Comhairle Cathrach
& Contae **Luimnigh**

Limerick City
& County Council

Air Quality Report for Limerick

March 2023

Introduction

Limerick City and County Council currently has air quality monitors operating at three locations in the metropolitan area of Limerick to provide live indicative air quality data to the public. These monitors are located in Mungret, Castletroy and O'Connell Street.

The particulate air quality monitors at Castletroy, Mungret and O'Connell Street and the gas monitors at Castletroy, Mungret and O'Connell Street were removed on the 8th March 2023 for return to the manufacturer, Turnkey Instruments Ltd, in the UK for service and calibration.

A replacement particulate monitor was installed at Mungret on the 8th March but it is not possible for it to be publicly online.

The monitors measure particulate matter and gases, including nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and ozone (O_3). Real time data from these monitors can be accessed at www.airqweb.com.

The following report is a presentation of the results of that monitoring.

Particulate matter

Particulate matter (PM) which is commonly used as an indicator of dust particles in air, including total suspended particulates, PM_{10}, $PM_{2.5}$ and PM_1.

PM_{10} is particulate matter 10 microns or less in diameter, $PM_{2.5}$ is particulate matter 2.5 microns or less in diameter and PM_1 is particulate matter 1 micron or less. $PM_{2.5}$ is generally described as fine particulates. As a comparison, the width of a human hair is around 100 microns so approximately 40 $PM_{2.5}$ will fit along its width.

The particulate matter indices that are of primary concern for human health are PM_{10}, $PM_{2.5}$ and PM_1. These are the sub-fraction of particles, which can penetrate into the alveoli (air sacs) in the lungs. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer.

Nitrogen dioxide

Nitrogen dioxide (NO_2) is produced during combustion at high temperatures with the main sources in Ireland being vehicles and power stations. Short-term exposure to NO_2 is linked to adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in asthmatics. Long-term exposure is associated with increased risk of respiratory infections in children.

Sulphur dioxide

Sulphur dioxide (SO_2) is a gas, which is formed when sulphur-containing fuels (e.g. coal and oil) are burned in power stations, domestically and elsewhere. Impacts of high concentrations of SO_2 include temporary breathing difficulties for those that suffer from respiratory conditions such as asthma. Long-term exposure to SO_2 can aggravate existing cardiovascular disease and respiratory illness.

Carbon monoxide

Carbon monoxide (CO) is a colourless gas, formed from incomplete oxidation during combustion of fuel. Outdoor sources of CO are mainly from vehicles with concentrations generally highest in areas of traffic congestion. CO enters the bloodstream through the lungs and impairs the delivery of oxygen to the body's organs and tissues. The health impact of CO concentrations in ambient air is most serious for those suffering cardiovascular disease such as angina.

Ozone

Ozone (O_3) is formed as a secondary pollutant in the troposphere from the chemical reaction of NO_x (the two pollutants nitric oxide, NO, and nitrogen dioxide, NO_2), CO and volatile organic compounds (VOCs) in the presence of sunlight. Ozone can also be present in the troposphere due to downward flux from the ozone-rich stratosphere, where it occurs naturally and has a role in absorbing harmful UV radiation. Ground-level ozone is depleted through reactions with traffic-emitted pollutants and so levels of ozone are higher in rural areas than in urban areas.

Ozone irritates the eyes, nose, throat and lungs. It can destroy throat and lung tissue leading to a decrease in lung function and respiratory symptoms such as coughing, shortness of breath, aggravated asthma and other lung diseases.

Air Quality Standards

The CAFE (Clean Air for Europe) Directive sets air quality standards for member states in Europe and has been transposed into Irish legislation by the **Air Quality Standards Regulations.** The limit values for particulates are given below.

Pollutant	Objective	Averaging Period	Limit Value	Basis of Application of the Limit Value	Limit Value Attainment Date
PM_{10}	Protection of human health	24-hours	50 µg/m^3	Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
	Protection of human health	Calendar year	40 µg/m^3	Annual mean	1 Jan 2005
$PM_{2.5}$	Protection of human health	Calendar year	25 µg/m^3	Annual mean	1 Jan 2005
	Protection of human health	Calendar year	20 µg/m^3	Annual mean	1 Jan 2020
NO_2	Protection of human health	1-hour	200 µg/m^3	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
	Protection of human health	Calendar year	40 µg/m^3	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010

SO_2	Protection of human health	1-hour	150 µg/m^3	Not to be exceeded more than 24 times in a calendar year	1 Jan 2005
	Protection of human health	24-hours	125 µg/m^3	Not to be exceeded more than 3 times in a calendar year	1 Jan 2005
CO	Protection of human health	Maximum 8-hour mean*	10mg/m^3	60% of the hourly running 8-hour averages	1 Jan 2005

**The maximum daily 8-hour mean concentration is selected by examining eight-hour running averages, calculated from hourly data.*

The World Health Organisation (WHO) provides air quality guidelines as follows:

Pollutant	Averaging period	2005 AQGs	2021 AQGs
PM_{10}	Calendar year	20 µg/m^3	15 µg/m^3
	24-hours[a]	50 µg/m^3	45 µg/m^3
$PM_{2.5}$	Calendar year	10 µg/m^3	5 µg/m^3
	24-hours[a]	25 µg/m^3	15 µg/m^3
NO_2	Calendar year	40 µg/m^3	10 µg/m^3
	24-hour[a]	-	25 µg/m^3
SO_2	24-hour[a]	20 µg/m^3	40 µg/m^3
O_3	Peak season[b]	-	60 µg/m^3
	8-hour[a]	100 µg/m^3	100 µg/m^3
CO	24-hour[a]	-	4 µg/m^3

[a] 99th percentile (i.e. 3–4 exceedance days per year).

[b] Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running- average O_3 concentration.

Note: Annual and peak season is long-term exposure, while 24 hour and 8 hour is short-term exposure.

Air Quality in March

The graphs on the following pages show the 24-hourly mean values of Total Particulates, PM_{10}, $PM_{2.5}$, PM_1, NO_2, SO_2, CO and ozone for the month of March at the three monitoring sites.

The monitoring results for particulate matter have been filtered out where the humidity at the station has been measured as greater than 85 %, as per a recommendation by the EPA[1]. The relevant air quality standards or WHO guideline values for PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO also indicated. There are no standards currently set for Total Particulates, PM_1 and ozone.

Further information on air quality and health can be found at http://www.epa.ie/air/quality/index/#d.en.51478.

The long-term mean values for particulate matter and gases (NO_2, SO_2, CO and ozone) since the monitors were installed are shown in the table below and compared with the annual mean limits and guidelines.

[1] Limerick City and County Council included humidity and temperature sensors to the monitoring suite on 24th January 2018.

Parameter	Location	Measured long term mean (µg/m³)	WHO annual mean guidelines (µg/m³)	EU CAFÉ Directive annual mean limit (µg/m³)
Total Particulates March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	20 µg/m³	None specified	None specified
	Castletroy	17 µg/m³		
	Mungret	27 µg/m³		
PM_{10} March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	14 µg/m³	20 µg/m³	40 µg/m³
	Castletroy	12 µg/m³		
	Mungret	19 µg/m³		
$PM_{2.5}$ March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	9 µg/m³	5 µg/m³	20 µg/m³
	Castletroy	8 µg/m³		
	Mungret	10 µg/m³		
PM_1 March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	5 µg/m³	None specified	None specified
	Castletroy	4 µg/m³		
	Mungret	4 µg/m³		
NO_2 March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	21 µg/m³	10 µg/m³	40 µg/m³
	Castletroy	19 µg/m³		
	Mungret	11 µg/m³		
SO_2 March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	24 µg/m³	None specified	None specified
	Castletroy	15 µg/m³		
	Mungret	14 µg/m³		
CO March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	0.20 µg/m³	None specified	None specified
	Castletroy	0.02 µg/m³		
	Mungret	0.25 µg/m³		
Ozone March 2022 – March 2023 O Connell St Castletroy Mungret	O'Connell St	47 µg/m³	None specified	None specified
	Castletroy	56 µg/m³		
	Mungret	46 µg/m³		

The maximum daily mean values for particulate matter, for March, are shown in the table below and compared with the WHO air quality guidelines where they exist.

Pollutant	Total Particulates	PM_{10}	$PM_{2.5}$	PM_1
Averaging period	**-**	**24-hours**	**24-hours**	**-**
Guideline	**None**	**45 µg/m³**	**15 µg/m³**	**None**
Maximum March '23 O'Connell Street	33 µg/m³ 06/03/23	22 µg/m³ 06/03/23	06 µg/m³ 03/03/23	03 µg/m³ 03/03/23
Maximum March '23 Castletroy	07 µg/m³ 02/03/23	04 µg/m³ 02/03/23	03 µg/m³ 03/03/23	02 µg/m³ 03/03/23
Maximum March '23 Mungret	24 µg/m³ 11/03/23	21 µg/m³ 11/03/23	19 µg/m³ 11/03/23	11 µg/m³ 11/03/23

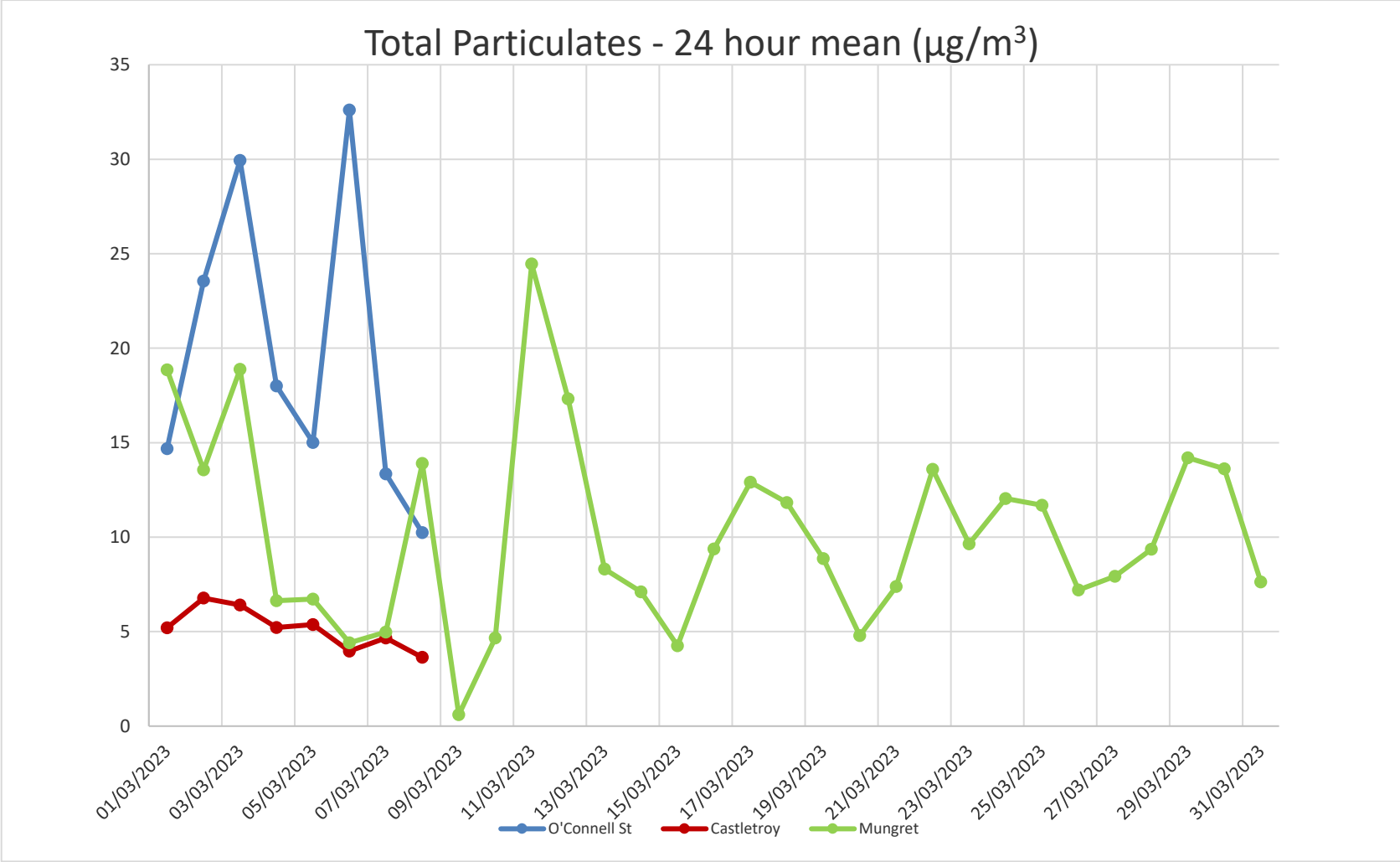
There were exceedances of the WHO guideline values for March for PM2.5 at the Mungret monitoring station on the 11/03/23

The maximum recorded short-term mean values for gases (NO_2, SO_2 and ozone), for March, are shown in the table below and compared with the WHO air quality guidelines.

Pollutant	NO_2	SO_2	Ozone
Averaging period	**1-hour**	**10-minutes**[2]	**8-hours**
Guideline	**200 µg/m³**	**500 µg/m³**	**100 µg/m³**
Maximum March '23 - O'Connell Street	64 µg/m³ *19:45 - 20:45, 02/03/23*	381 µg/m³ *08:15 - 08:30, 03/03/23*	67 µg/m³ *23:00 - 07:00, 06/03/23*
Maximum March '23 – Castletroy	43 µg/m³ *18:45 - 19:45, 02/03/23*	15 µg/m³ *20:00 -20:15, 02/03/23*	75 µg/m³ *10:30 - 18:30 08/03/23*
Maximum March '23 - Mungret	50 µg/m³ *18:45 - 19:45, 02/03/23*	94 µg/m³ *09:45 - 10:00, 02/03/23*	61 µg/m³ *10:15 - 18:15, 06/03/23*

There were no exceedances of the WHO guideline values for gases for the month of March.

[2] Measurements of SO_2 are averaged over 15-minute periods by the gas monitors. An exceedance is inferred where the measured 15-minutes average value from the gas monitors is greater than the 10-minutes WHO guideline value for SO_2.


Total Particulates - 24 hour mean (µg/m3)
35
30
25
20
15
10
5
0
01/03/2023
03/03/2023
05/03/2023
07/03/2023
09/03/2023
11/03/2023
13/03/2023
15/03/2023
17/03/2023
19/03/2023
21/03/2023
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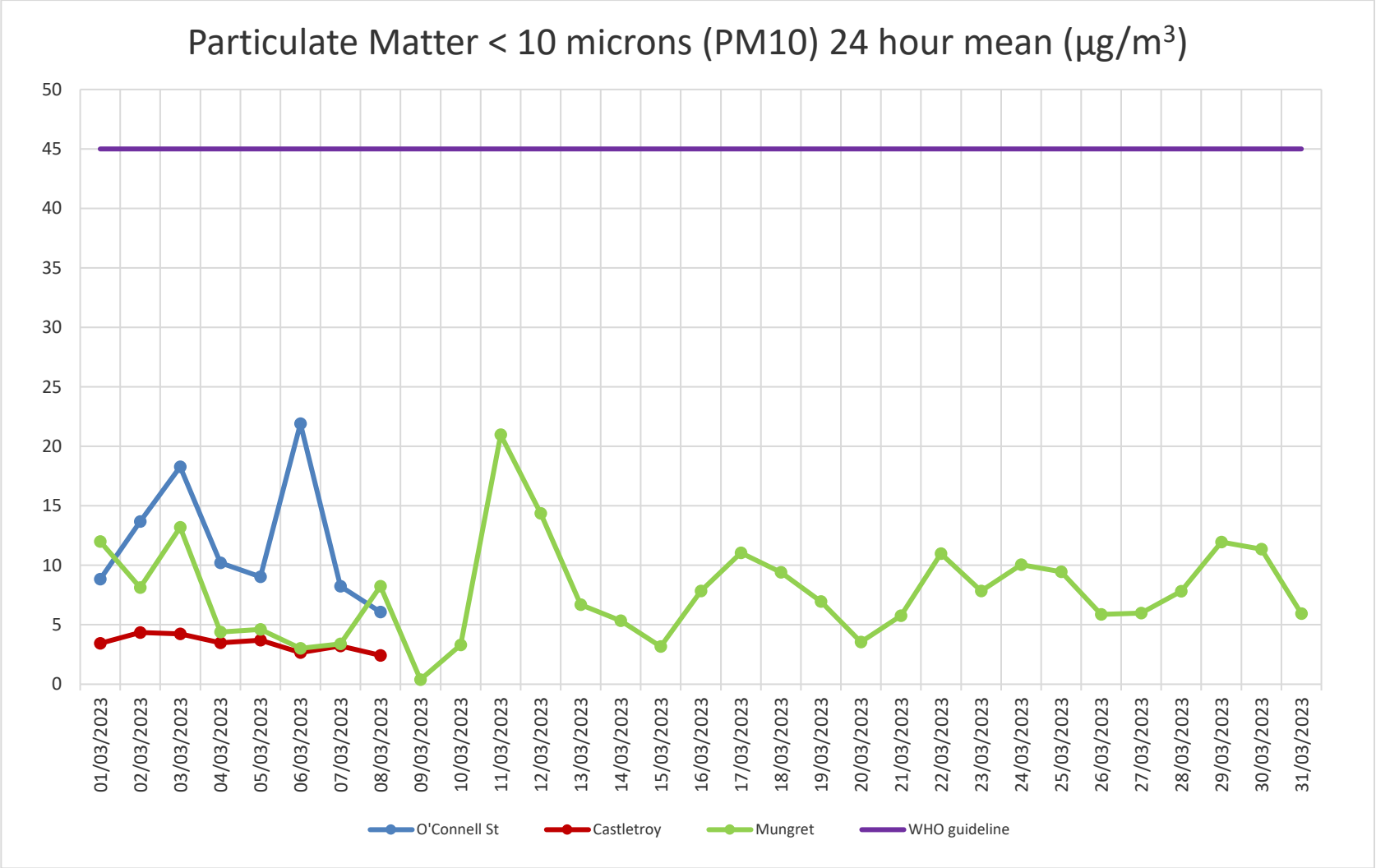
25/03/2023
27/03/2023
29/03/2023
31/03/2023
O'Connell St
Castletroy
Mungret


Particulate Matter < 10 microns (PM10) 24 hour mean (µg/m3)
50
45
40
35
30
25
20
15
10
5
0
01/03/2023
02/03/2023
03/03/2023
04/03/2023
05/03/2023
06/03/2023
07/03/2023
08/03/2023
09/03/2023
10/03/2023
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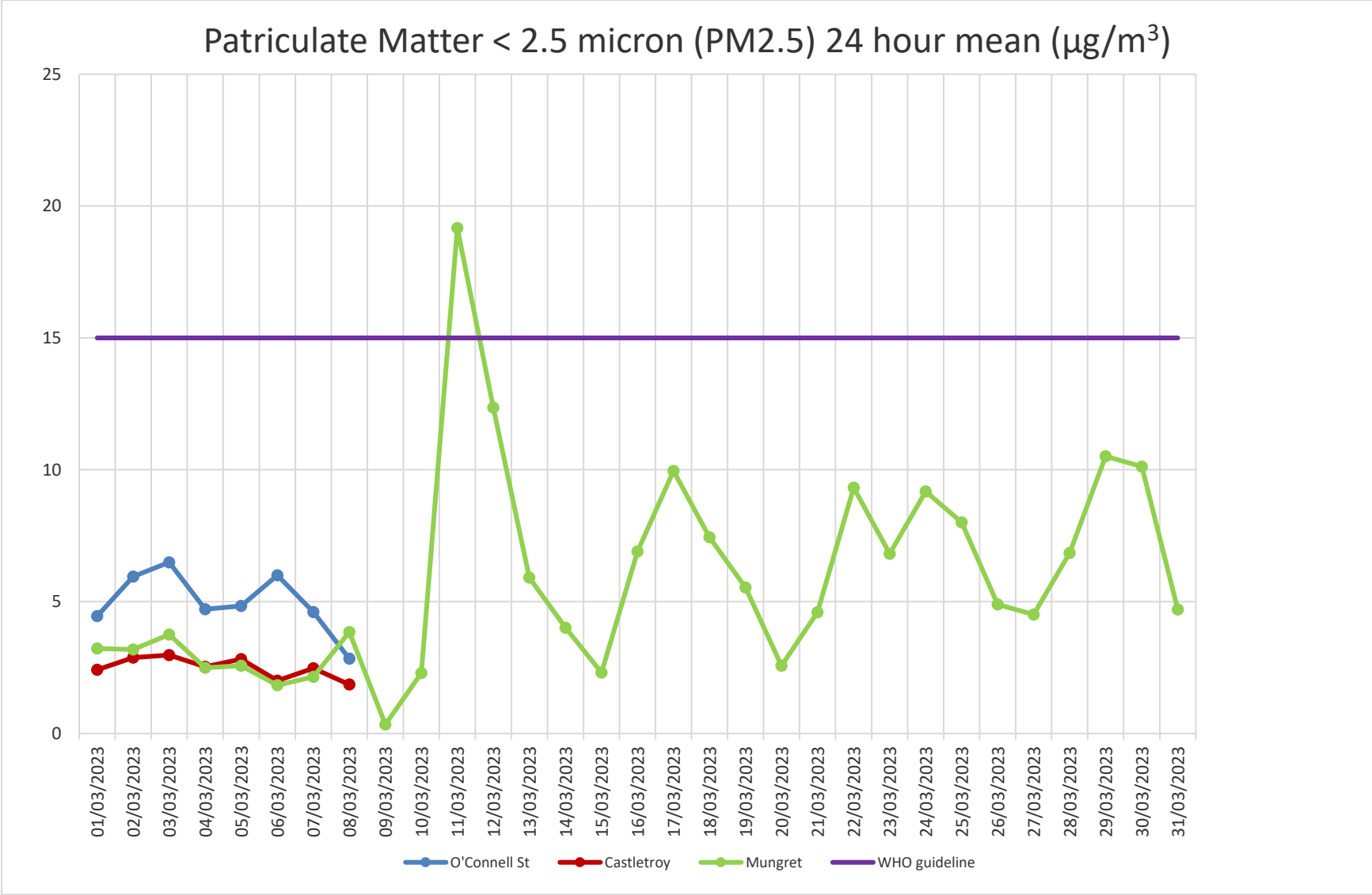
21/03/2023
22/03/2023
23/03/2023
24/03/2023
25/03/2023
26/03/2023
27/03/2023
28/03/2023
29/03/2023
30/03/2023
31/03/2023
O'Connell St
Castletroy
Mungret
WHO guideline


Patriculate Matter < 2.5 micron (PM2.5) 24 hour mean (µg/m3)
25
20
15
10
5
0
01/03/2023
02/03/2023
03/03/2023
04/03/2023
05/03/2023
06/03/2023
07/03/2023
08/03/2023
09/03/2023
10/03/2023
11/03/2023
12/03/2023
13/03/2023
14/03/2023
15/03/2023
16/03/2023
17/03/2023
18/03/2023
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31/03/2023
O'Connell St
Castletroy
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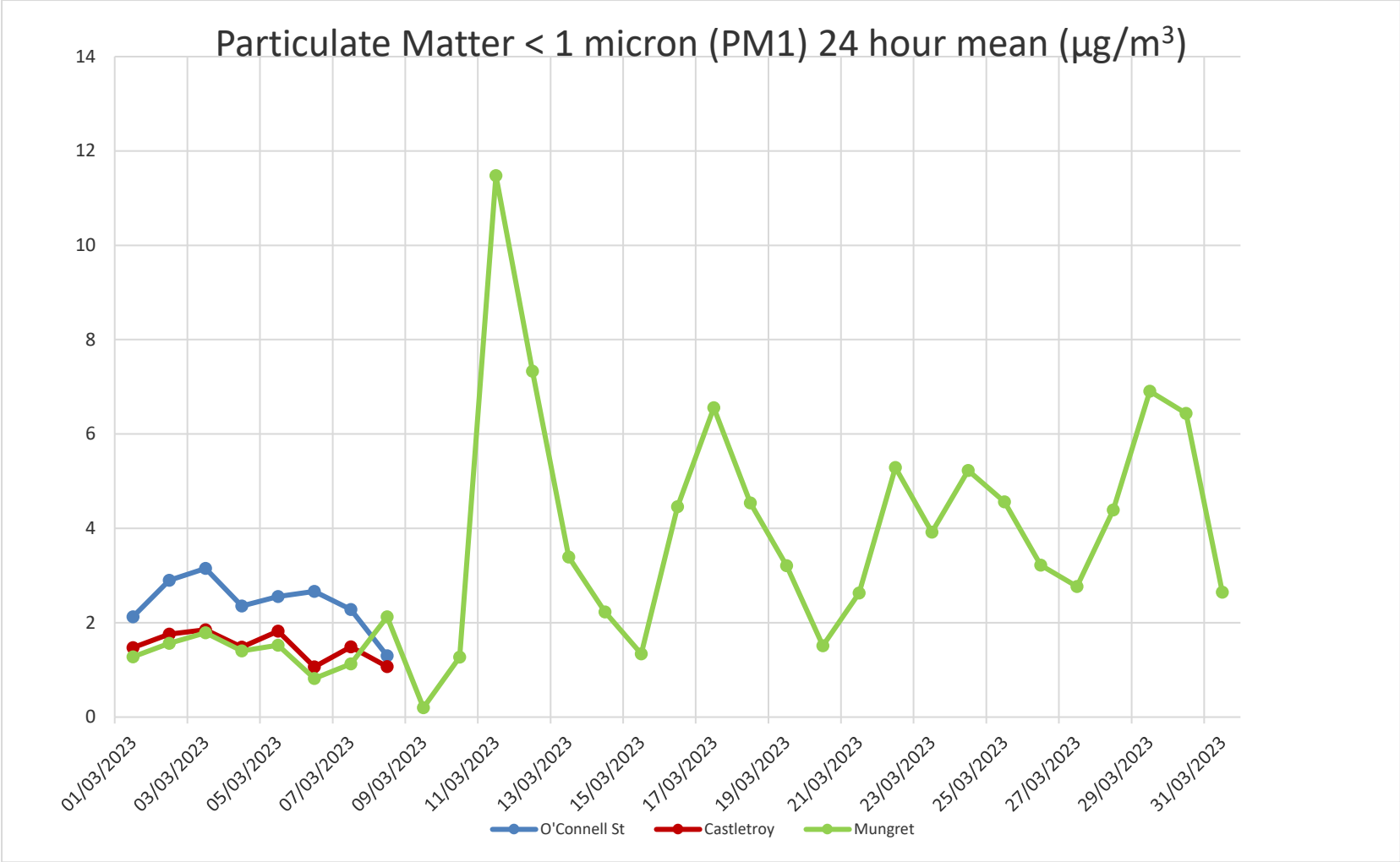
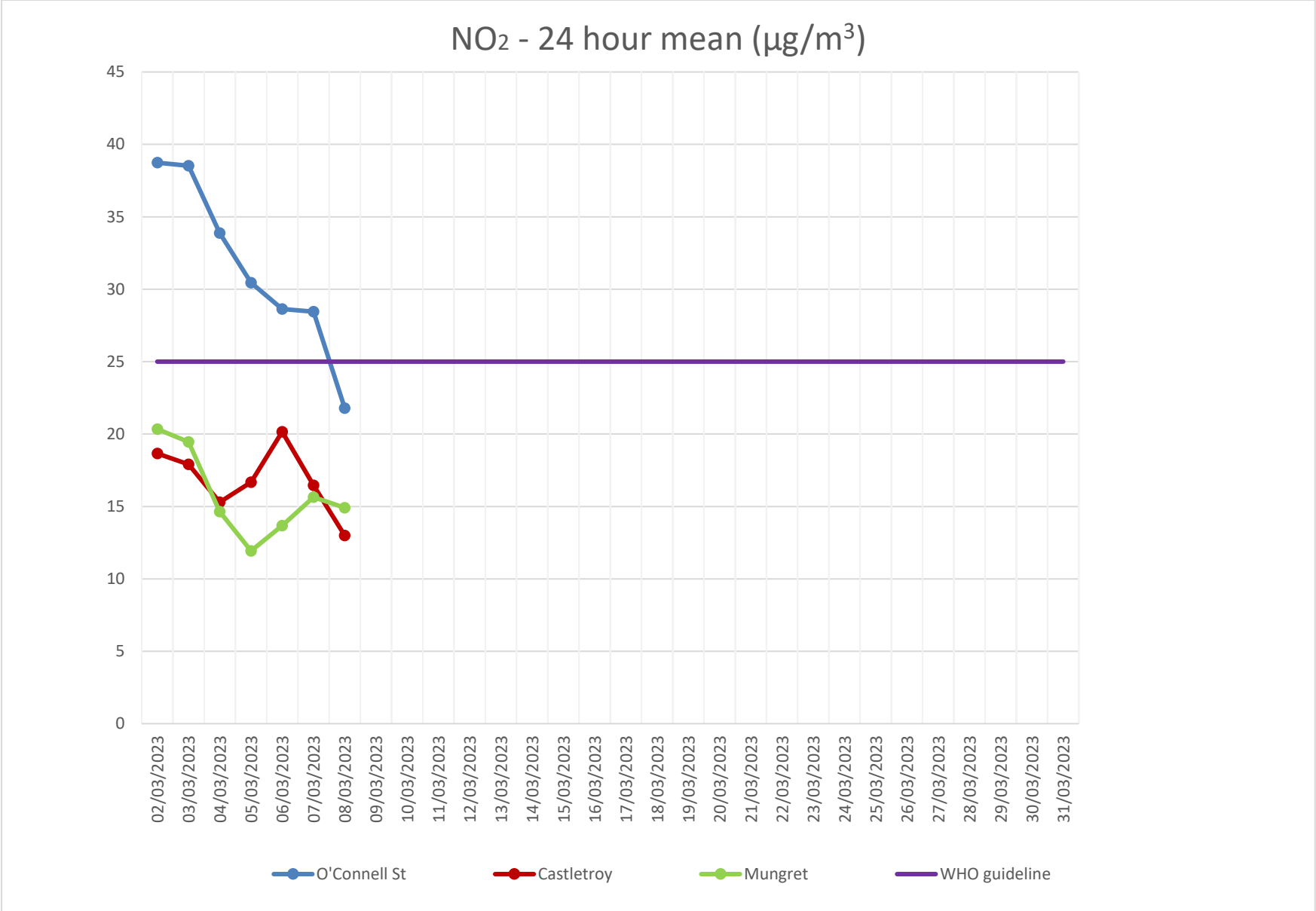

Particulate Matter < 1 micron (PM1) 24 hour mean (µg/m3)
14
12
10
8
6
4
2
0
01/03/2023
03/03/2023
05/03/2023
07/03/2023
09/03/2023
11/03/2023
13/03/2023
15/03/2023
17/03/2023
19/03/2023
21/03/2023
23/03/2023
25/03/2023
27/03/2023
29/03/2023
31/03/2023
O'Connell St
Castletroy
Mungret


NO2 - 24 hour mean (µg/m3)
45
40
35
30
25
20
15
10
5
0
02/03/2023
03/03/2023
04/03/2023
05/03/2023
06/03/2023
07/03/2023
08/03/2023
09/03/2023
10/03/2023
11/03/2023
12/03/2023
13/03/2023
14/03/2023
15/03/2023
16/03/2023
17/03/2023
18/03/2023
19/03/2023
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25/03/2023
26/03/2023
27/03/2023
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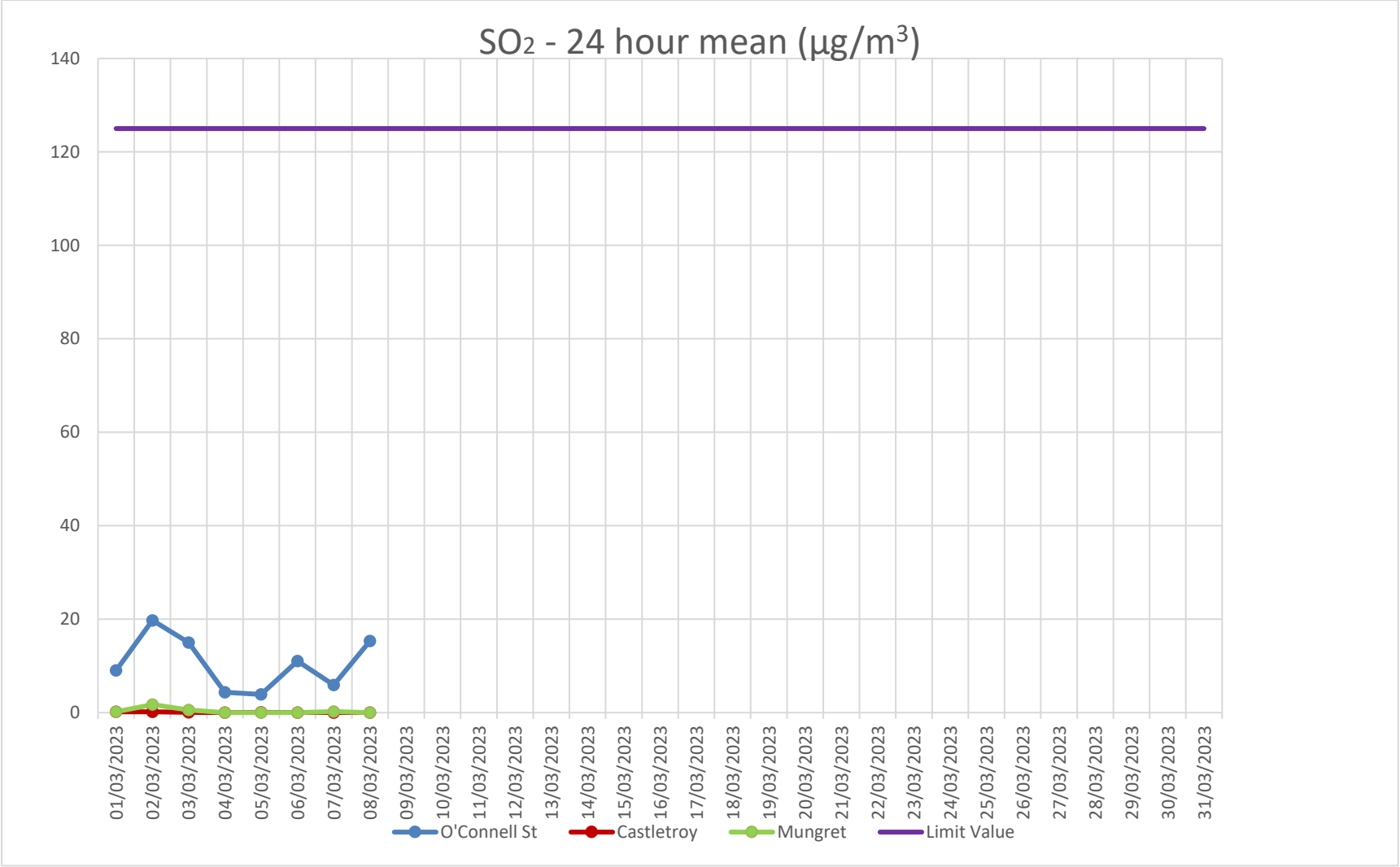
30/03/2023
31/03/2023
O'Connell St
Castletroy
Mungret
WHO guideline


SO2 - 24 hour mean (µg/m3)
140
120
100
80
60
40
20
0
01/03/2023
02/03/2023
03/03/2023
04/03/2023
05/03/2023
06/03/2023
07/03/2023
08/03/2023
09/03/2023
10/03/2023
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15/03/2023
16/03/2023
17/03/2023
18/03/2023
19/03/2023
20/03/2023
21/03/2023
22/03/2023
23/03/2023
24/03/2023
25/03/2023
26/03/2023
27/03/2023
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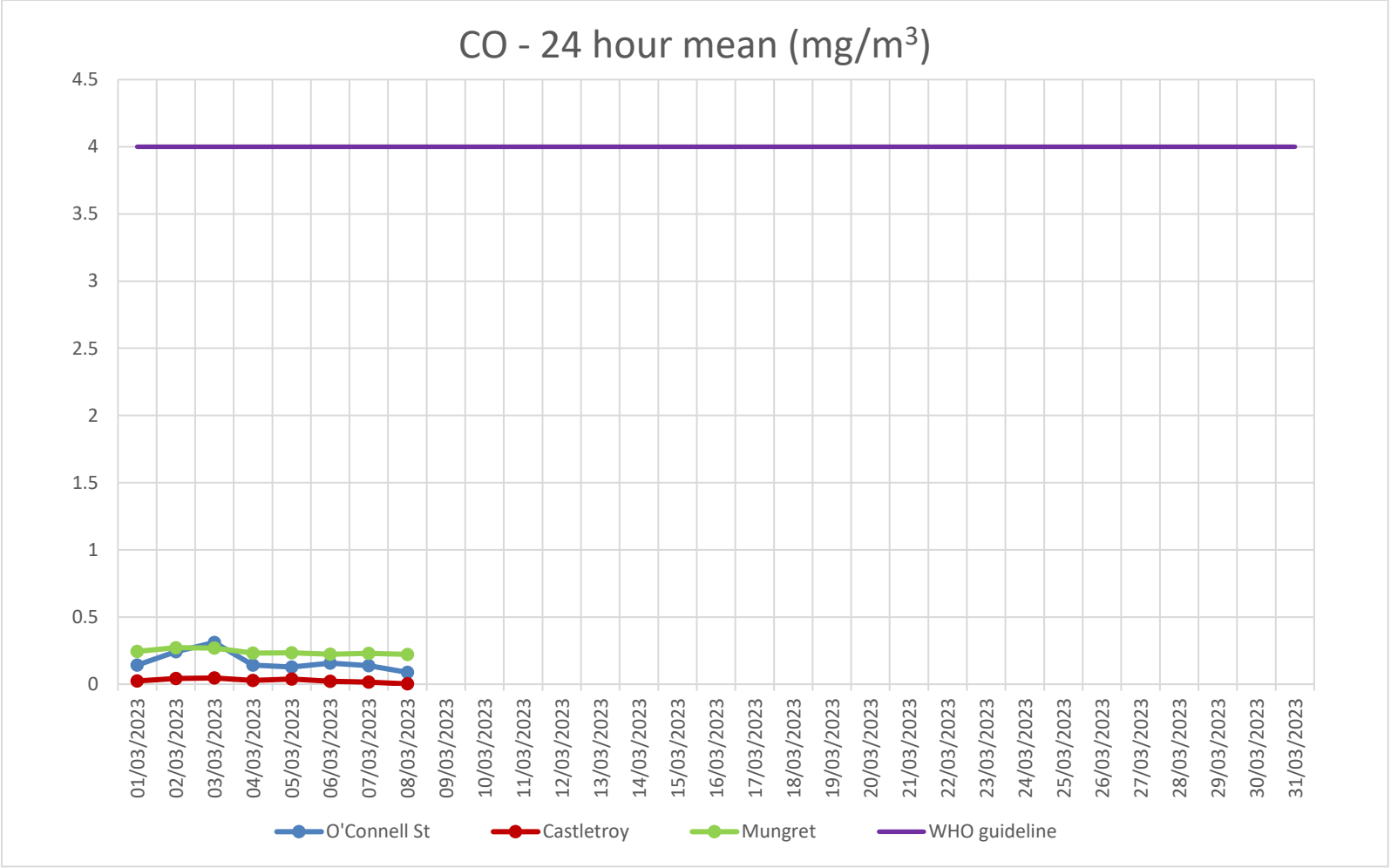
29/03/2023
30/03/2023
31/03/2023
O'Connell St
Castletroy
Mungret
Limit Value


CO - 24 hour mean (mg/m3)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01/03/2023
02/03/2023
03/03/2023
04/03/2023
05/03/2023
06/03/2023
07/03/2023
08/03/2023
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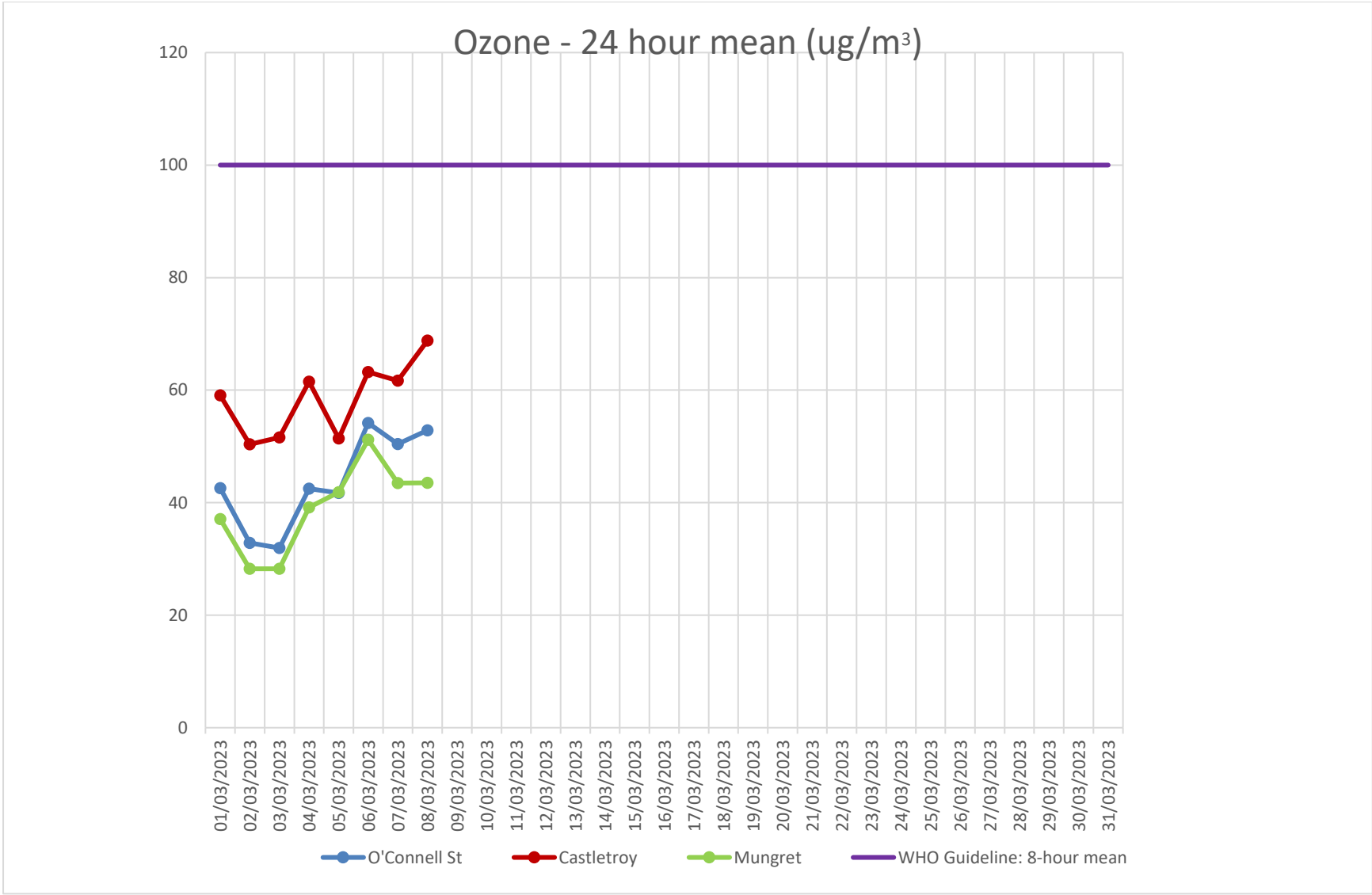
Ozone - 24 hour mean (ug/m3)
120
100
80
60
40
20
0
01/03/2023
02/03/2023
03/03/2023
04/03/2023
05/03/2023
06/03/2023
07/03/2023
08/03/2023
09/03/2023
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24/03/2023
25/03/2023
26/03/2023
27/03/2023
28/03/2023
29/03/2023
30/03/2023
31/03/2023
O'Connell St
Castletroy
Mungret
WHO Guideline: 8-hour mean