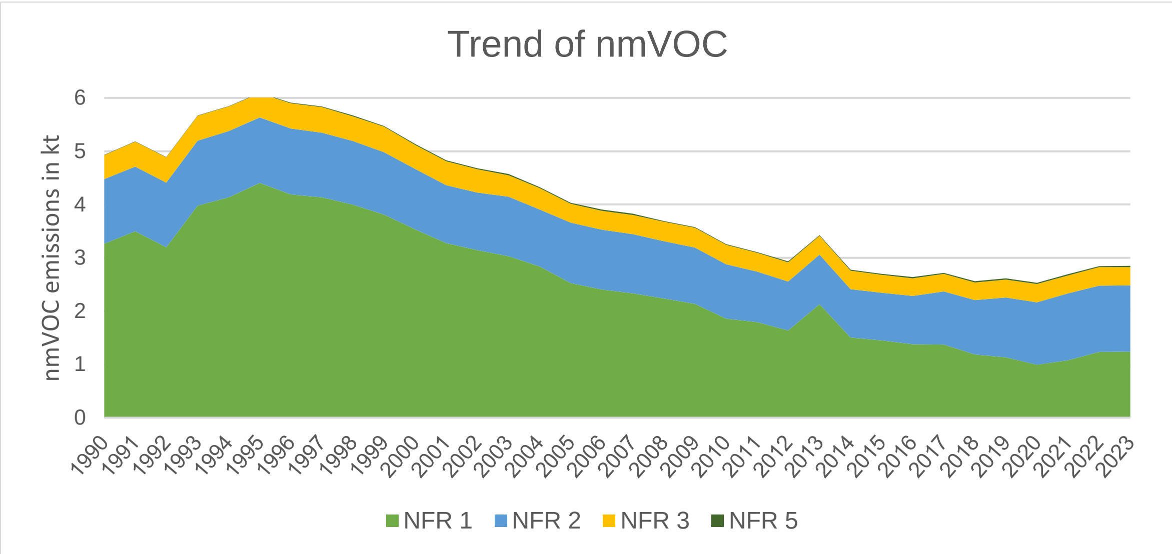

Figure 65: NMVOC trend throughout the time series

Table 150 highlights the top ten sectors contributing to nmVOC emissions in 2023, which are predominantly within the Industry and Energy sector. 13.1% of nmVOCs originate from Printing (2D3h). followed by Coating applications (2D3d) at 13.0%. The third most contributing sector is Gasoline Evaporation from Road Transport (1A3bv) with 12.1%, The following three sectors that contribute to NMVOC emissions are Domestic Solvent Use including Fungicides (2D3a) at 10.9%, Passenger Cars (1A3bi) at 9.2%, and Mopeds & Motorcycles (1A3biv) at 5.2% Together, these six sectors constitute 63.5% of the total nmVOC emissions.

Table 150: Table summarising the top 10 contributors of nmMVOC emissions in 2023

1	2D3h	Printing	13.1%	13.1%
2	2D3d	Coating applications	13.0%	26.1%
3	1A3bv	Road transport: Gasoline evaporation	12.1%	38.2%
4	2D3a	Domestic solvent use including fungicides	10.9%	49.0%
5	1A3bi	Road transport: Passenger cars	9.2%	58.2%
6	1A3biv	Road transport: Mopeds & motorcycles	5.2%	63.5%
7	1A5b	Other, Mobile (including military, land based and recreational boats)	4.4%	67.9%
8	3Da2a	Animal manure applied to soils	4.1%	72.0%
9	1B2av	Distribution of oil products	3.7%	75.7%
10	2D3e	Degreasing	3.4%	79.2%

11	2H2	Food and beverages industry	3.2%	82.3%

10.3 Sulphur oxides (SO_x)

The Energy sector is the dominant sector responsible for SO_x emissions. The highest load was recorded in 1993 at 15.13kt, whereas the lowest emissions were recorded in 2023 at 0.16kt. One can note a visible decreasing trend of SO_x emissions from 2010 onwards following the introduction of lower sulphur content of certain liquid fuels, the closure of the Marsa Power Station, the introduction of the Malta-Sicily interconnector and the shift from heavy fuel oil to liquefied natural gas at the Delimara Power station. In view of this, SO_x is no longer considered as a pollutant of great concern.

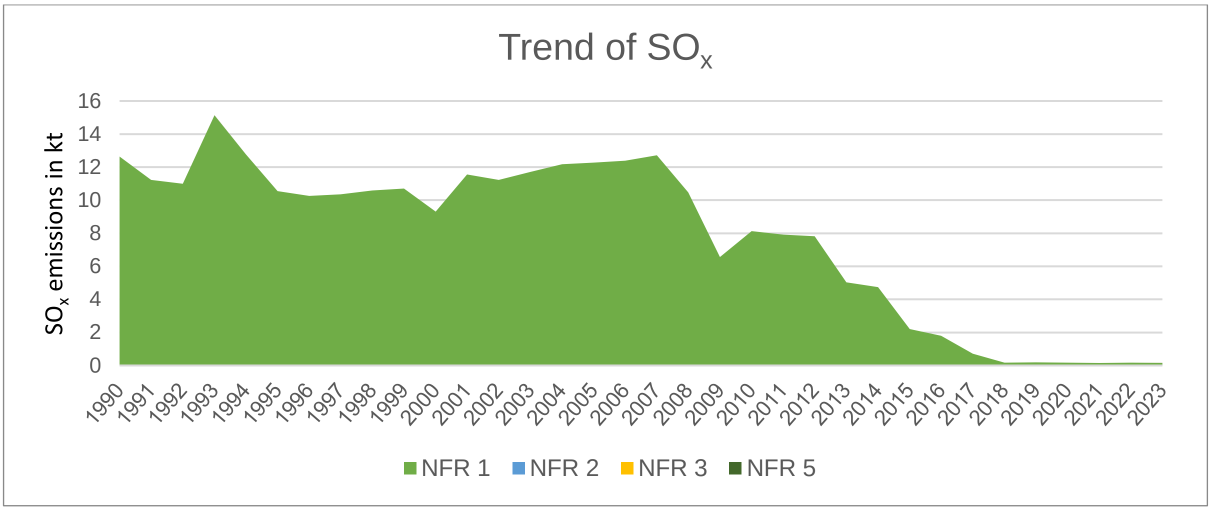

Figure 66: SO_x trend throughout the time series

In 2023, the main contributor to SO_x emissions in Malta, is the Stationary Combustion Sector (1A2gviii) which constitutes 29% of the total emissions. The second most contributing sector is the Commercial and Institutional Sector (1A4ai) at 23.6%, followed by the Public Electricity and Heat Sector (1A1a) at 13.9%, the Other, Mobile (including military, land based and recreational boats) sector (IA5b) at 7.4% and closely followed by the Agriculture/Forestry/Fishing: Off-road vehicles and Other Machinery (1A4cii) at 7.3%. Together these five sectors cover 81.3% of the entire SO_x emissions. The below table provides an overview of the top ten contributors of sulphur dioxide emissions in Malta.

Table 151: Table summarising the top 10 contributors of SO_x emissions in 2023

Rank	NFR Code	Long name	% share	% sum
1	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	29.0%	29.0%
2	1A4ai	Commercial/Institutional: Stationary	23.6%	52.7%
3	1A1a	Public electricity and heat production	13.9%	66.6%
4	1A5b	Other, Mobile (including military, land based and recreational boats)	7.4%	74.0%
5	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	7.3%	81.3%
6	1A3ai(i)	International aviation LTO (civil)	7.0%	88.3%
7	1A3dii	National navigation (shipping)	6.4%	94.7%
8	1A4ciii	Agriculture/Forestry/Fishing: National fishing	2.4%	97.1%
9	5C1bv	Cremation	1.0%	98.1%
10	1A3bi	Road transport: Passenger cars	0.7%	98.8%

10.4 Ammonia (NH_3)

Ammonia is heavily dominated by the agricultural sector, making it the only pollutant that is not largely associated with the Energy sector, which makes up almost 76% of emissions in 2023. The initial years in the time-series experienced relatively higher emission loads with emissions from the agricultural sector at almost 2kt. A gentle decreasing trend is visible with the lowest load was observed in 2017 at 1.56kt.

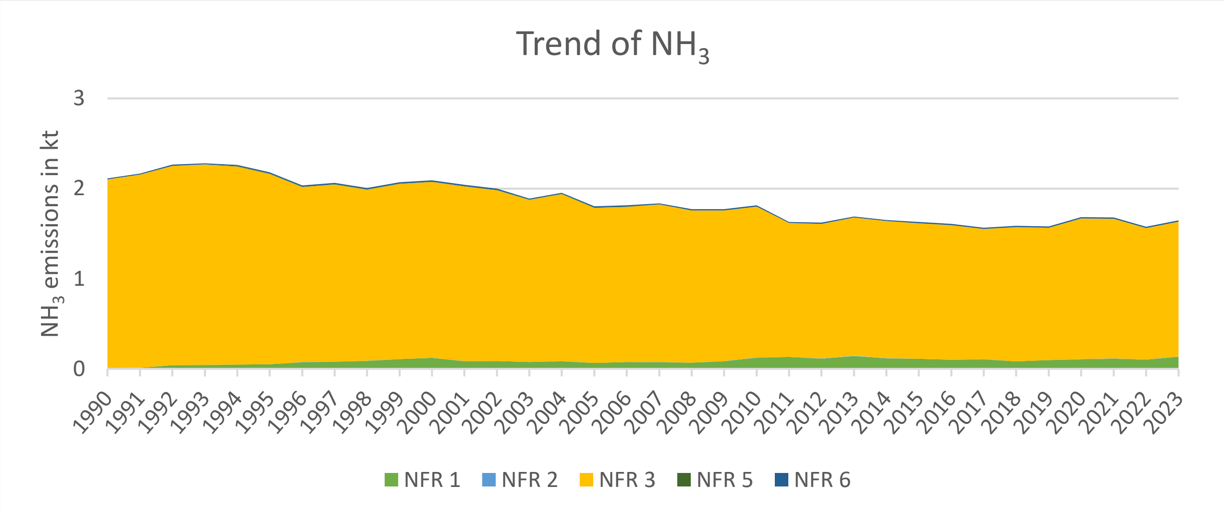

Figure 67: NH_3 trend throughout the time series

As already mentioned the agricultural sector is the main contributor to NH_3 emissions. In 2023, Animal Manure applied to Soils (3Da2a) contributed to 35.9% of the total NH_3 emissions, followed by Inorganic N-fertilizers (3Da1) at 10.6%. This is followed by Manure management of Dairy Cattle (3B1a) at 10.5%, Swine (3B3) at 9.7%, other animals (3B4h) at 8.5% and non-dairy cattle (3B1b) at 6.2%. The above mentioned sectors make up 81.4% of the emissions of NH_3.The below table provides an overview of the top ten contributors of ammonia emissions in Malta:

Table 152: Table summarising the top 10 contributors of NH_3 emissions in 2023

Rank	NFR Code	Long name	% share	% sum
1	3Da2a	Animal manure applied to soils	35.9%	35.9%
2	3Da1	Inorganic N-fertilizers (includes also urea application)	10.6%	46.6%
3	3B1a	Manure management - Dairy cattle	10.5%	57.0%
4	3B3	Manure management - Swine	9.7%	66.7%
5	3B4h	Manure management - Other animals	8.5%	75.2%
6	3B1b	Manure management - Non-dairy cattle	6.2%	81.4%
7	3B4gii	Manure management - Broilers	3.6%	85.0%
8	1A5b	Other, Mobile (including military, land based and recreational boats)	3.6%	88.6%
9	3B4gi	Manure management - Laying hens	3.0%	91.6%
10	1A3bi	Road transport: Passenger cars	2.6%	94.2%

10.5 Particulate Matter ($PM_{2.5}$)

The Energy and IPPU are the primary sectors contributing to the majority of $PM_{2.5}$, with Energy being evidently dominant in the earlier years of the time series. One can note that the trend starts to decrease from 2004 onwards, with 2004 being the year with the highest loads of $PM_{2.5}$ with emissions of 0.83kt and 2020 registering the lowest levels at 0.3kt

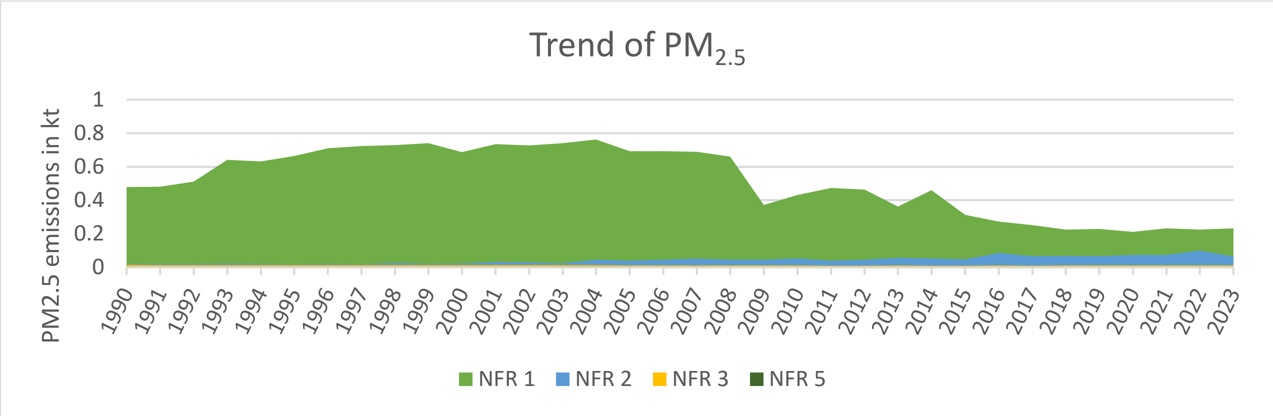

Figure 68: NH_3 trend throughout the time series

The main contributor to $PM_{2.5}$ emissions in 2023 comes from the IPPU sector, with Construction and Demolition sector (2D5b) contributing to 18.9% of the total emissions. This sector is followed by Other, Mobile (1A5b) at 16.0% and non-exhaust emissions from tyre wear and brake wear (1A3bvi) of the road transport sector at 12.4%. This is followed by light duty vehicles (1A3bii) at 6.3% and Other Product use at 5.9%. The below table provides an overview of the top ten contributors of the finer fraction of PM emissions in Malta:

Table 153: Table summarising the top 10 contributors of $PM_{2.5}$ emissions in 2023

Rank	NFR Code	Long name	% share	% sum
1	2A5b	Construction and demolition	18.9%	18.9%
2	1A5b	Other, Mobile (including military, land based and recreational boats)	16.0%	34.9%
3	1A3bvi	Road transport: Automobile tyre and brake wear	12.4%	47.3%
4	1A3bii	Road transport: Light duty vehicles	6.3%	53.6%
5	2G	Other product use (please specify in the IIR)	5.9%	59.5%
6	1A3bi	Road transport: Passenger cars	5.0%	64.5%
7	1A4bi	Residential: Stationary	5.0%	69.5%
8	2D3b	Road paving with asphalt	4.7%	74.1%
9	1A3biii	Road transport: Heavy duty vehicles and buses	4.7%	78.8%
10	1A3bvii	Road transport: Automobile road abrasion	4.4%	83.2%

10.6 Emission ceilings and Adjustments

Article 4 of Directive 2016/2284 outlines requirements for Member States to limit their annual anthropogenic emissions, specifically for SO_x, NO_x, NMVOC, NH_3 and $PM_{2.5}$ in accordance with the national emission reduction commitments applicable from 2020.

The below table provides a summary of Malta's performance in 2023 against the 2005 base year and the actual percentage deduction Malta managed to attain in order to be compliant with the 2020 ceilings as established by the said Directive.

	NO_X	**NMVOC**	**SO_x**	**NH_3**	**$PM_{2.5}$**
2005 base year results (kt)	9.50	3.68	12.27	1.8	0.75
2023 results (kt)	4.39	2.50	0.16	1.65	0.31
2020 reduction targets	42%	23%	77%	4%	25%
Deductions from the base year	-53.8%	-32.1%	-98.7%	-8.3%	-58.7%

10.6.1 Nitrogen Oxides (NO_x)

In 2023, Malta managed to reduce the total NO_x emissions by 53.8% over the 2005 base year emissions. The total NO_x emissions estimated for 2023 were 4.39kt and in order for Malta to be compliant with the 2020 NO_x emissions ceilings, the total amount of NO_x emitted by the country had to be 5.51kt or lower. In order for Malta to comply with the 2030 ceilings, a further decrease of at least 2.39kt of the total NO_x emissions are required. As discussed throughout the IIR, this is a very difficult task for Malta, as it requires drastic changes in several sectors, especially those related to transport. The below figures illustrates Malta's current situation vis-à-vis the 2020 and 2030 emission ceilings for NO_x.

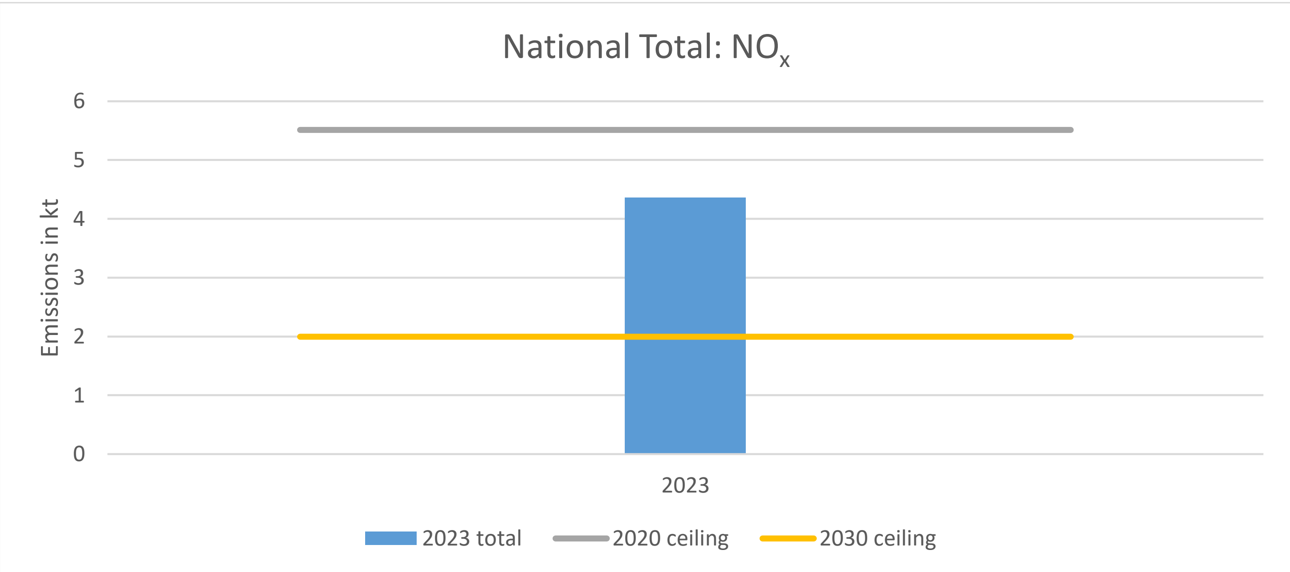

Figure 69: The total amount of NO_x emissions in kt in 2023 compared to the 2020 and 2030 ceilings

10.6.2 Non-methane Volatile Organic Compounds (NMVOC)

In 2023, Malta managed to reduce the total NMVOC emissions by 32.1% over the 2005 base year emissions. The total NMVOC emissions estimated for 2023 were 2.5kt. In order for Malta to be compliant with the 2020 NMVOC emissions ceilings, the total amount of NMVOC emitted by the country had to be 2.83kt or lower, whereas for Malta to be compliant with 2030 ceilings, emissions have to be 2.69kt or lower. The graph below clearly demonstrates Malta's compliance with both emission targets for NMVOC.

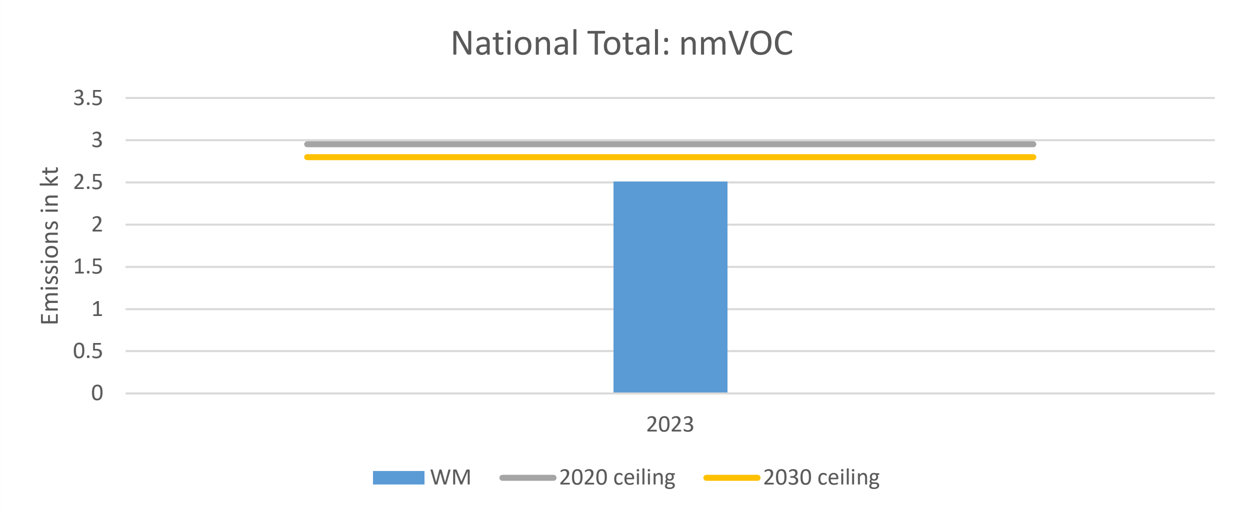

Figure 70: The total amount of NMVOC emissions in kt in 2023 compared to the 2020 and 2030 ceilings

10.6.3 Sulphur Oxides (SO_x)

In 2023, Malta deducted the total SO_x emissions by 98.7% over the 2005 base year emissions where 0.16kt of total SO_x emissions were recorded. In order for Malta to be compliant with the 2020 SO_x emissions ceilings, total emissions had to be 2.82kt or lower. As things stand, Malta is already in compliance with the 2030 ceilings of 0.61kt. The below figures illustrates Malta's current situation vis-à-vis the 2020 and 2030 emission ceilings for SO_X.

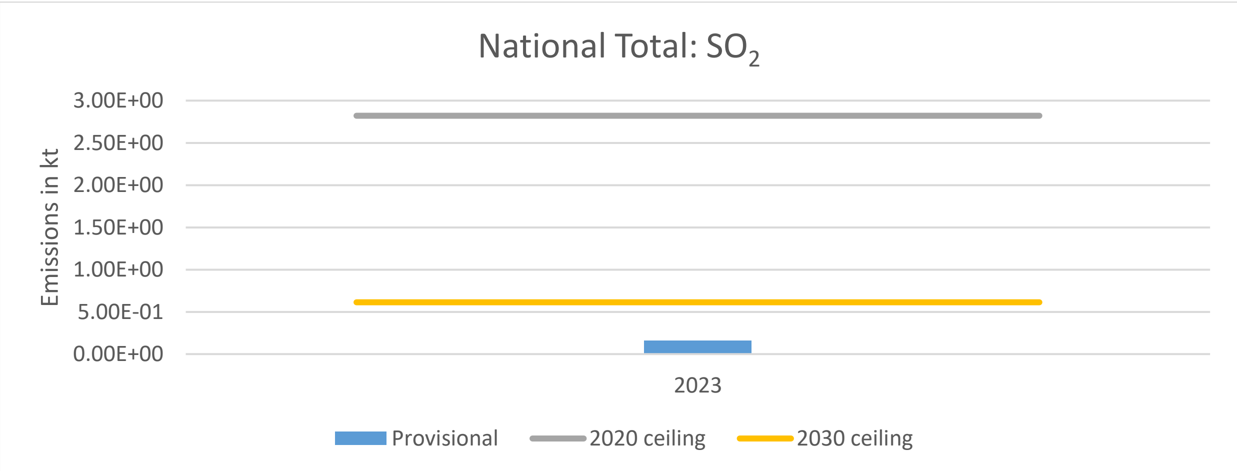

Figure 71: The total amount of SO_x emissions in kt in 2023 compared to the 2020 and 2030 ceilings

10.6.4 Ammonia (NH_3)

In 2023, Malta recorded 1.65kt of NH_3 emissions, managing to deduct the total NH_3 emissions by 8.3% over the 2005 base year emissions. The 2020, NH_3 emissions ceiling for Malta was at 1.73kt . In order for Malta to be in compliance with the 2030 ceilings, a further decrease of 0.28kt of the total NH_3 emissions required. The below figures illustrates Malta's current situation vis-à-vis the 2020 and 2030 emission ceilings for NH_3.

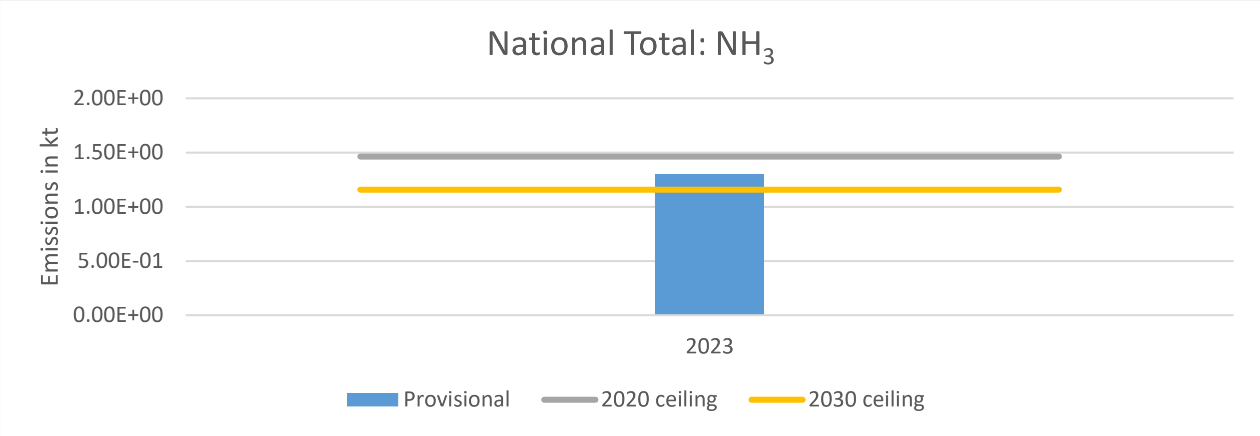

Figure 72: The total amount of NH_3 emissions in kt in 2023 compared to the 2020 and 2030 ceilings

10.6.5 Fine Particulate Matter ($PM_{2.5}$)

In 2023, Malta deducted the total $PM_{2.5}$ emissions by 58.7% over the 2005 base year emissions. The total $PM_{2.5}$ emissions estimated for 2023 were 0.31kt and in order for Malta to be compliant with the 2020 $PM_{2.5}$ emissions ceilings, the total amount of $PM_{2.5}$ emitted by the country had to be 0.56kt or lower. In 2023, Malta is in compliance with the 2030 ceilings of 0.38kt. The below figures illustrates Malta's current situation vis-à-vis the 2020 and 2030 emission ceilings for $PM_{2.5}$.

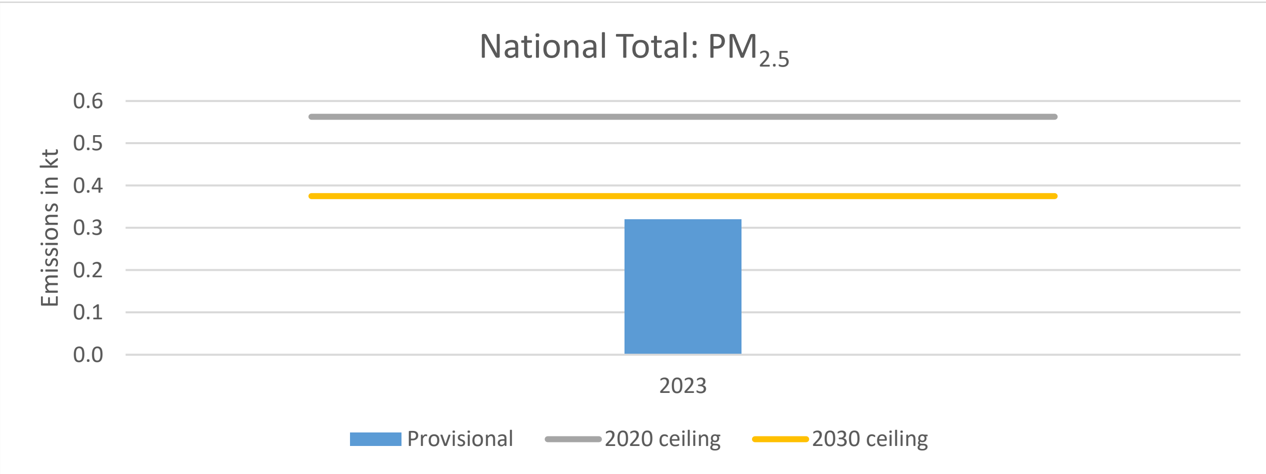

Figure 73: The total amount of $PM_{2.5}$ emissions in kt in 2023 compared to the 2020 and 2030 ceilings

11. Recalculations and Improvements

Chapter Updated: 2025

For a comprehensive understanding of the recalculations and enhancements under consideration across all sectors, it is recommended to consult the corresponding chapters for detailed descriptions. Each sector-specific chapter delves into the intricacies of proposed revisions and optimizations, providing a thorough overview of the planned improvements.

12. Gridded emissions

Chapter Updated: 2025

12.1 Background information

This chapter provides a summary of input data and methodologies of Malta's gridded emissions for the year 2023 which are to be reported by the 1st of May 2025 and results for the said emissions shall be documented in the 2023 IIR submission.

As part of the obligations under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP), and Directive (EU) 2016/2284 on the reduction of national emission of certain atmospheric pollutants (NECD), parties/member states are requested to compile and report spatial emissions every four years starting from 2017 onwards. Member States shall report for the year x-2 national gridded data emissions by source category (GNFR) and Large Point Source emissions.

All substances referred to in paragraph 7 of the Reporting Guidelines (UNECE, 2023) shall be included: SOx as SO_2, NOx as NO_2, NH_3, BC, NMVOCs, CO, $PM_{2.5}$, PM_{10}, Cd, Pb, Hg, PAHs: benzo(a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, and indeno(1,2,3_cd)pyrene, PCDD/F, PCBs and HCB. Gridded data shall be reported using the NFR2014 reporting table: ANNEX V - Template file for gridded sector data for each of the relevant aggregated Gridding NFR sectors (GNFR), whilst emissions from Large Point Sources (LPS) shall be submitted using the NFR2014 reporting table: ANNEX VI - Template for LPS data for each relevant aggregated Gridding NFR sectors (GNFR).

12.2 Gridded emissions data

As per the provisions set out in the EMEP/EEA Air Pollutant Emissions Inventory Guidebook, emission data is to be spatially allocated in the EMEP grid with a resolution of 0.1 x 0.1 degree longitude/latitude grid. Under the EMEP domain, Malta's geographical area is covered by 10 grids, with an area of approximately 100km^2. In order to spatially disaggregate emissions, Malta downloaded the EMEP ESRI shapefile with the grid definition. No emissions are generated in Grid 0 on the islet of Filfla, noting that it is an uninhabited marine protected area and therefore no gridded emissions data shall be attributed to this particular grid.

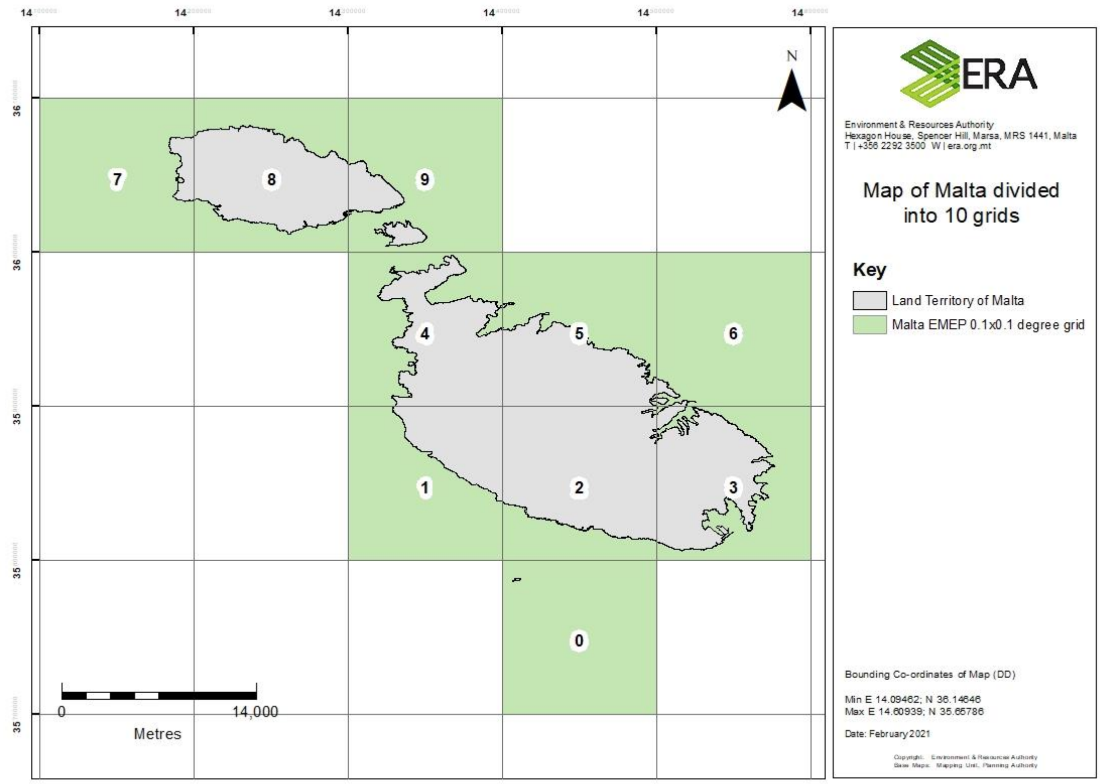

Figure 74: The Maltese Islands (grey) spatially allocated in the EMEP grid (in green)

Malta will be calculating the gridded emissions by making use of an in-house model specifically built for this purpose. This tool makes use of the emission inventory and through the use of a geographic information system (GIS) software (ArcMap 10.8.1), Malta shall estimate the proportion of emissions falling with each grid for each GNFR as per table 26 below.

12.2.1 Methods and data for disaggregation of emission data

The Maltese emission inventory covers point, line and area sources. However, where no spatial information on emission sources is available, Malta intends to assume an equal share of emissions for each grid.

Concerning point sources, emissions shall be allotted to the corresponding geographical coordinates of the sectors included in the national inventory. In this context, when gridded, the emissions resulting from this point data shall be classified under the respective grid which contains the said point data.

Emissions from area sources shall not be allocated to a particular local administrative boundary (i.e. local regions) but to the respective grid they belong to as per figure 69. Malta is making efforts to acquire spatial data for each grid and due to the small size of sectors comprising of area emissions, Malta does not foresee the need to intersect polygon data with the grids to produce a dataset of polygons contained within each grid, particularly because polygon data is not envisaged to be used. In cases where polygon data is used, Malta shall follow the guidelines stipulated in Chapter 7, Section 3.4.2 of the Guidebook.

Furthermore, line data shall only be used for *F_RoadTransport*, whereby the emissions generated from this sector are considered to be originating from diffused sources. In this context, the total emissions from road transport shall be aggregated according to each road segment using a modelling scenario provided by Transport Malta, referred to as the *Base Year 2021 scenario*. Annual average daily traffic shall be provided in such dataset and this shall therefore be used to determine the road transport derived emission, distributed within each grid cell.

The various spatial dataset shapefiles (point, line, area) used for the compilation of the gridded emission inventory shall be inputted into a geographic information systems (GIS) software (ArcMap 10.8.1) superimposed on the EMEP Grid shapefile (0.1° x 0.1° longitude/latitude). An exhaustive list of all the GNFR categories and the NFR codes used for the reporting of the 2025 gridded emission data for year 2023 as well as a summary of the intended methodology to be used for such gridded emission reporting, will be presented in due time with the submission of the gridding inventory in May.

12.3 Large Point Sources (LPS) Data

Information providing Large Point Sources (LPS) refers to the industrial units considered individually in Malta's inventory. Emissions from LPS shall be submitted using the ANNEX VI - Template for LPS data for each relevant aggregated Gridding NFR sectors (GNFR) (UNECE, 2023).

13. References

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14. Annex I – Key Category Analysis

Table 154: Key Category Analysis

Pollutant	NFR	Long Name	% Share	% Sum
NO_x (as NO_2)	1A3biii	Road transport: Heavy duty vehicles and buses	17.7%	17.7%
	1A3bi	Road transport: Passenger cars	14.8%	32.5%
	1A3dii	National navigation (shipping)	13.6%	46.1%
	1A1a	Public electricity and heat production	11.9%	58.0%
	1A3bii	Road transport: Light duty vehicles	9.1%	67.1%
	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	6.0%	73.1%
	1A5b	Other, Mobile (including military, land based and recreational boats)	5.8%	78.9%
	1A4ciii	Agriculture/Forestry/Fishing: National fishing	5.2%	84.1%
NMVOC	2D3h	Printing	13.1%	13.1%
	2D3d	Coating applications	13.0%	26.1%
	1A3bv	Road transport: Gasoline evaporation	12.1%	38.2%
	2D3a	Domestic solvent use including fungicides	10.9%	49.0%
	1A3bi	Road transport: Passenger cars	9.2%	58.2%
	1A3biv	Road transport: Mopeds & motorcycles	5.2%	63.5%
	1A5b	Other, Mobile (including military, land based and recreational boats)	4.4%	67.9%
	3Da2a	Animal manure applied to soils	4.1%	72.0%
	1B2av	Distribution of oil products	3.7%	75.7%
	2D3e	Degreasing	3.4%	79.2%
	2H2	Food and beverages industry	3.2%	82.3%
SO_x (as SO_2)	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	29.0%	29.0%
	1A4ai	Commercial/Institutional: Stationary	23.6%	52.7%
	1A1a	Public electricity and heat production	13.9%	66.6%
	1A5b	Other, Mobile (including military, land based and recreational boats)	7.4%	74.0%
	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	7.3%	81.3%
NH_3	3Da2a	Animal manure applied to soils	35.9%	35.9%
	3Da1	Inorganic N-fertilizers (includes also urea application)	10.6%	46.6%
	3B1a	Manure management - Dairy cattle	10.5%	57.0%
	3B3	Manure management - Swine	9.7%	66.7%
	3B4h	Manure management - Other animals (Rabbits)	8.5%	75.2%

	3B1b	Manure management - Non-dairy cattle	6.2%	81.4%
$PM_{2.5}$	2A5b	Construction and demolition	18.9%	18.9%
	1A5b	Other, Mobile (including military, land based and recreational boats)	16.0%	34.9%
	1A3bvi	Road transport: Automobile tyre and brake wear	12.4%	47.3%
	1A3bii	Road transport: Light duty vehicles	6.3%	53.6%
	2G	Other product use (please specify in the IIR)	5.9%	59.5%
	1A3bi	Road transport: Passenger cars	5.0%	64.5%
	1A4bi	Residential: Stationary	5.0%	69.5%
	2D3b	Road paving with asphalt	4.7%	74.1%
	1A3biii	Road transport: Heavy duty vehicles and buses	4.7%	78.8%
	1A3bvii	Road transport: Automobile road abrasion	4.4%	83.2%
PM_{10}	2A5b	Construction and demolition	46.0%	46.0%
	2D3b	Road paving with asphalt	22.7%	68.8%
	1A3bvi	Road transport: Automobile tyre and brake wear	6.1%	74.9%
	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	5.6%	80.5%
TSP	2D3b	Road paving with asphalt	46.8%	46.8%
	2A5b	Construction and demolition	41.8%	88.5%
BC	1A5b	Other, Mobile (including military, land based and recreational boats)	22.1%	22.1%
	1A3bii	Road transport: Light duty vehicles	16.2%	38.3%
	1A3bi	Road transport: Passenger cars	14.0%	52.3%
	1A3biii	Road transport: Heavy duty vehicles and buses	11.5%	63.8%
	1A3bvi	Road transport: Automobile tyre and brake wear	10.4%	74.2%
	2G	Other product use (please specify in the IIR)	7.7%	81.7%
CO	1A3bi	Road transport: Passenger cars	55.0%	55.0%
	1A3biv	Road transport: Mopeds & motorcycles	11.8%	66.9%
	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	7.8%	74.7%
	1A5b	Other, Mobile (including military, land based and recreational boats)	7.0%	81.6%
Pb	1A3bvi	Road transport: Automobile tyre and brake wear	74.5%	74.5%
	2G	Other product use	19.1%	93.5%
Cd	2G	Other product use	51.6%	51.6%
	1A3bvi	Road transport: Automobile tyre and brake wear	26.8%	78.5%
	1A4bi	Residential: Stationary	8.9%	87.4%
Hg	1A3bi	Road transport: Passenger cars	38.1%	38.1%

	1A1a	Public electricity and heat production	12.1%	50.2%
	1A5b	Other, Mobile (including military, land based and recreational boats)	9.3%	59.5%
	1A3dii	National navigation (shipping)	8.5%	67.9%
	1A3biii	Road transport: Heavy duty vehicles and buses	7.2%	75.2%
	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	7.1%	82.3%
As	1A3bvi	Road transport: Automobile tyre and brake wear	56.8%	56.8%
	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	12.9%	69.8%
	1A4ai	Commercial/Institutional: Stationary	6.6%	76.4%
	1A1a	Public electricity and heat production	5.2%	81.5%
Cr	1A3bvi	Road transport: Automobile tyre and brake wear	80.4%	80.4%
Cu	1A3bvi	Road transport: Automobile tyre and brake wear	97.1%	97.1%
Ni	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	60.8%	60.8%
	1A4ai	Commercial/Institutional: Stationary	28.3%	89.1%
Se	1A3bvi	Road transport: Automobile tyre and brake wear	36.8%	36.9%
	5C1bv	Cremation	28.5%	65.4%
	1A5b	Other, Mobile (including military, land based and recreational boats)	15.8%	81.9%
Zn	1A3bvi	Road transport: Automobile tyre and brake wear	86.9%	86.9%
PCDD/PCDF (dioxins/furans)	2G	Other product use	28.5%	28.5%
	5E	Other waste	18.5%	47.0%
	1A3bi	Road transport: Passenger cars	17.4%	64.3%
	3F	Field burning of agricultural residues	10.2%	74.6%
	1A4bi	Residential: Stationary	5.3%	79.9%
	1A3bii	Road transport: Light duty vehicles	5.3%	85.2%
benzo(a)pyrene	5C1bv	Cremation	44.2%	44.2%
	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	26.2%	70.4%
	1A4ai	Commercial/Institutional: Stationary	12.0%	82.5%
benzo(b)fluoranthene	5C1bv	Cremation	53.8%	53.8%
	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	21.6%	75.5%
	1A4ai	Commercial/Institutional: Stationary	9.7%	85.1%
benzo(k)fluoranthene	5C1bv	Cremation	45.4%	45.4%

	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	26.8%	72.2%
	1A4ai	Commercial/Institutional: Stationary	11.3%	83.5%
Indeno (1,2,3-cd)pyrene	5C1bv	Cremation	69.0%	69.0%
	1A2gviii	Stationary combustion in manufacturing industries and construction: Other	11.7%	80.7%
HCB	5C1bv	Cremation	95.2%	95.2%
PCBs	1A5b	Other, Mobile (including military, land based and recreational boats)	34.7%	36.2%
	1A3dii	National navigation (shipping)	31.7%	66.3%
	5C1bv	Cremation	15.9%	82.2%

15. Annex II – TERT and CLRTAP Questions

Below is a list of questions that Malta received from the TERT reviewers in 2023 for reference year 2021. Malta took note of the suggestions and concerns that the TERT highlighted and carried out improvements to the relevant sectors accordingly in this year's emission inventory submission.

TERT questions

Sector	ID	TERT recommendation for the issue identified	Replies
Agriculture	MT-3Da1-2023-0003	For 3Da1 Inorganic N-fertilizers NH3 and NOx 1990-2022 the TERT notes that activity data given in the NFR tables is not consistent with numbers registered in the GHG emission inventory CRF Table 3D (see attached Excel spreadsheet "NEC2024_MT-3Da1-2023-0003"). This was raised during the 2023 NECD inventory review. This over/under-estimate may have an impact on total emissions that is above the threshold of significance. The TERT notes that there might be shifts in between the years (e.g. same numbers for 2007 in CRF and 2009 in NFR). Please provide further justification for your current estimate and explain the difference between NFR and CRF or provide a revised estimate that resolves the potential over/under-estimate. You may also wish to provide evidence in case you consider that the impact of the over/under-estimate is below the threshold of significance	The activity data presented within the NFR submission was taken from the model utilised for the CRF submission. The emission inventory compilers for the NFR submission communicated with the emission inventory compilers for the CRF submission and ascertained that the activity data utilised for the NFR submission was the latest available data.
Agriculture	MT-3Da1-2023-0002	For 3Da1 NH3 and NOX 1990-2022, the TERT notes that implied emission factors (IEF) calculated from data reported under the NFR tables show IEF equal to the default given in EMEP/EEA Guidebook 2023 (0.085 for NH3 and 0.040 for NOX) for the years 1990-2021, but for the year 2022 IEF are increased to 0.092 for NH3 and 0.043 for NOX. Can you explain why the emission factors change in 2022?	The emissions for 2022 for NOx and NH3 have been revised and they are now 0.076144kt and 0.161806kt respectively, with the activity data remaining the same. Hence, the IEF is now consistent across the entire time series.

Waste	MT-5E-2022-0001	For PM10 and PM2.5 from 5E t and years 2005, 2020, 2021 and 2022 the TERT notes that in the IIR, page 145 table 129 there is a lack of transparency regarding the 2005 activity data. This does not relate to an over- or under-estimate of emissions. This (number of fires for each category and the repartition used to split the number of houses/apartments fires between apartment, detached house and undetached house) was raised during the 2022 and 2023 NECD inventory review. In response to a question raised during the 2023 review, Malta indicated that it will provide the respective values for 2005 and the 3 latest reporting years in the 2024 IIR. The TERT notes that the activity data for 2005 is missing in table 129. Can Malta please explain why the 2005 activity data isn't reported as done for 2020, 2021 and 2022 and how this will be corrected in the 2025 submission?	. The total number of fires for 2005 have been included in the 2025 IIR submission.
Waste	MT-5C1bv-2024-0001	For category 5C1bv SO2 and years 2020 and 2021 the TERT notes that there may be an under estimate of emissions. This under estimate may have an impact on total emissions that is above the threshold of significance. The TERT notes that this under estimate may be due to not updating the emission factors for 2020 and 2021 to match those for 2022. Please provide further justification for your current estimate of the 2020 and 2021 SO2 emissions or provide a revised estimate that resolves the potential under estimate. You may also wish to provide evidence in case you consider that the impact of the over estimate is below the threshold of significance.	During the compilation of the 2023 activity data and the revision of annual loads reported by the operator, obtained through the Continuous Emissions Monitoring System (CEMS), the sectoral expert noticed that, since 2016, SO_2, among other pollutants, had been erroneously considered as periodic monitoring instead of continuous monitoring. This means that emission calculations were previously based on one or two instances of flue gas monitoring per year rather than on average monthly readings from the continuous monitoring system. To better reflect accurate trends and improve emission estimates from 2016 onwards, recalculations for this sector were carried out and are described in the recalculations section of chapter 5C1bv. The revised methodology uses the monthly average concentration per pollutant (as reported by the operator, in mg/m^3), multiplied by the flow rate (m^3/h) and the operating hours per year, resulting in total emission loads expressed in kg/year.

			These recalculations address the TERT question concerning the underestimation of SO_2 emissions for 2020 and 2021, as well as the sudden increase in 2022, now presenting a more reasonable trend. .
Waste	MT-5B1-2023-0001	For 5B1 and NH3 and years 2007-2023 the TERT finds the justification in the IIR for the use of the notation key "NO" not fully adequate. This issue was raised in the 2023 NECD review. The TERT notes that in the IIR only is mentioned that the activity stopped in 2006 without any explanation on what's done with the waste stream after the biological treatment plant stopped. Can Malta please explain where the organic waste that used to be composted is treated after 2006 and add this as additional justification to the IIR in the next submission.	As described in the 2025 IIR submission, under the 5B1 sector, the composting plant in Malta operated from 1993 until early 2007. Between the decommissioning of the composting plant in 2007 and the commissioning of the new Anaerobic Digestion plant in 2010, no large-scale biological treatment of solid waste was operational in Malta. During this period, organic waste, as part of mixed municipal waste (collected without separation), was directly landfilled. .
Agriculture	MT-3Da2a-2022-0002	For 3Da2a Animal manure applied to soils, NH3 and NOx, 1990-2022, the TERT notes that during the review in 2022 a potential over/under estimate exceeding the threshold of significance were identified. During review 2023 Malta provided the N-flow tool and the TERT noted differences of N2O from the N-flow tool with the reported emissions in the CRF. Malta explained this due to differences between the methodologies used to calculate greenhouse gases and air pollutants. The TERT recommended that Malta report the total amount of N from manure applied to soils as activity data in the NFR and explain the differences between numbers reported in the NFR and CRF in the IIR in submission 2024. In the current review 2024, the TERT notes that seemingly again animal numbers are reported in the NFR 2024 (column AK, row 113) instead of the total amount of N from manure applied to soils (no information on units are given in the NFR). Additionally, no numbers on the N amounts	Malta had initially updated the N-flow tool with the updated parameters provided by the TERT during 2024 review. However, Malta has communicated with the compilers of the CRF submission and updated the activity data for Nex, animal heads, weight etc. in line with the latest data used by the CRF emission inventory.

		applied to soils are included in the IIR 2024. The TERT acknowledges the efforts undertaken by Malta in order to exercise QAQC procedures for this source category as described in the IIR 2024 (page 118), however no information is included explaining the differences between NFR and CRF as recommended during review 2023.	
IPPU	MT-2-2022-0001	For 2D3g Chemical products, for 1990-2022, for NOx, SOx, CO, NH3, PM10, PM2.5, BC, all heavy metals and all POPs the TERT notes that in the IIR there is a lack of transparency regarding the non estimate for NMVOC emissions, i.e. there is not any information included in the IIR for this category, while the TERT would expect a rationale for using the notation key 'NE' and the 'efforts will be made to rectify this situation in future submissions if data becomes available', as stated during the 2022 review. This was raised during the 2022 and 2023 NECD inventory review. The TERT is unable to determine whether there is an over/under-estimate that may be above the threshold of significance. Please provide further clarification of the use of notation key NE and the efforts made to rectify the non estimate for NMVOC emissions for this category.	Based on research conducted by sectoral experts, it has been confirmed that the following processes do not occur in Malta: polyurethane and polystyrene foam processing, bitumen blowing, tire manufacturing, and the production of inks and adhesives. While the manufacturing of paints, the extraction of fats and oils, and the industrial application of adhesives may potentially take place in Malta, there is currently no available data to substantiate this. This sector will be updated accordingly in future submissions if relevant data becomes available.
IPPU	MT-2D3g-2022-0001	This issue is related to issue MT-2-2022-0001. For 2D3g Chemical products, for 1990-2022, for NMVOC the TERT notes that in the IIR there is a lack of transparency regarding the non estimate of emissions, i.e. there is not any information included in the IIR for this category, while the TERT would expect a rationale for using the notation key 'NE' and the 'efforts will be made to rectify this situation in future submissions if data becomes available', as stated during the 2023 review. This was raised during the 2022 and 2023 NECD inventory review. The TERT is unable to determine whether there is an over/under-estimate that may be above the threshold of significance. Please provide further clarification of the	As per the reply provided for question relayed in MT-2-2022-0001, sectoral experts cannot provide revised emissions estimates for 2D3g at this time since no activity data is available. Efforts will be made to provide estimates for this sector in future submissions provided that this data becomes available.

		use of notation key NE and the efforts made to rectify the non estimate for NMVOC emissions for this category.	
IPPU	MT-2D3i-2023-0001	For 2D3i Other solvent use, NMVOC, 1990-2022 the TERT notes that in NFR table the notation key NE has been used but without further explanation on the efforts made to provide an estimate in the IIR. This was raised during the 2023 NECD inventory review. The TERT is unable to determine whether there is an over/under-estimate that may be above the threshold of significance. Please provide further clarification of how emissions for this category will be estimated and why this has not been included in the IIR.	According to research carried out by sectoral experts, activities such as oil extraction and the application of glues and adhesives may potentially occur within Malta. Efforts will be made to estimate emissions from this sector in future submissions, provided that reliable activity data can be obtained.
Waste	MT-5C2-2022-0001	For 5C2 Open burning of waste, SO2, NOx, NH3, NMVOC, PM2.5, PM10 and TSP for all years, the TERT noted that there could be an underestimate of emissions. Malta only includes the arable area in the estimate. However, the 2019 EMEP/EEA Guidebook also identifies orchards residues and forest residues in this 5C2 category. During the 2022 and 2023 NECD reviews, the TERT asked Malta to provide information on how orchard residues and forest residues are considered in the inventory and if there is any regulation to ban the burning of these residues in the country with the date of the legislation. Malta indicated that the sectoral experts considers that burning of orchard and forest residues does not occur within the Maltese Islands and hence, no activity data are available. The TERT noted that the issue is expected to be below the threshold of significance for a technical correction. In the 2023 review the TERT recommended that Malta investigate further and provide more information in the 2024 IIR about the types of waste not included in the estimate and in support of the statement about the lack of burning of waste from vineyards, fruit and olive orchards and, for example, the effective date of legislation that bans open burning or explain what is commonly done with the waste from renewal and pruning the trees and vines. The TERT notes that the current text	Forest residues do not occur within the Maltese Islands. Regarding orchards, sectoral experts have contacted various entities and verified that not all orchard waste is burned. Instead, these residues are managed in different ways, including: disposal in landfills under EWC 20 02 01, shredding on-site and reincorporation into the soil (e.g., prunings from vines), provision to fireworks factories for conversion into explosive powder, which is subsequently burned. However, since these activities occur on a small scale and are not subject to formal approvals or reporting obligations, no reliable data is currently available. The land area for orchards (permanent crops) is now considered under this sector, and the Tier 1 methodology and assumptions used are further described in the 2025 IIR.

		in the IIR contains only an unsupported statement on this. Please provide additional support to the current text in the IIR regarding with regard the absence of open burning from orchard (pruning)wastes (but also other possible missing sources).	
IPPU	MT-2G-2023-0001	For 2G Other product use, 1990-2022, SO2, NOX, NH3, NMVOC, PM2.5, PM10 the TERT notes that in there is a lack of transparency regarding the concrete values of the activity data. This was raised during the 2023 NECD inventory review. Please provide further clarification of the activity data used by providing an overview of the values used per firework and tobacco activity and how they are combined with the emission factors to come to the estimate provided in the 2024 submission and clarify whether the information will be included in the next IIR.	Activity data, emission factors and final calculated emissions for 2005 and the 3 latest reporting years can be found attached. Within the 2025 IIR, a table showing the activity data of 2005 and the 3 latest reporting years was included.
IPPU	MT-2D3e-2022-0001	For 2D3e Degreasing, NMVOC, 1990-2022 the TERT notes that in there may be an over/under-estimate of emissions. This was raised during the 2022 and 2023 NECD inventory review. The TERT notes that Malta has reported Tier 1 estimates this year for the first time (in response to last year's PTC). Now the TERT concludes that Malta should move to a Tier 2, because this is a key category. In the IIR the TERT did not retrieve reference to a planned improvement to overcome this issue. The TERT asks Malta what steps it considers to move to a Tier 2 method, e.g. could Malta investigate whether less solvent paints are used or abatement measures are in operation, that could be taken into account in the Tier 2 methodology. This over/under-estimate may have an impact on total emissions that is above the threshold of significance. Please provide further justification for your current estimate or provide a revised estimate that resolves the potential over/under-estimate. You may also wish to provide evidence in case you consider that the impact of the over/under-estimate is below the threshold of significance.	MT's sectoral experts have determined that the PTC may not lead to more accurate emission estimates for the 2D3e category. The suggested methodology introduces additional assumptions that, in our specific context, may not be realistic or substantiated. It is important to note that, unlike Italy, Malta relies on EUROSTAT data rather than information from industrial associations. Our activity data exhibits a different trend compared to Italy's, with Malta's solvent use showing an increase in recent years. Italy's IIR states that "it has been assumed that the percentage of NMVOC emissions remains constant" and hence Malta's experts disagree that Malta should take the same approach mainly because there is no data that can support such a claim and are thus not in favour of the use of this PTC in the review report. As previously communicated, we have planned capacity-building efforts in the near future, which will inform improvements in this sector.

Energy	MT-1B2av-2022-0001	The TERT notes that, according to the IIR, the recommendation from the NECD 2023 review was not included in the list of improvements. What is the current status of the implementation of the recommendation?	This sector was estimated at a Tier 2 level in the 2025 NFR submission.

CLRTAP questions

Sector	ID	CLRTAP questions	Malta reply
IPPU	1	The ERT observed significant dips for reported 2.D.3.d NMVOC emissions between 1999/2000, and 2006/2007; also, from 2013 to 2022 there is a continuous increase, emissions in 2022 are about 3 times higher than from 2007-2014 where emissions were rather constant, although emission factors applied (Table 63 of the IIR2024) decreased significantly. The reasons for these notable inter-annual variations and the trend of the time series are not described in the IIR. Could you please briefly explain the main reasons for these notable inter-annual variations and the overall trend?	The significant dips identified for NMVOC emissions between 1999/2000 and 2006/2007 are due to the respective changes in emission factors. In 1999, the emission factor stood at 165.46 g/kg, followed by 137.58 g/kg for both 2000 and 2006. Subsequently, in 2007, the emission factor notably decreased to 61.08 g/kg, consistently reflecting the findings of an EU-wide EGTEI study provided within the 2.D.3 Additional Guidance: Solvent and Product Use document which is part of the 2023GB. The overall increase in emissions from 2013 to 2022 is due to the general increase in imported quantities of the various PRODCOM codes indicated within the IIR. The data utilised is sourced from EUROSTAT.
IPPU	2	According to the IIR2024 p79, the sub category 2.G covers emissions from firework and tobacco, and Table 68 and Figure 26 indicate that no NMVOC emissions arise from this category. However, in the NFR tables NMVOC emissions are reported (0,0025 kt NMVOC in 2022 for Category 2.G). Could you please clarify what the reported NMVOC emissions refer to?	Sub category 2.G amounts to 0.094% of the national total for NMVOC. The value is too low to be visible within Figure 26. Table 68 only includes information on the Key Categories of the particular sub category, since sub category 2.G is not a Key Category of NMVOC this was not included within this table.

IPPU	3	1.The ERT noted with reference to the data reported in the NFR tables that NMVOC emissions from 2D3a domestic solvent use including fungicides do not show a peak during the COVID-19 pandemic. Does Malta plan to consider the increased use of hand sanitizers for the NMVOC emission estimates for 2D3a domestic solvent use? 2. The ERT noted that categories listed in the IIR p. 65f do not include 20.20.14 codes which include desinfectants. Could you please check?	1.MT utilises EUROSTAT import and export data for sub category 2D3a, hence any increase due to the COVID-19 pandemic should immediately impact the import values emanating from this data source. The methodology utilised within MT's emission inventory assumes that all the products destined for use in Malta are sold and utilised within a period of 5-years. This assumption may have made the increase use of hand sanitizers during the COVID-19 pandemic less apparent. Notwithstanding, the unmodified EUROSTAT data does not show a major increase in solvent use during the COVID-19 pandemic as the following figures show: 2018 - 16.63kt, 2019 - 15.56kt, 2020 - 16.83kt, 2021 - 15.35kt, 2022 - 14.60 kt. 2.MT does not currently include the 202014 codes and lacks the necessary emission factors to calculate emissions resulting from the use of disinfectants. Nevertheless, when extracting the 202014 codes, namely 20201430, 20201450, and 20201490, from the EUROSTAT database, no import/export/production quantities are available for Malta. The available data solely pertains to import/export/production monetary values, which cannot be directly converted to quantities. Could the ERT provide guidance on a potential approach to convert import/export/production values to import/export/production quantities and recommend possible emission factors for use within this sector.
IPPU	4	The ERT noted that for NMVOC emissions from 2.D.3.d Coating applications the emission factors applied are not transparently referenced in the IIR. Could you please provide a clear reference to the EF presented in Table 63 of the IIR 2024?	The emission factors have been sourced from Table 10 of the 2.D.3 Additional Guidance: Solvent and Product Use document which is part of the 2023GB.
IPPU	5	1.The ERT noted that Malta estimates NMVOC emissions from 2.D.3.d Coating applications with a modified Tier 1 approach (equation on page 15 of the Chapter on 2.D.3.d Coating applications of the 2023 EMEP/EEA Guidebook:	1.Currently MT does not have the required data to estimate this sector as per the Guidebook Tier 2 methodology. Efforts will be made to estimate this sector in accordance with the

		Emissions = AD * EF), using an european wide emission factor changing over time. The Tier 1 methdology of the GB would consider different EF for different sub categories (decorative, industrial and other paint application), whereas no differentation was made in the calculation by Malta. The Tier 2 methodology of the GB does consider technological dependant parameters for the calculation, which is not considered in the calculation by Malta. Therefore the ERT interprets that the applied calculation can not be considered as a Tier 2 methodology. Please note that this category is a key category for NMVOC emissions, thus a Tier 2 approach should be applied. Does Malta plan to implement a Tier 2 approach using technological dependent parameters in future submissions? 2. According to the Industrial Emissions Directive 2010/75/EU installations using solvents over a certain threshold have to monitor their solvent emissions, and provide a solvent management plan to the compentent authority upon request to verify compliance with the requiremens of their permit (Article 62). Has Malta tried to access this data from the competent authority for use in inventory preparation?	aforementioned methodology provided that reliable activity data becomes available. 2.MT is presently exploring methods by which the sectoral experts can optimize the utilization of data emanating from the IED. Capacity building efforts are planned in the near future.