HALSTON

APPENDIX 9.1

AMBIENT AIR QUALITY SURVEY DATA – PASSIVE

Appendix 9.1

Diffusion Tube Air Quality Monitoring Surveys at Coolpowra Site

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: ICH
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 14.03.2024
place: passam ag

test report
created on: 15.03.2024
created by: K. Bodei
checked on: 18.03.2024
checked by: T. Hangartner
file name: ICH12-S-2401
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-1	IHC-1	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-102	2	2	45287	45301	08/02/2024		336.0	< 0.05	0.03	< 0.05	< 2.5	1.8	< 3.2	
AS-103	3	3	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-104	4	4	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-105	5	5	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement ICH12-S-2401

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	IHC-1	08/02/2024		22/02/2024		10		NA
AS-102	2	2	08/02/2024		22/02/2024		10		NA
AS-103	3	3	08/02/2024		22/02/2024		10		NA
AS-104	4	4	08/02/2024		22/02/2024		10		NA
AS-105	5	5	08/02/2024		22/02/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers
date received: 12.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis
method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report
created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102401
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: *applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025*
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-1	45306-4	08/02/2024	15:30	22/02/2024	09:00	329.5	0.251	-	0.253	< 0.72	< 2	
AS-102	2	45306-4	08/02/2024	16:00	22/02/2024	09:15	329.3	0.251	-	0.270	< 0.72	< 2	
AS-103	3	45306-4	08/02/2024	16:15	22/02/2024	09:30	329.3	0.251	-	0.250	< 0.72	< 2	
AS-104	4	45306-4	08/02/2024	16:30	22/02/2024	09:45	329.3	0.251	-	0.260	< 0.72	< 2	
AS-105	5	45306-4	08/02/2024	17:15	22/02/2024	10:00	328.8	0.251	-	0.262	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102401

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	start time	end date	end time	Optional information Temp [°C]	air pressure [hPa]	Comment on sampling
AS-101	IHC-1	08/02/2024	15:30	22/02/2024	09:00	4		NA
AS-102	2	08/02/2024	16:00	22/02/2024	09:15	4		NA
AS-103	3	08/02/2024	16:15	22/02/2024	09:30	4		NA
AS-104	4	08/02/2024	16:30	22/02/2024	09:45	4		NA
AS-105	5	08/02/2024	17:15	22/02/2024	10:00	4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112401
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
			start		end		exp. time	blank	sample		m analyte/ sampler	C NH3	
	label	lot no.	date	time	date	time	[h]	[ABS]	dilution	value [ABS]	[ug]	[ug/m3]	
AS-101	IHC-1	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.133	0.55	0.8	
AS-102	IHC-2	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.416	2.47	3.7	sampler uncapped
AS-103	IHC-3	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.124	0.49	0.7	
AS-104	IHC-4	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.147	0.65	1.0	
AS-105	IHC-5	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.164	0.76	1.1	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112401

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	08/02/2024		22/02/2024		4		NA
AS-102	IHC-2	08/02/2024		22/02/2024		4		NA
AS-103	IHC-3	08/02/2024		22/02/2024		4		NA
AS-104	IHC-4	08/02/2024		22/02/2024		4		NA
AS-105	IHC-5	08/02/2024		22/02/2024		4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 14.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 22.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC12-S-2402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-6	IHC-6	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.1	< 3.2	
AS-102	IHC-7	IHC-7	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-103	IHC-8	IHC-8	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-104	IHC-9	IHC-9	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-105	IHC-10	IHC-10	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2402

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 14.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-6	45306-4	22/02/2024	09:00	07/03/2024	10:00	337.0	0.251	-	0.250	< 0.72	< 2	
AS-102	7	45306-4	22/02/2024	09:15	07/03/2024	10:15	337.0	0.251	-	0.256	< 0.72	< 2	
AS-103	8	45306-4	22/02/2024	09:30	07/03/2024	10:30	337.0	0.251	-	0.260	< 0.72	< 2	
AS-104	9	45306-4	22/02/2024	09:45	07/03/2024	10:45	337.0	0.251	-	0.264	< 0.72	< 2	
AS-105	10	45306-4	22/02/2024	10:00	07/03/2024	11:00	337.0	0.251	-	0.254	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102402

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	22/02/2024	09:00	07/03/2024	10:00	10		NA
AS-102	7	22/02/2024	09:15	07/03/2024	10:15	10		NA
AS-103	8	22/02/2024	09:30	07/03/2024	10:30	10		NA
AS-104	9	22/02/2024	09:45	07/03/2024	10:45	10		NA
AS-105	10	22/02/2024	10:00	07/03/2024	11:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Mr.Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112402
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
			start		end		exp. time	blank	sample		m analyte/ sampler	C NH3	
	label	lot no.	date	time	date	time	[h]	[ABS]	dilution	value [ABS]	[ug]	[ug/m3]	
AS-101	IHC-6	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.137	0.58	0.9	
AS-102	IHC-7	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.136	0.57	0.9	
AS-103	IHC-8	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.099	< 0.34	< 0.5	
AS-104	IHC-9	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.145	0.64	0.9	
AS-105	IHC-10	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.117	0.45	0.7	

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 28.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 11.04.2024
place: passam ag

test report
created on: 11.04.2024
created by: U. Kunz
checked on: 11.04.2024
checked by: T. Hangartner
file name: IHC12-S-2403
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-11	IHC-11	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-102	IHC-12	IHC-12	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-103	IHC-13	IHC-13	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	Back with green membrane, uncapped!
AS-104	IHC-14	IHC-14	45287	45301	07/03/2024	11:00	358.0	0.09	0.02	0.12	4.5	1.4	6.0	Back with green membrane, uncapped!
AS-105	IHC-15	IHC-15	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2403

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 28.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102403
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-11	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.263	< 0.72	< 1.9	
AS-102	12	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.264	< 0.72	< 1.9	
AS-103	13	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.262	< 0.72	< 1.9	
AS-104	14	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.265	< 0.72	< 1.9	
AS-105	15	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.268	< 0.72	< 1.9	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102403

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers

date received: 28.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis

method: SP11 photometer
analyte: Ammonium
date: 04.04.2024
place: passam ag

test report

created on: 04.04.2024
created by: U. Kunz
checked on: 04.04.2024
checked by: T. Hangartner
file name: IHC112403
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ABS]	sample dilution	sample value [ABS]	m analyte/ sampler [ug]	C NH3 [ug/m3]	
AS-101	IHC-11	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.337	1.95	2.7	
AS-102	IHC-12	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.189	0.94	1.3	
AS-103	IHC-13	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.173	0.83	1.2	
AS-104	IHC-14	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.150	0.68	0.9	
AS-105	IHC-15	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.192	0.96	1.3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112403

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information: Temp [°C]	Optional information: air pressure [hPa]	Optional information: Comment on sampling
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

APPENDIX 9.2

AMBIENT AIR QUALITY SURVEY DATA – ACTIVE

Appendix 9.2

Continuous Ambient Air Quality Monitoring Surveys at Coolpowra Site

Figure A9.2.1 Continuous monitoring results NO_2

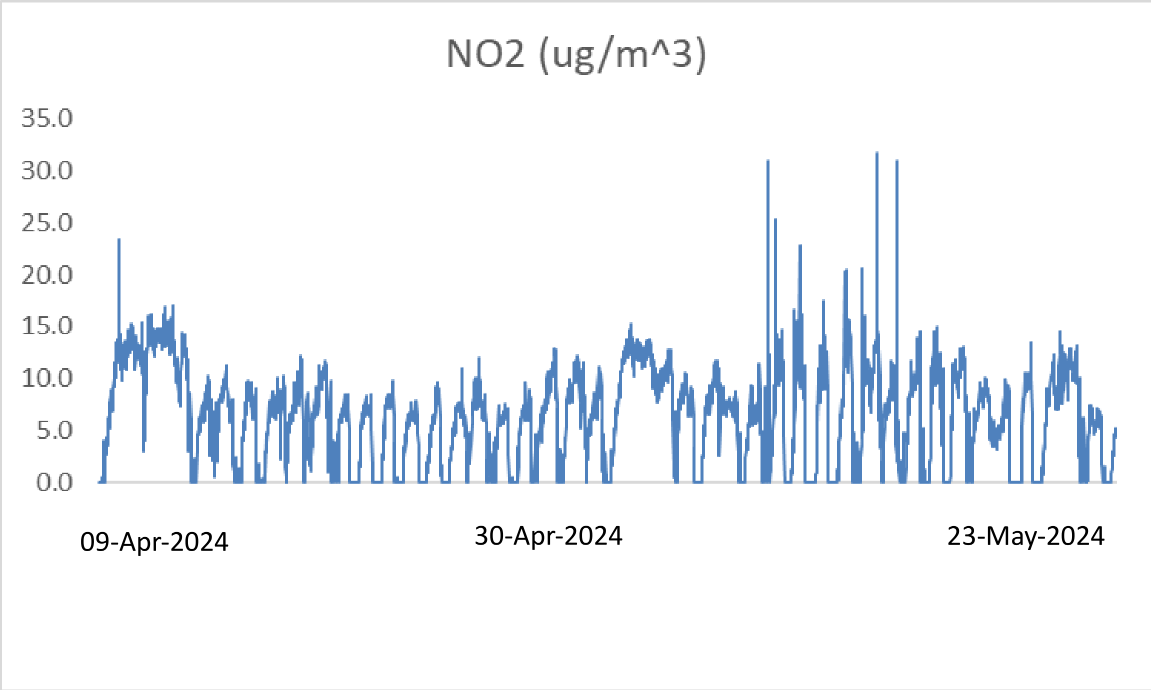


Figure A9.2.2 Continuous monitoring results NO

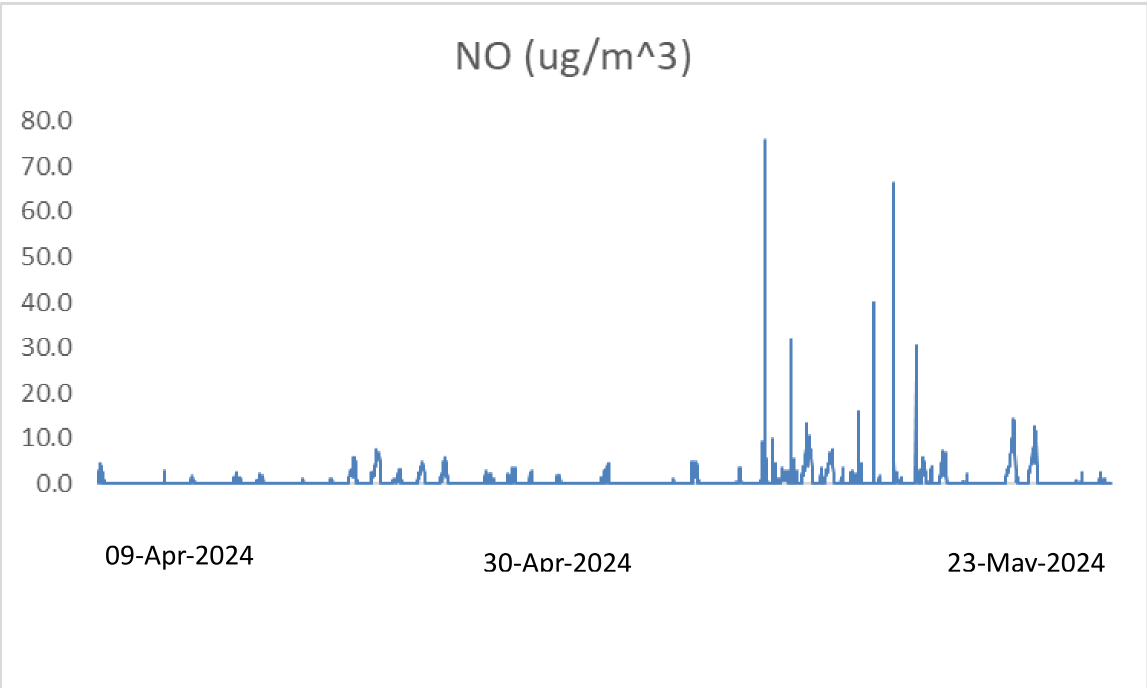
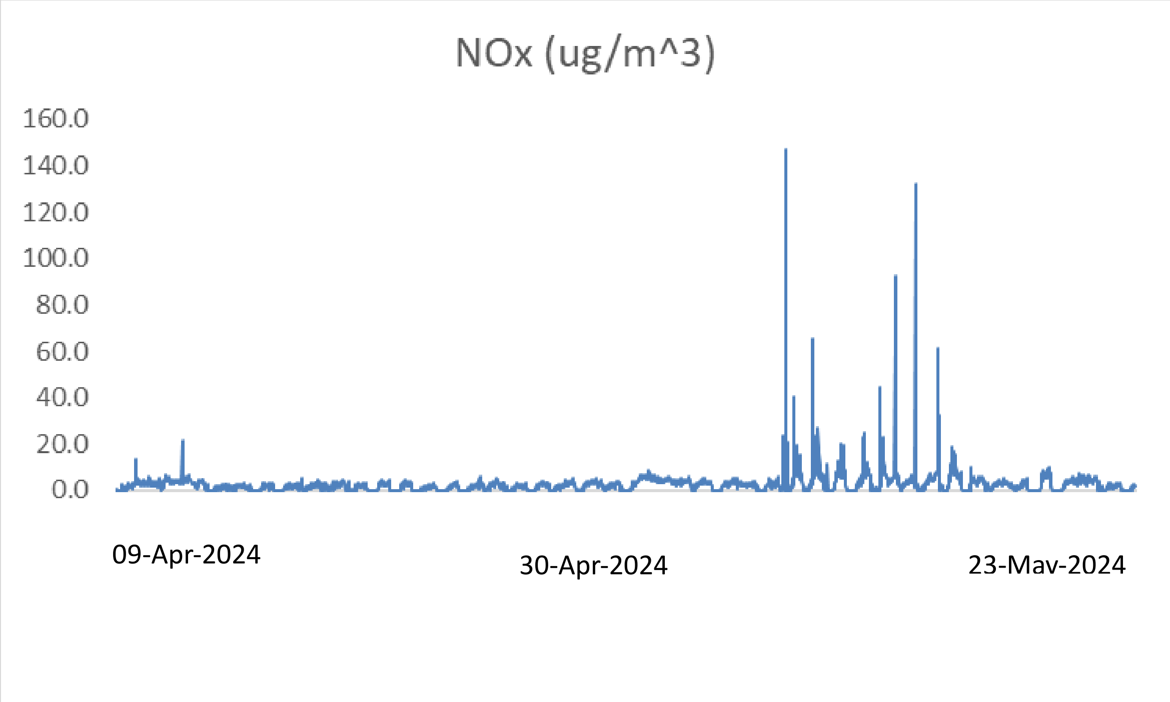


Figure A9.2.3 Continuous monitoring results NO_x



Date	PM10	PM1	PM2.5
09/04/2024	3.56	1.68	3.5
10/04/2024	2.18	1.31	2.15
11/04/2024	6.86	4.4	6.85
12/04/2024	1.76	0.93	1.65
13/04/2024	4.56	2.38	4.51
14/04/2024	4.92	2.45	4.88
15/04/2024	6.48	3.54	6.47
16/04/2024	4.67	2.47	4.66
17/04/2024	4.37	2.07	4.31
18/04/2024	4.41	2.39	4.39
19/04/2024	1.66	0.89	1.63
20/04/2024	2.92	1.87	2.87
21/04/2024	3.85	2.68	3.81
22/04/2024	2.8	1.69	2.71
23/04/2024	2.08	1.06	2.04
24/04/2024	4.73	2.39	4.67
25/04/2024	3.14	1.69	3.12
26/04/2024	2.16	1.44	2.13
27/04/2024	2.1	1.46	2.03
28/04/2024	2.04	1.25	1.93
29/04/2024	1.51	0.77	1.45
30/04/2024	1.78	0.9	1.66
01/05/2024	1.88	0.97	1.84
02/05/2024	2.38	1.62	2.32
03/05/2024	1.66	0.75	1.52
04/05/2024	1.94	1.01	1.89
05/05/2024	1.88	1.1	1.75
06/05/2024	2.66	1.7	2.58
07/05/2024	4.27	2.28	4.2
08/05/2024	3.44	2.16	3.33
09/05/2024	2.93	2.11	2.83
10/05/2024	3.45	2.49	3.39
11/05/2024	5.18	4.1	5.17
12/05/2024	5.61	4.44	5.53
13/05/2024	1.36	0.74	1.25
14/05/2024	2.63	1.58	2.54
15/05/2024	1.66	1.04	1.64
16/05/2024	3.64	2.66	3.45
17/05/2024	3.75	2.49	3.68
18/05/2024	2.91	1.93	2.88
19/05/2024	1.85	1	1.65
20/05/2024	3.09	2	3
21/05/2024	2.57	1.96	2.44
22/05/2024	1	1.87	1.69
23/05/2024	1.58	3.18	3.05
Average 24-hr	***3.1***	***2.2***	***3.0***

APPENDIX 9.3

AIR QUALITY DISPERSION MODELLING REPORT

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monitoring and
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DISPERSION MODELLING ASSESSMENT OF AIR QUALITY IMPACTS OF PROPOSED RESERVE GAS FIRED POWER GENERATION PLANT AT COOLPOWRA, CO. GALWAY

Report Ref. 33186-1

TMS Environment Ltd.

Revised 01 June 2024

Approved By: Imelda Shanahan

Dr Imelda Shanahan

Technical Manager

Contents

1.0 INTRODUCTION AND SCOPE

This report deals with an assessment of the potential impacts on air quality of emissions to atmosphere from the proposed Reserve Power plant at Coolpowra The purpose of the report is to provide information in relation to the quantitative assessment of air quality impacts associated with the emissions from the facility. The report presents the results of air quality dispersion modelling to evaluate the impact of potential emissions from the facility on ambient air quality, human health and ecosystems.

2.0 DESCRIPTION OF PROCESS AND SOURCES OF EMISSIONS TO ATMOSPHERE

2.1 Site location and layout

The facility is located on lands at Kiltotan, Collinstown Oldtown, Co. Westmeath as shown in Figure 2.1. The layout of the site and primary elements of each area are shown in Figure 2.2.

Figure 2.1 Site location

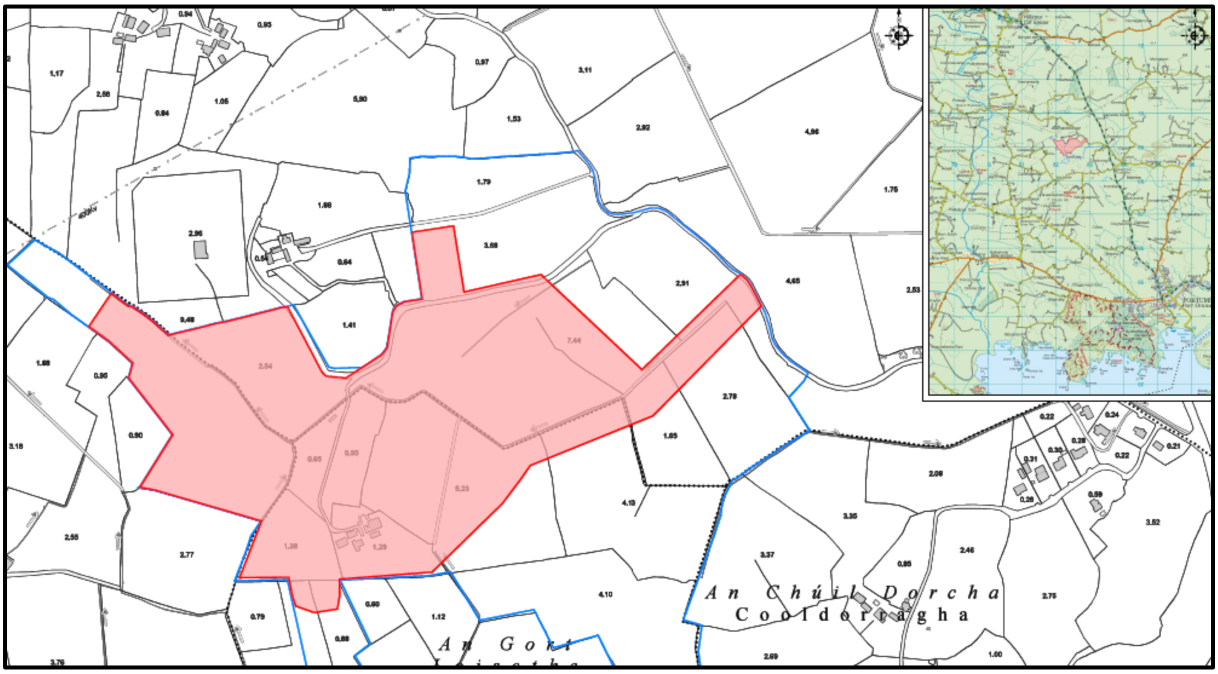
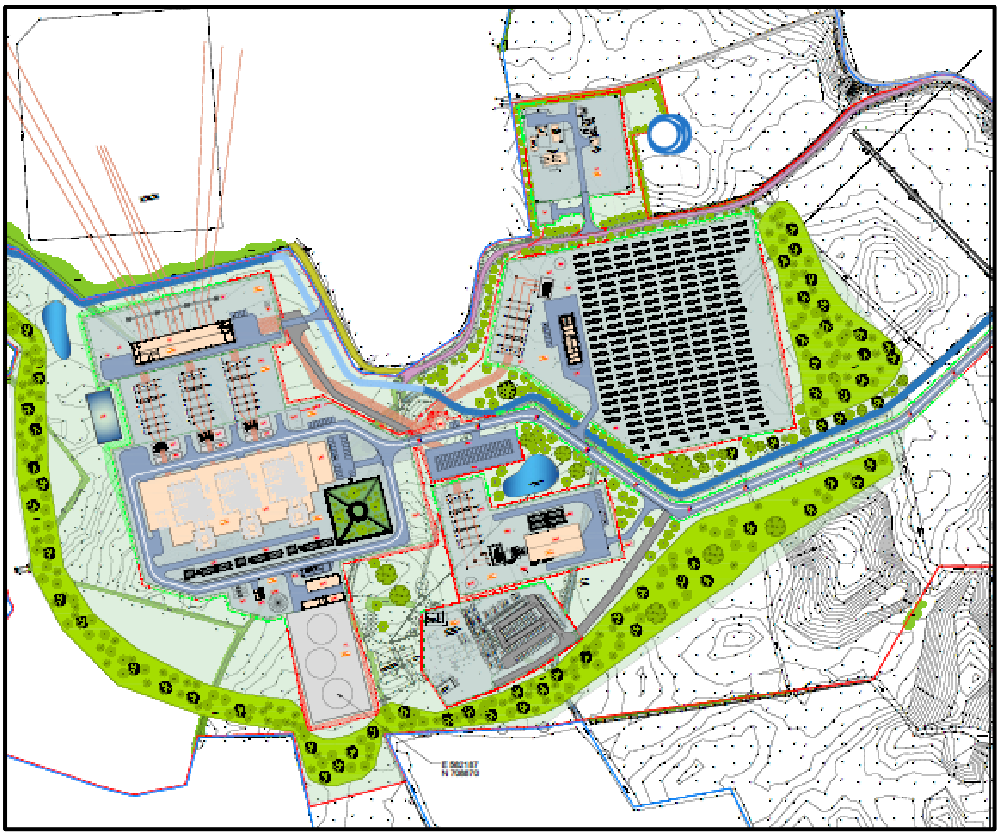


Figure 2.2 Outline of Proposed Development



2.2 Process Description

The overall proposed development for which planning permission is sought comprises three elements – the Reserve Gas-Fired Generator, the GIS Electrical Substation and the proposed Energy Storage System (ESS) using long duration energy storage (LDES) battery technology and synchronous condenser technology. A single Environmental Impact Assessment Report (EIAR) has been prepared for all three projects proposed as part of the development. The potential environmental impacts from each project are assessed individually and cumulatively (with each other and with any other identified projects) within the EIAR.

The Reserve Gas-Fired Generator project will combust natural gas supplied from the Gas Networks Ireland (GNI) transmission system in three (3 No.) open-cycle gas turbines (OCGT) and associated infrastructure. GNI will separately manage the process of managing and delivering the underground natural gas pipeline to the proposed site. In accordance with the requirements of the Commission for Regulation of Utilities (CRU), the proposed OCGT units are dual fuel units. Natural gas will be the primary combustion fuel to each of the OCGT units when operating, with gas oil as the secondary fuel. In order to ensure compliance with the requirements set by the CRU in the event of interruptions to the natural gas supply, the Reserve Gas-Fired Generator is capable of running continuously for 72 hours using secondary fuel.

The Electrical Substation project will enhance and upgrade the existing Oldstreet AIS 400kV substation and will provide for the connection of the Reserve Gas Fired Power Generator and Energy Storage System to the electricity transmission network. The GIS substation itself includes a two storey building and associated ancillary site development works.

The proposed Energy Storage System (ESS) facility comprises a Long Duration Energy Storage (LDES) static battery positioned within a secure outdoor compound, and a Synchronous Condenser which will operate within a building in a separately secured compound. The LDES will provide peaking, active power and back start capability services to the electricity grid.

The potential emissions to atmosphere during operation are limited to those from the Reserve Gas Fired Generator since there are no operation phase emissions associated with either the GIS or ESS projects.

2.2 Sources and characteristics of emissions to atmosphere

The most significant potential impacts are emissions of combustion gases such as CO, SO_2, PM_{10} and NO_2 from the gas turbines and associated back up and emergency units.

Sulfur dioxide emissions originate from the sulfur in the fuel used in the combustion process. Since natural gas is the principal fuel to be used sulfur dioxide emissions will be negligible for normal operating conditions. Nitrogen oxides are also present in the emission stream as a result of the combustion process. Much of the emissions are in the form of nitrogen oxide (NO) which is expected to be substantially oxidised to nitrogen dioxide in the atmosphere. Nitrogen oxide emissions from sources using natural gas as fuel are significantly lower than the emissions associated with other fuels. For the Reserve

Power plant project, low emission DLE burners will be employed which reduces the nitrogen oxide emissions.

Particulate matter and carbon monoxide may also arise from the combustion process in the emission stream but only in minor amounts. Again, natural gas is a very clean fuel and particulate emissions are predicted to be very low.

There is the potential for a number of greenhouse gas emissions to atmosphere which may give rise to CO_2 emissions.

There is a requirement to run the turbines using gas oil to ensure that there is always a guaranteed energy supply and substances released in the emissions to atmosphere from the use of gas oil are the same as those associated with natural gas combustion. Emissions when using gas oil will be slightly higher for sulfur dioxide since there is a higher sulfur content in the fuel.

In addition to considering the actual or expected emissions that are released to atmosphere, the requirements of the Large Combustion Plant Regulations, European Union (Large Combustion Plants) Regulations are also considered. The relevant Emission Limit Values from the Regulations are the maximum emissions that will be permitted from the proposed facility and therefore these represent the worst case emissions scenario for the assessment.

The potential emissions to atmosphere include particulates (including fine particulate matter PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), water vapour. The pollutants of particular concern include NO_2 and NO_x, and SO_2 all of which have specific standards to be achieved, and it is these pollutants that are modelled to assess the impact of emissions from the combustion plant on air quality in the vicinity of the development.

3.0 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

3.1 Impact assessment methodology

The impact of emissions to atmosphere on air quality is assessed using a dispersion modelling assessment approach. This approach involves computation of predicted incremental contributions to ground level concentrations of pollutants over defined averaging intervals as a result of emissions from the combustion plant. The predictions are then compared with relevant Air Quality Standards to determine whether the impact on air quality meets the requirements of the Standards. The general approach is summarised as follows:

- Review of local air quality data in the area surrounding the site;
- Review of the nearest building arrangements and locations of human receptors in the area;
- Identification of non-statutory ecological receptors within 2 km of the site and statutory ecological receptors within 15 km of the site;
- Dispersion modelling of combustion plant emissions to predict process contributions (PCs) at identified sensitive receptors for comparison against relevant Air Quality Standards;

Guidance on air emissions risk assessments was published by the UK Government for developments which require an environmental permit under the Environmental Permitting (as Amended) Regulations 2016 (EPR). For those emissions that cannot be screened out the guidance states that detailed modelling must be carried out of the emissions. The screening assessment screened out emissions of particulate matter (including PM_{10} and $PM_{2.5}$) as insignificant. Nitrogen oxides, carbon monoxide and sulfur dioxide were considered relevant as they are regulated pollutants and a detailed dispersion modelling assessment was carried out for those pollutants. Particulate matter (including PM_{10} and $PM_{2.5}$) was included in the assessment when gas oil is used as fuel.

Guidance has also been issued by the EPA in the AG4 Guidance Note and this Guidance was followed in the assessment.

3.2 Impact assessment criteria

The assessment of impact significance is based on a comparison of predicted impacts with air quality standards and guidelines, and consideration of the magnitude and duration of the potential impact.

Air Quality Standards in Ireland have been defined to ensure compliance with EC Directives; they are developed at different levels for different purposes. European legislation on air quality has been framed in terms of two categories, limit values and guide values. Limit values are concentrations that cannot be exceeded and are based on WHO guidelines for the protection of human health. Guide values are set as a long-term precautionary measure for the protection of human health and the environment. The WHO guidelines differ from EU air quality standards in that they are primarily set to protect public health from the effects of air pollution, whereas Air Quality Standards are recommended by governments, and other factors such as socio-economic factors, may be considered in setting the standards.

The Clean Air for Europe (CAFE) Directive (Council Directive 2008/50/EC) is an amalgamation of the Air Quality Framework Directive and its subsequent daughter Directives and sets out limit and target values for named air quality parameters. The fourth daughter Directive (European Parliament 2004) also sets out limit values to be met for certain air quality parameters. The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2022 (S.I. No. 739 of 2022).

The air quality standards and guidelines referenced in this report are summarized in Table 3.1. The Clean Air for Europe (CAFE) Directive (Council Directive 2008/50/EC) was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). This Directive and the Irish Regulations set out the main standards against which the potential impact of the development on air quality are assessed.

In addition to the Air Quality Standards Regulations and the Directive Standards, it is also appropriate to consider the World Health Organisation (WHO) Guidelines. These guidelines were developed by the WHO to provide appropriate air quality targets worldwide, based on the latest health information available. The air quality guidelines for particulate matter (PM_{10}), nitrogen dioxide and sulfur dioxide, and $PM_{2.5}$ are considered in this report (WHO, 2005; updated in 2008 and in 2021). While the WHO Guidelines are not mandatory, they represent current informed opinion on the levels to which we should be aspiring in order to minimise adverse health impacts of air pollution. The WHO guidelines referenced in this report are summarized in Table 3.2.

The potential impact of the emissions on ecosystems is considered using the gaseous nitrogen oxides concentration. An Air Quality Standard expressed in concentration terms has been defined for the protection of vegetation and this standard is one of the benchmarks against which the impact of the facility is assessed.

The potential impact of nitrogen deposition in sensitive ecosystems was evaluated by comparing the modelled nitrogen deposition rate with the critical loads for the relevant habitat. The most sensitive habitat for this purpose is bog ecosystems and a recommendation of 5kg N ha-1 year-1 has been made as the critical load for habitat protection [UNECE 5 – 10 kg N ha-1 year-1 and EPA Research Report 390: Nitrogen–Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats (2016-CCRP-MS.43) 5kg N ha-1 year-1].

3.3 Dispersion Model Selection

Computerised mathematical dispersion models are used to predict the incremental additions to ground level concentrations of relevant criteria pollutants as a result of emissions from a given development. A detailed modelling assessment was undertaken using the US EPA Model AERMOD Prime, AERMOD Version 23132, which is the current regulatory version of this Model. AERMOD is currently the most widely used air quality modelling tool and has been widely used in studies of this type in relation to regulated facilities.

The model computes average ground-level concentrations of pollutants emitted from either elevated or ground-level emission sources. Separate utilities associated with the dispersion modelling software allow computation of ground-level concentrations of pollutants over defined statistical averaging periods, and additional features permit suitable consideration to be given to building downwash effects and the effects of elevated terrain in the vicinity of the plant.

Table 3.1 Air Quality Standards Regulations 2011 (based on EU Clean Air For Europe [CAFE] Directive 2008/50/EC)

Pollutant	EU Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	None	200 μg/m^3 NO_2
		Annual limit for protection of human health	None	40 μg/m^3 NO_2
		Annual limit for protection of vegetation	None	30 μg/m^3 NO +NO_2
Sulfur Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 μg/m^3	350 μg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 μg/m^3
		Annual & Winter limit for the protection of human health and ecosystems	None	20 μg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 μg/m^3
		Annual limit for protection of human health	20%	40 μg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health (Stage 1)	20% from June 2008. Decreasing linearly to 0% by 2015	25 μg/m^3
		Annual limit for protection of human health (Stage 2)	None To be achieved by 2020	20 μg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)

NOTE
The Air Quality Standards Regulations 2022 (SI 739 of 2022) transposed EU Directive 2008/50/EC (CAFE) into Irish law.

Table 3.2 WHO Air Quality Standards

Pollutant	Averaging time	Interim target				2021 Guidelines
		1	2	3	4	
Particulate matter (as $PM_{2.5}$), µg/m^3	Annual limit for protection of human health	35	25	15	10	5
	24-hour limit for protection of human health Note [1]	75	50	37.5	25	15
Particulate matter (as PM_{10}), µg/m^3	Annual limit for protection of human health	70	50	30	20	15
	24-hour limit for protection of human health Note [1]	150	100	75	50	45
Ozone, µg/m^3	Peak season Notes [2]	100	70	NA	NA	60
	8-hour Note [1]	160	120	NA	NA	100
Nitrogen Dioxide, µg/m^3	Annual limit for protection of human health	40	30	20	NA	10
	24-hour limit for protection of human health Note [1]	120	50	NA	NA	25
Sulfur Dioxide, µg/m^3	24-hour limit for protection of human health Note [1]	125	50	NA	NA	40
Carbon Monoxide, mg/m^3	24-hour limit for protection of human health Note [1]	7	NA	NA	NA	4

Note [1] Expressed as the 99th percentile

Note [2] 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.

3.4 Dispersion Model Assumptions and Limitations

The inherent assumptions of the dispersion Model and associated limitations are summarised as follows.

- The model is based on a five-year meteorological dataset collected from the nearest meteorological stations. Since the meteorological data are not collected at the specific facility location being assessed, this is a limitation of the Model. This is not a significant factor for the current study as the data was sourced from a nearby recording station which is considered representative of the site.
- The model assumes steady-state meteorological conditions that are invariant over the entire model space for each hour modelled, and as such, has reduced accuracy in areas where significant variations in meteorological conditions exist. For instance, AERMOD cannot be used to incorporate highly variable wind patterns caused by changes in terrain elevations, and modelling across complex terrains may result in over-predictions. This is not a significant factor for the current study.
- AERMOD is the Gaussian model recommended by the US EPA for short-range transport of pollutants, up to 50 km from the source. At distances beyond 50 km, steady-state Gaussian plume models like AERMOD tend to over-estimate pollutant ground concentrations, because the model maintains constant wind patterns that are unlikely to persist over long distances. This is not considered significant for the current study due to the relatively low stack height and emission rates and the anticipated dispersion pattern.
- The model cannot be used to model reactive pollutants (e.g., ozone). This is not significant for the current study.

An evaluation of the impact of these limitations concluded that there is no significant adverse impact on the reliability of the Model for the current study.

3.5 Dispersion Modelling Protocol

3.5.1 Dispersion Model Inputs

Evaluation of the impact of a proposed development on air quality using dispersion modelling requires information on the following:

- Emissions characteristics
- Site layout and topography
- Meteorological data
- Averaging intervals
- Receptor locations

Of these, the most significant input parameters are the emissions characteristics and the site layout and topography and surrounding terrain features.

3.5.2 Emissions Characteristics and special treatments

Emission characteristics predicted for the emission sources are summarised in Table 3.3. Information on dimensions and physical characteristics of the main emission sources was obtained from the developer and from a consideration of the nature and scale of the processes that will be carried out at the plant, the chemical composition of the fuels, information supplied by the manufacturers of the plant, and consideration of the levels of emissions that would normally be expected from a plant of this type.

The worst possible emissions scenario is one where the maximum permissible emission rates from the plant occur. For the purposes of modelling and air quality impact assessment, the maximum possible emission values were used in accordance with relevant Guidance. The maximum permissible emission limits are the Large Combustion Plant Emission Limit Values for nitrogen oxides (Section 2.2), carbon monoxide, sulfur dioxide and PM_{10}. The maximum potential sulfur dioxide (SO_2) emission rates are derived from the fuel usage rate and permissible sulfur content. Best practice guidance requires that the impact assessment must represent a worst-case emissions scenario, thereby determining the maximum potential impact of plant emissions on ground level concentrations of pollutants in the vicinity of the plant.

The emissions to atmosphere arise due to the combustion process. The three (No.) Open

Cycle Gas Turbines (OCGT) are intended to run on natural gas but provision is made to use Gas oil as a back-up fuel for emergencies. Consequently both scenarios are considered in the assessment. In addition, the Emergency Generators may be required in emergency situations to start the turbines in which case they would be used to start the first turbine which will then be used for the remaining starts; their operation is therefore very limited.

The dispersion model considered a number of possible operating scenarios as follows.

(i) OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500hours)

A conservative assumption of 1500 operating hours per year was made with units expected to run for much shorter times. An assumption of 2 hours operation per day during the morning (06:00 – 08:00) and evening (16:00 – 19:00) peak demand periods was made. The turbines start very quickly and reach steady state normal operation in approximately 10 minutes. The assessment assumes that 30% of the operating hours are start-up or shut down for the purpose of modelling. The use of gas oil fuel is tested every month and a run time of 2 hours per month is assumed for the testing. The Emergency Generators are tested for 8 hours every month and this has been included in all model runs.

(ii) OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation)

A conservative assumption of full time operation using natural gas as fuel was made to ensure that all worst case meteorological conditions were investigated. This is an unrealistic scenario and is not expected to occur. However the test is a useful sensitivity test to test the sensitivity of the model predictions to the meteorological conditions for the short term one-hour averaging periods. The Emergency Generators are tested for 8 hours every month and this has been included in all model runs.

(iii) OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation)

A conservative assumption of full time operation of the turbines using gas oil as fuel was made to consider what would occur in the event of a national gas distribution network outage and to ensure that all worst case meteorological conditions were investigated. This is an unrealistic scenario and is not expected to occur. However the test is a sensitivity test to test the sensitivity of the model predictions to the meteorological conditions for the short term one-hour averaging periods and to the use of diesel instead of natural gas. The Emergency

Generators are tested for 8 hours every month and this has been included in all model runs.

(iv) OCGT Operating Scenario #4: Gas Oil fuel (500 hours per annum)

An assumption of 500 operating hours per year was made. The units are required to be capable of operating on gas oil and a 72-hour gas oil fuel reserve has been specified by the Commission for Regulation of Utilities. This operating scenario was assessed on an assumption that the operating hours would run continuously and separately as an average across the entire year and the worst case outcome was reported for evaluation. The use of gas oil fuel is tested every month and a run time of 2 hours per month is assumed for the testing. The Emergency Generators are tested for 8 hours every month and this has been included in all model runs.

(v) Emergency Generators

These units will run in emergencies and will be tested once every month. For the purpose of this assessment a Model run was executed with the units operating every month for 8 hours. This run was assimilated into all of the main operating scenarios.

These operating scenarios represent conservative approaches and will lead to an overestimate of the predicted ambient concentrations beyond the site boundary. The stack height for the assessment was determined to be 45m and the detailed assessment as reported in Appendix 9.3 also considered alternative stack heights as discussed below.

In most combustion processes, NO_x is emitted almost totally in the form of nitric oxide (NO). Nitrogen oxides are very reactive and also contribute, due to the formation of nitrogen dioxide from nitric oxide, to the phenomenon of photochemical ozone formation. These transformations are generally of greatest concern in the areas where the highest ozone concentrations occur – for example, in rural areas in late afternoon in summer time. Unless photochemical dispersion models are used for the assessment of impacts associated with the release of nitrogen oxides from point emissions sources, then assumptions must be made regarding the rate and extent of conversion of NO to NO_2. For the current study, Guidance from the EPA taken from the Air Dispersion Modelling Guidance Note AG4 was followed whereby a default annual ratio of 1.00 and a default 1-hour NO_2/NO_X ratio of 0.50 was used for the conversion of NO_X to NO_2.

The EPA Guidance notes that a site-specific ratio at the point of maximum concentration may be used if extensive continuous monitoring data (one-year or greater) is available at this location, but the site-specific ratio will only be valid for locations which are a similar distance from the source as the monitoring station. The limited on-site data suggests a ratio close to 1 for the long term data which is consistent with the EPA default values.

Table 3.3 OCGT Stack and emission characteristics

Emission Point	Stack Co-ordinates		Stack Height, m	Exit Diameter, m	Exit Area, m^2
OCGT #1	5489774	5887146	45	6.8	36.31
OCGT #2	549017	5887156	45	6.8	36.31
OCGT #3	549056	5887164	45	6.8	36.31
Emergency Generator #1	549010	5887111	4.755	0.5	0.196
Emergency Generator #2	549011	5887108	4.755	0.5	0.196
Emergency Generator #3	549012	5887104	4.755	0.5	0.196

UTM Coordinate system

Table 3.4a Process emissions data for proposed Reserve Power plant (Natural Gas Fuel)

Emission Point	Fuel Type	Temperature K	Flow Nm^3/hour	Exit velocity m/sec	NO_x Emission		CO Emission		SO_2 Emission		PM_{10} Emission	
					mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec
OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500 hours per annum); maximum daily emission rate												
OCGT #1-#3	Natural gas (1500 hr pa)	883.15	7,498,800	57.36	50	104.15	100	208.30	Note 3	Note 3	Note 3	Note 3
OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500 hours per annum); annual average emission rate												
OCGT #1-#3	Natural gas (1500 hr pa)	883.15	7,498,800	57.36	35	72.91	40	83.32	Note 3	Note 3	Note 3	Note 3
OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation); maximum daily emission rate												
OCGT #1-#3	Natural gas (Full time)	883.15	7,498,800	57.36	50	104.15	100	208.30	Note 3	Note 3	Note 3	Note 3
OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation); annual average emission rate												
OCGT #1-#3	Natural gas (Full time)	883.15	7,498,800	57.36	35	72.91	40	83.32	Note 3	Note 3	Note 3	Note 3

Notes:
1. Emissions are stated at STP.
2. Start up duration 10 minutes; model conservatively assumes 0.33 hr duration.
3. SO_2 and PM_{10} emissions are negligible for natural gas combustion and are therefore screened out of assessment
4. The dispersion model ran the maximum permissible daily emission rates as worst case scenario for full time operation on natural gas; the annual average emissions were assessed separately

Table 3.4b Process emissions data for proposed Reserve Power plant (Gas Oil fuel) for full time operation

Emission Point	Fuel Type	Temperature K	Flow Nm^3/hour	Exit velocity m/sec	NO_x Emission		CO Emission		SO_2 Emission		PM_{10} Emission	
					mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec
OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation) **Maximum daily emissions**												
OCGT #1-#3	Gas oil (Full time)	808.15	6,732,000	51.49	50	93.5	100	187.0	66	123.42	10	18.70
OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation) **Annual average emissions**												
OCGT #1-#3	Gas oil (Full time)	808.15	6,732,000	51.49	NS	NS	NS	NS	60	112.20	5	9.35

Notes:
1. An assumption of full time operation on Gas oil is run due to the potential scenario of an interruption to the availability of natural gas.
2. The dispersion model ran the highest daily emission rates listed as worst case scenario for full time operation on gas oil; the annual average emissions were assessed separately
3. NS means None Specified

Table 3.4c Process emissions data for proposed Reserve Power plant (Gas Oil fuel), < 500 hours per year)

Emission Point	Fuel Type	Temperature K	Flow Nm^3/hour	Exit velocity m/sec	NO_x Emission		CO Emission		SO_2 Emission		PM_{10} Emission	
					mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec
OCGT Operating Scenario #4: Gas Oil fuel (500 hours per annum)												
Maximum daily emissions												
OCGT #1-#3	Gas oil (< 500 hr pa)	808.15	6,732,000	51.49	250	467.50	100	187.00	66	123.42	10	18.70
Annual average emissions												
OCGT #1-#3	Gas oil (< 500hr pa)	808.15	6,732,000	51.49	NS	NS	NS	NS	60	112.20	5	9.35

Notes:

1. The dispersion model ran the highest daily emission rates listed as worst case scenario for operation on gas oil when operating less than 500 hours per year; the annual average emissions were assessed separately
2. Where the gas turbines operate on gas oil less than 500 hours per year , the emission limit for nitrogen oxides is 250mg/Nm^3 and no emission limit for CO applies.

3.5.3 Site Layout and Topography

The layout and area of the site and the dimensions of the various buildings on site were taken from the drawings of the site. Topographical information was obtained from a site survey and from Ordnance Survey maps and from digital terrain data. Building downwash effects might be expected as a result of the proximity of the buildings on site to the plant stack. These effects were modelled using the modelling facility, BPIP, which is part of the AERMOD modelling suite.

The presence of complex terrain features can lead to significantly higher ambient concentrations than would occur in the absence of terrain features, especially if there is a significant relative difference in elevation between the source and off-site receptors. International Guidance suggests that when modelling in a region of flat terrain, no digital mapping of terrain will be necessary. General guidance is that digital mapping of terrain should be conducted where terrain features are greater than 10% of the effective stack height within 5km of the stack (for effective stack heights of 100m or less). From a review it is concluded that digital terrain data is required to ensure that a reliable assessment is completed. This data was acquired and used in the dispersion model.

3.5.4 Meteorological Data

The magnitude of potential impacts of the proposed development on air quality will largely be influenced by the local meteorological conditions, in particular by wind speed and direction and by precipitation rates. An evaluation of the climatic conditions at the site is therefore useful for an assessment of the type required for this study.

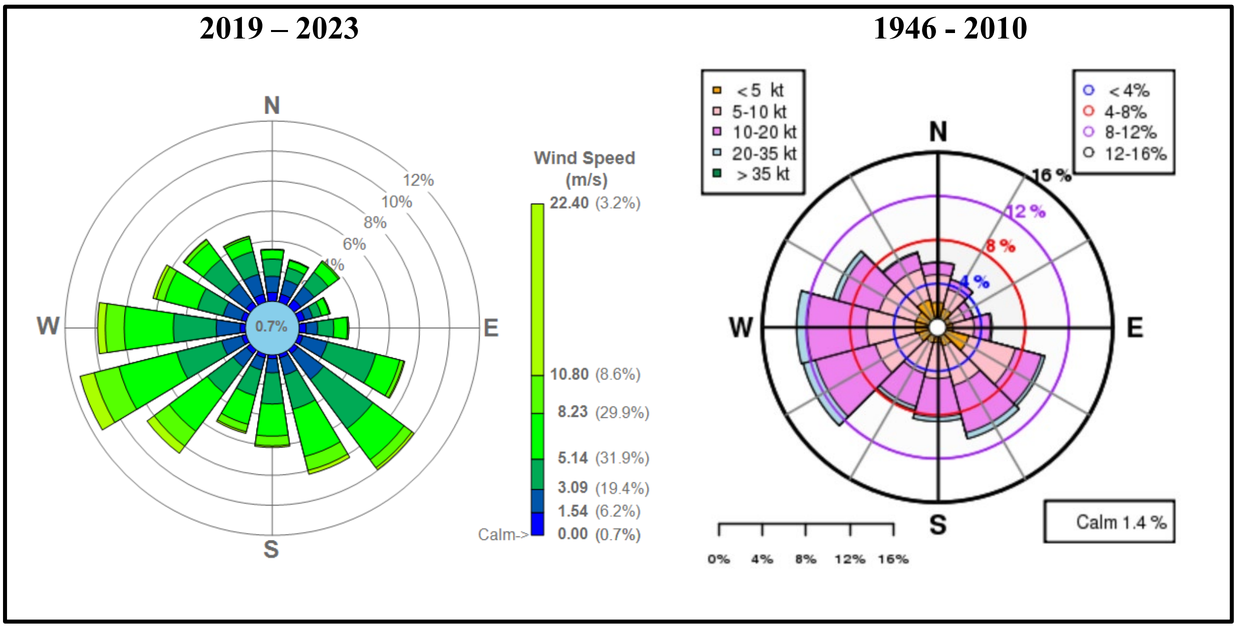
Met Éireann operate a Synoptic Network of weather stations at Belmullet, Malin Head, Rosslare (closed since 2008), Johnstown Castle, Birr, Clones, Kilkenny and Mullingar while the Aviation Division of Met Éireann maintains observing stations at Shannon Airport, Knock Airport, Casement Aerodrome, Dublin Airport and Cork Airport. There is no continuous meteorological monitoring on the subject site but the general guidance on selection of meteorological data for air quality impact assessments is to choose representative data, recently acquired, which best represents conditions at the site. At least three years of recently acquired data is preferred.

Comprehensive monitoring data is available for Shannon Airport (located 92km southwest of the subject site) which would be indicative of the meteorological conditions that are experienced at the proposed site. Therefore, for the purpose of obtaining reliable information about the climatological conditions at the site of the proposed development, a full set of meteorological data for the period 2019 – 2023 recorded at Shannon Airport was analysed. This is considered an appropriate data set for the study because of the close proximity of the station to the site and the similarity in topography in the immediate area and at the site of the proposed development. Comprehensive data for Mullingar (located 80km northeast) and Casement Aerodrome (located 120km northeast) are also available and were considered for the purpose of testing the sensitivity of the modelling predictions to the input meteorological data.

Wind speed and direction in particular is important in determining how emissions associated with the activity are dispersed. The prevailing wind direction determines which areas are most significantly affected by the emissions from the activity and wind speed determines in part the effectiveness of the dispersion of the emissions.

The windrose for Shannon is presented in Figure 3.1 for the years 2019 – 2023 together with the long term average windrose for 1946 – 2010. The dominant wind direction for Shannon is from the southwest quadrant with wind blowing from this quadrant for more than 40% of the time. The average long-term wind speed over the period 1991 to 2020 is 4.7m/s.

Figure 3.1 Windrose for Shannon Airport



9.5.2 Influences on Ambient Air Quality

The existing activities at and in the vicinity of the site have the potential to exert an influence on ambient air quality by release of emissions to atmosphere as follows:

- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) from domestic, commercial and industrial heating;
- emissions of particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO and benzene from traffic on adjoining roads;
- emissions of ammonia, dust and PM from agricultural activities.

Overall the contribution of traffic travelling on the surrounding road network, agriculture and heating sources in the area are considered to be the dominating influence on air quality in the immediate vicinity of the site.

The main substances which are of interest in terms of existing air quality are sulfur dioxide, nitrogen oxides, particulate dusts including PM_{10} and $PM_{2.5}$ which could originate from combustion sources and traffic. There are no new substances expected to be present in emissions released from the proposed development. A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the development and is presented in section 3.6.

3.5.5 Averaging Intervals

The dispersion model was used to predict the incremental additions to ground level concentrations of the main pollutants emitted from the plant over defined averaging periods. These averaging periods were chosen to allow direct comparison of predicted ground level concentrations with the relevant assessment criteria as outlined in Table 3.1. In particular, 1-hour, 24-hour and annual average ground level concentrations (GLCs) of various pollutants were calculated at various distances from the site; percentiles of these average GLCs were also computed for comparison with the relevant Air Quality Standards.

3.5.6 Receptor Locations

Two nested uniform cartesian receptor grids centred on the site were used for the modelling domain as follows:

- A coarse outer grid of 15km x 15km of 3721 receptors with a spacing of 250 meters was used to cover the whole study area;
- A fine inner grid of 2km x 2km of 1681 receptors (41 x 41 receptors with a spacing of 50 meters) was used to better characterise the zones where the maximum predicted air quality impact from the Project emissions are expected.

In line with expectations, the highest predicted ground level concentrations occur at the receptors closer to the source.

Sensitive receptors in the vicinity of the plant were also input to the Model to evaluate the impact on air quality at those sensitive locations. These sensitive receptors are shown in Appendix I as well as maps showing the nested receptor grids.

3.6 Background ambient air quality

The dominant influences on air quality in the area are emissions from domestic heating, agriculture and traffic. Emissions from traffic sources are expected to be the principal contributors to ambient air quality in the vicinity of the site.

The main substances which are of interest in terms of existing air quality are sulfur dioxide, nitrogen oxides (nitric oxide, NO and nitrogen dioxide NO_2, collectively referred to as NO_x), fine particulate matter including PM_{10} and $PM_{2.5}$ which could originate from combustion sources and traffic. Carbon monoxide is also potentially of interest, and benzene may also be of interest from traffic sources. There are no significant new substances expected to be present in emissions released from the proposed development relative to the existing situation.

Particulate matter is made up of tiny particles in the atmosphere that can be solid or liquid and is produced by a wide variety of natural and manmade sources. Particulate matter includes dust, dirt, soot, smoke and tiny particles of pollutants. Particulate matter of 10 micrometers in aerodynamic diameter or less are also referred to as PM_{10} or more strictly, particles which pass through a size selective inlet with a 50% efficiency cut-off at 10 µm aerodynamic diameter. Similarly, $PM_{2.5}$ refers to particulate matter of 2.5 micrometers or less in aerodynamic diameter. In the past domestic coal burning was a major source of particulate matter in Irish cities during winter months. Levels of particles have decreased significantly since then following the introduction of abatement strategies including Special Control Areas and other Regulations regarding the use, marketing, sale and distribution of certain fuels. The significance of particulate matter is predominantly related to human health and respiratory effects.

Nitrogen oxides (NO_x, which is the sum of NO and NO_2), are generated primarily by combustion processes. The main anthropogenic sources are mobile combustion sources (road, air and traffic) and stationary combustion sources (including industrial combustion). The main source of nitrogen oxides in the vicinity of the site is traffic. The significance is health-related for nitrogen dioxide (NO_2) and ecological for nitrogen oxides (NO_x).

Sulfur dioxide also originates from combustion but predominantly from heating sources and not traffic. The trend in ambient SO_2 concentrations in Ireland is very clearly downward and this pollutant is not a matter for concern in Ireland. This reduction can be attributed to fuel switching from high-sulfur fuels, such as coal and oil, to natural gas and to decreases in the sulfur content of oil.

Carbon Monoxide (CO) is a colourless and odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor-vehicle exhaust, which accounts for most of the CO emissions nationwide. Consequently, CO concentrations are generally higher in areas with heavy traffic congestion.

A description of existing levels of the various substances in ambient air is required to allow for the evaluation of air quality impacts associated with the development. The available data from the National Ambient Air Quality Network is a reliable data set for consideration in this study.

The Environmental Protection Agency (EPA) and local authorities maintain and operate a number of ambient air quality monitoring stations throughout Ireland in order to implement EU Directives and to assess the country's compliance with national air quality standards. Ireland's small population and generally good air quality means that a relatively small number of monitoring stations are sufficient across the country for the purposes of implementing the EU Air Directives. For ambient air quality management and monitoring in Ireland, four zones, A, B, C and D are defined in the Air Quality Standards (AQS) Regulations (S.I. No. 739 of 2022) and are defined as follows:

- Zone A: Dublin Conurbation.
- Zone B: Cork Conurbation.
- Zone C: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge and Balbriggan, Portlaoise, Greystones and Leixlip.
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B &C.

The subject site is considered to be located in Zone D and is considered a rural location site for assessment purposes. Air Quality Data from representative air monitoring stations in Zone D are therefore considered representative of air quality at the subject site. The EPA publishes Ambient Air Quality Reports every year which details the air quality in each of the four zones. The most recent report, published by the EPA in 2023, is the Air Quality in Ireland 2022 report, which contains monitoring data collected during 2022.

The EPA maintains monitoring stations in a number of rural locations including Castlebar, Claremorris, Emo, Enniscorthy, Kilkitt and Longford to monitor rural background air quality. Other monitoring stations have operated at various times and some new stations have been added to the network, but long-term data is available for the above stations. Data from the most recent published Air Quality Monitoring Annual reports for 2020 - 2022 was reviewed and a summary of the data for representative stations for the three most recent years is presented for each parameter of interest in Table 3.5.

The approach taken is to take the average of the three most recent years for each of the Zone D rural stations detailed above and the averages of the values for the stations are reported in Table 3.5. This is the data set which is used in the assessment of the potential impact of the proposed development on air quality. A graphical comparison of the data with the relevant Air Quality Standards is given in Figure 3.2.

It is noted from the data that existing ambient air quality is good for all health-related pollutants. All concentration levels are well within the EU Standards for all parameters of interest.

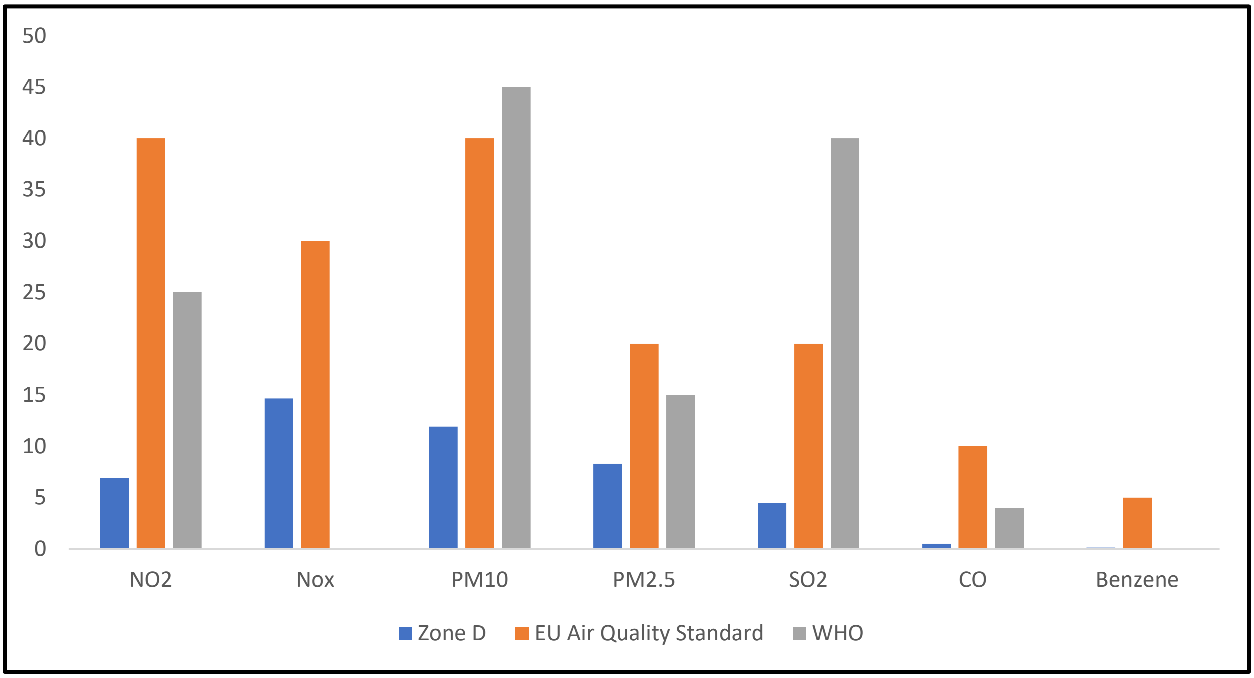
Table 3.5 Summary baseline air quality data (2020-2022)

Data set	**Parameter and averaging interval**		**Concentration µg/m^3**
Rural background	Nitrogen dioxide NO_2	*Annual Mean, µg/m^3*	6.9
Rural background	Nitrogen oxides, NO_x	*Annual Mean, µg/m^3*	14.7
Rural background	Particulate Matter PM_{10}	*Annual Mean, µg/m^3*	11.9
Rural background	Particulate Matter $PM_{2.5}$	*Annual Mean, µg/m^3*	8.3
Rural background	Sulfur dioxide, SO_2	*Annual Mean, µg/m^3*	4.5
Rural background	Carbon Monoxide CO	*Annual Mean 8-hour, mg/m^3*	0.5
Rural background	Benzene	*Annual Mean, µg/m^3*	0.1

NOTE

1. Data summarised from the EPA Annual Ambient Air Quality Monitoring Reports 2020 to 2022
2. No Zone D measurements recorded during this interval but a value of 0.1 m*g/m^3 was recorded for Zone C.*

Figure 3.2 Comparison of Zone D Background Air Quality and Ambient Air Quality Standards



3.7 Site specific ambient air quality monitoring

A survey of air quality in the area of the site was carried out during the period February to May 2024. The survey consisted of deployment of a series of diffusion tubes to measure ambient levels of nitric oxide (NO), nitrogen dioxide (NO_2), nitrogen oxides (NO_x), sulfur dioxide (SO_2) and ammonia (NH_3) levels at 5 locations at and in the vicinity of the site. A continuous monitoring survey of nitrogen oxides (NO, NO_2 and NO_x) and PM_{10} was also undertaken at one of these locations. The detailed results of the surveys are presented in Appendix II. A summary of the results is presented in Table 3.6 to Table 3.11.

The results of the ambient air quality survey are consistent with expectations in that the levels are generally low and are clearly influenced by emissions from traffic on the surrounding road network. All of the monitoring results are compliant with the annual mean air quality standard for nitrogen oxides and sulfur dioxide and the results are consistent with the longer term EPA monitoring data for rural locations. Levels of nitric oxide are extremely low which indicates that the main sources of NO_x in the area are removed from the site and are likely to be traffic on the surrounding roads. Peaks in NO detected occasionally during the monitoring period were attributed to machinery working on site for intensive investigations, while the ammonia originates from agricultural activity in the area. The site specific monitoring data are generally lower than the longer term EPA data which is not surprising given the limited duration of this survey. In the absence of a longer site-specific monitoring data set, the longer term EPA data is likely to be more representative of the annual average concentrations and is therefore selected for use in this assessment. The data from the continuous monitoring survey is a useful benchmark, it confirms the dominant influence of traffic emissions on air quality at the site. Using the higher long term monitoring data from the EPA is a conservative approach and may overestimate the impact of the proposed development on ambient air quality in the area.

Table 3.6 Diffusion tube NO_2 survey results

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	1.5	1.1	1.6	1.4
AS-102	1.8	1.4	1.6	1.6
AS-103	1.5	1.2	1.6	1.4
AS-104	1.4	1.2	1.4	1.3
AS-105	1.5	1.2	1.6	1.4

Table 3.7 Diffusion tube NOx survey

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	< 3.2	< 3.2	< 3	< 3.1
AS-102	< 3.2	< 3.2	< 3	< 3.1
AS-103	< 3.2	< 3.2	< 3	< 3.1
AS-104	< 3.2	< 3.2	6.0	4.1
AS-105	< 3.2	< 3.2	< 3	< 3.1

Table 3.8 Diffusion tube SO_2 survey

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	< 2	< 2	< 1.9	< 2
AS-102	< 2	< 2	< 1.9	< 2
AS-103	< 2	< 2	< 1.9	< 2
AS-104	< 2	< 2	< 1.9	< 2
AS-105	< 2	< 2	< 1.9	< 2

Table 3.9 Diffusion tube NH_3 survey

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	0.8	0.9	2.7	1.5
AS-102	3.7	0.9	1.3	2.0
AS-103	0.7	< 0.5	1.2	0.8
AS-104	1.0	0.9	0.9	0.9
AS-105	1.1	0.7	1.3	1.0

Table 3.10 Continuous monitoring survey for NOx

Location	09 April to 23 May 2024		
	NO_2, µg/m^3	NO, µg/m^3	NOx, µg/m^3
AS-105 Survey average	6.4	0.6	2.8

Table 3.11 Continuous monitoring survey for PM_{10}

Location	09 April to 23 May 2024		
	PM_{10}, µg/m^3	PM_1, µg/m^3	$PM_{2.5}$, µg/m^3
AS-105 Survey average	3.1	2.2	3.0

4.0 DISPERSION MODELLING PREDICTIONS

4.1 Modelling predictions

Model executions were completed to assess the incremental additions to ground level concentrations of NO_2, NO_x, CO, PM_{10} and SO_2 over specified averaging intervals to allow comparison of the predictions with the relevant Air Quality Standards, which have been defined for all of these pollutants as set out in Table 3.1. These pollutants have been selected as a screening analysis identified these as the most sensitive parameters for assessing the impact on air quality of the emissions.

The detailed modelling predictions (using meteorological data for 2019 – 2023) are presented in Appendix III. In each case, the maximum predicted Process Contribution to ground level concentrations is shown in the Tables. In addition, the predicted impact on air quality taking account of the existing background levels is also assessed with the calculation of the Predicted Environmental Concentration (PEC). Representative isopleths showing the distribution of emissions from the plant are shown in Appendix III to show the outputs from the model in a map format.

4.2 Assessment of air quality impact on human health

4.2.1 Introduction

A summary of the dispersion modelling results for the maximum predicted Process Contributions for the worst case meteorological year is presented in Table 4.1a – Table 4.4f. The results are presented for a number of operating scenarios as described in section 3.5.2 and summarised as follows:

- **OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500hours);** this scenario considered 1500 operating hours per year on natural gas;
- **OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation);** this scenario considered full time operation on natural gas;
- **OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation);** this scenario considered full time operation on gas oil;
- **OCGT Operating Scenario #4: Gas Oil fuel (500 hours per annum);** this scenario considered < 500 operating hours per year on gas oil;

4.2.1 Impact Assessment for Normal Operation on Natural Gas

OCGT Operating Scenario #1 considered 1500 operating hours for the proposed Reserve Power plant per year using natural gas as fuel.

The most sensitive pollutant is nitrogen dioxide so the detailed discussion presented here is for nitrogen dioxide; results for carbon monoxide are also presented as this is also a regulated pollutant under the Large Combustion Plant Directive. All other substances are emitted at lower concentrations and the impacts are less significant. The results of the model runs are presented in Table 4.1a for NO_2 and in Table 4.1b for CO for the annual average emissions scenario with 1500 operating hours per year.

The modelling predictions show that the predicted concentrations are all significantly lower than the relevant air quality standard. For the most sensitive pollutant, nitrogen dioxide, the predicted ambient concentrations expressed as the Process Contribution for the 99.8-percentile of 1-hour concentrations will not exceed 19.1% of the air quality standard.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards. As is evident from the contour plot presented in the representative isopleth shown in Figure 4.1 for the normal operating scenario on natural gas, the highest predicted Process Contributions (PCs) are close to the facility with concentrations reducing with distance from the source as expected.

Results are also presented for an operating scenario that assumes maximum daily emission rates will occur continuously throughout the operating period. Results are presented in Table 4.1a and Table 4.1b. The modelling predictions show that the predicted concentrations are all significantly lower than the relevant air quality standards.

Table 4.1a Predicted NO_2 concentrations for Normal Operation on Natural Gas

OCGT Operating Scenario #1: Natural gas (Normal Operation)

1500 operating hours per year

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.1	13.8	51.9	200	19.1
	Annual mean	0.28	6.9	7.2	40	0.7
Annual average emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.5	13.8	52.3	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.1b Predicted CO concentrations for Normal Operation on Natural Gas

OCGT Operating Scenario #1: Natural gas (Normal Operation)

1500 operating hours per year

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	Maximum 8-hour mean	143	500	643	10,000	1.4
Annual average emission rate						
2019 - 2023	Maximum 8-hour mean	196	500	696	10,000	2.0

NOTE

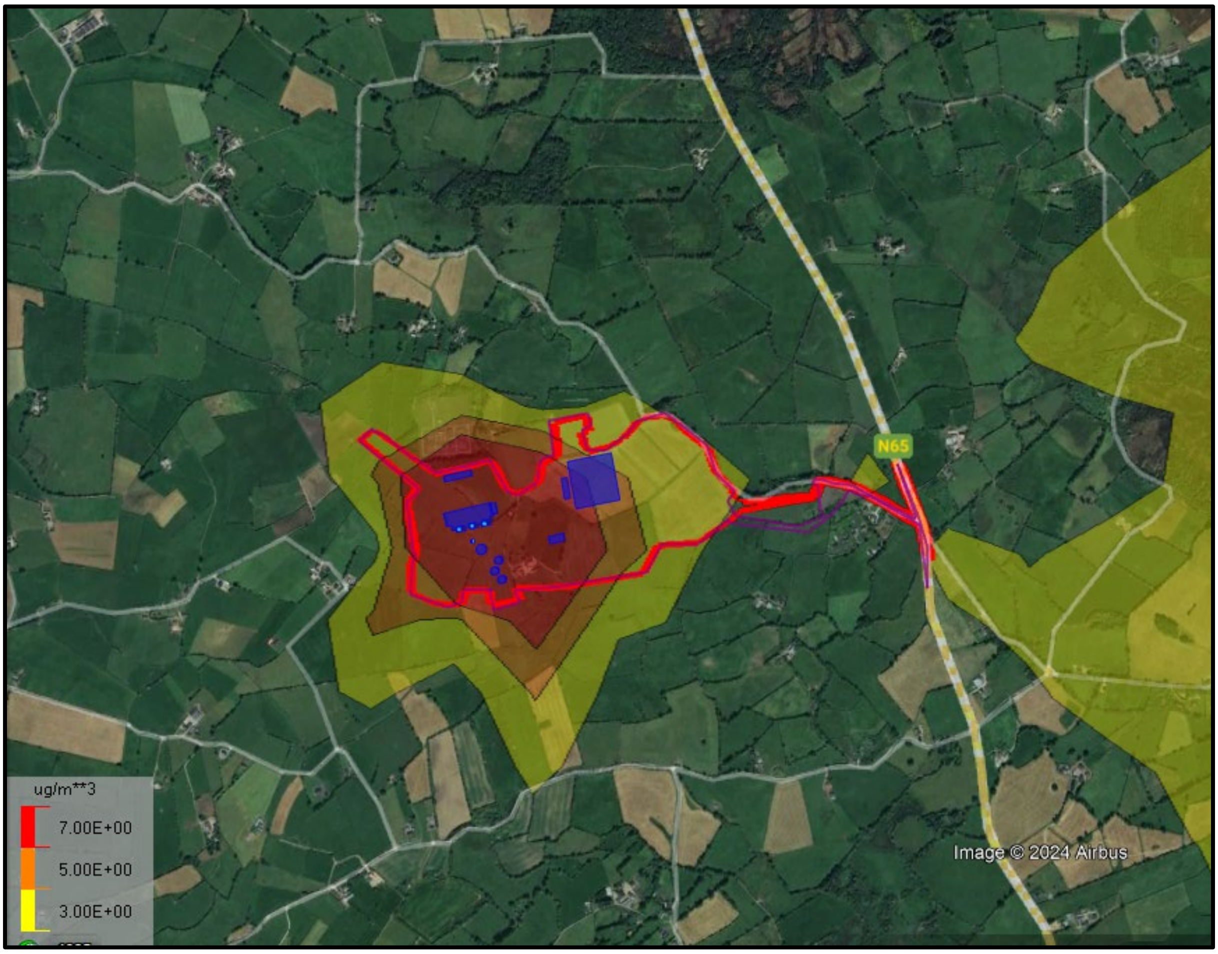
The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Figure 4.1 Isopleth showing predicted ground level concentrations of NO2 expressed as the 99.8-percentile of 1-hour NO_2 for the normal operation of the facility on natural gas

OCGT Operating Scenario #1: Natural gas (Normal Operation)

1500 operating hours per year

Table 3.4a Annual average emissions



4.2.2 Impact Assessment for Worst Case Operation on Natural Gas

OCGT Operating Scenario #2 considers the unlikely scenario of full time operation on natural gas.

Results are presented for nitrogen dioxide and carbon monoxide as both are regulated pollutants under the Large Combustion Plant Directive. All other substances are emitted at lower concentrations and the impacts are less significant. The results of the runs are presented in Table 4.2a and Table 4.2b for NO_2 and CO for full time operation on natural gas. Modelling predictions based on annual average emission rates as well as maximum daily emissions assumed to run continuously are presented.

The modelling results show that even if the plant were to run full time on natural gas, the predicted ambient concentrations for the most sensitive pollutant, nitrogen dioxide, expressed as the Process Contribution will not exceed 19.3% of the air quality standard for the 99.8 percentile of one-hour concentrations.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards. As is evident from the contour plot presented in Figure 4.2, the highest predicted Process Contributions (PCs) are close to the facility with concentrations reducing with distance from the source as expected.

A conservative assumption that the maximum daily emission rate would apply for the entire year was modelled to specifically assess potential impacts for shorter averaging intervals as shown in Table 4.2a and Table 4.2b. This is an ultra-conservative approach and overestimates the potential impacts. Even for this unrealistic scenario, the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

Table 4.2a Predicted NO_2 concentrations for Worst Case Operation on Natural Gas

OCGT Operating Scenario #2: Natural gas fuel (Worst Case)

Full time operation on natural gas

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.6	13.8	52.3	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7
Annual average emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.5	13.8	52.3	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.2b Predicted CO concentrations for Worst Case Operation on Natural Gas

OCGT Operating Scenario #2: Natural gas fuel (Worst Case)

Full time operation on natural gas

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	Maximum 8-hour mean	426	500	926	10,000	4.3
Annual average emission rate						
2019 - 2023	Maximum 8-hour mean	196	500	696	10,000	2.0

NOTE

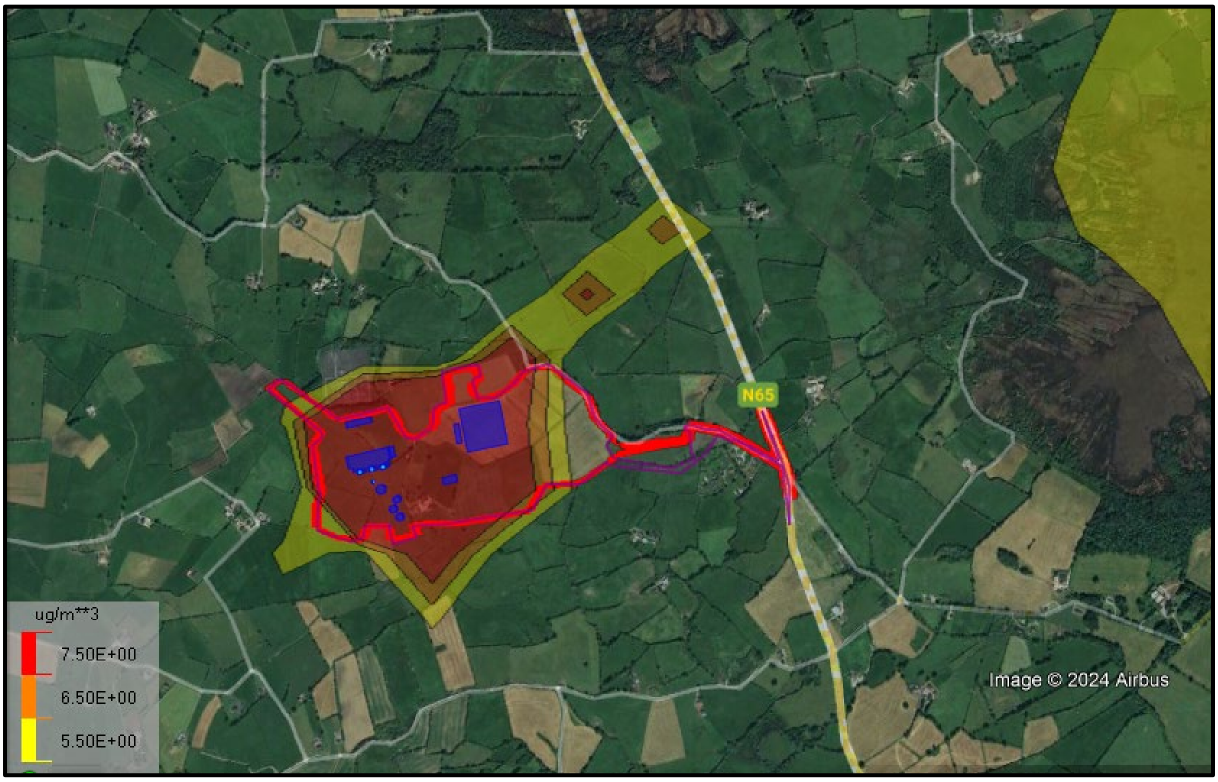
The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Figure 4.2 Isopleth showing predicted ground level concentrations of NO2 expressed as the 99.8-percentile of 1-hour NO_2 for the full time operation of the facility on natural gas

OCGT Operating Scenario #2: Natural gas fuel (Worst Case)

Full time operation on natural gas

Table 3.4a Annual average emissions



4.2.3 Impact Assessment for Worst Case Operation on Gas oil

OCGT Operating Scenario #3 considered full time operation on gas oil. This scenario is highly unlikely to occur given the logistical difficulties of fuel delivery and storage but the assessment is included to ensure that all meteorological conditions are considered.
Results are presented for nitrogen dioxide, carbon monoxide, sulfur dioxide and PM_{10} as all are regulated pollutants under the Large Combustion Plant Directive. The results of the runs are presented in Table 4.3a to 4.3f for full time operation on gas oil. Modelling predictions based on annual average emission rates are presented in Tables 4.3a to Table 4.3b for SO_2 and PM_{10}, respectively, while predictions based on maximum daily emissions are presented in Tables 4.3c to 4.3f.

The modelling results show that even if the plant were to run full time on Gas oil, which could arise only in the event of an interruption to the national supply of natural gas, the predicted ambient concentrations for the most sensitive pollutant, sulfur dioxide, expressed as the Process Contribution will not exceed 47% of the air quality standard for the 99.7 percentile of one-hour concentrations.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

A conservative assumption that the maximum daily emission rate would apply for the entire year was modelled to specifically assess potential impacts for shorter averaging intervals as shown in Table 4.3c to Table 4.3d. This is an ultra-conservative approach and overestimates the potential impacts. Even for this unrealistic scenario, the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

Table 4.3a Predicted SO_2 concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	164,1	9.0	173.1	350	46.9
	99.2 %ile of 24-hour means	33.5	4.5	38.0	125	26.8
	Annual mean	1.3	4.5	5.8	20	6.5

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3b Predicted PM_{10} concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	0.23	11.9	12.1	50	0.4
	Annual mean	0.32	11.9	12.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3c Predicted NO_2 concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) $\mu g/m^3$	Background concentration $\mu g/m^3$	Predicted Environmental Concentration (PEC) $\mu g/m^3$	Air Quality Standard $\mu g/m^3$	PC as % of Air Quality Standard
2019 - 2023	99.8^{th} %ile of 1-hour means	38.6	13.8	52.4	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3d Predicted CO concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) $\mu g/m^3$	Background concentration $\mu g/m^3$	Predicted Environmental Concentration (PEC) $\mu g/m^3$	Air Quality Standard $\mu g/m^3$	PC as % of Air Quality Standard
2019 - 2023	Maximum 8-hour mean	511	500	1011	10,000	5.1

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3e Predicted SO_2 concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	180.6	9.0	189.6	350	51.6
	99.2 %ile of 24-hour means	36.8	4.5	41.3	125	29.4
	Annual mean	1.4	4.5	5.9	20	7.0

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3f Predicted PM_{10} concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	0.39	11.9	12.3	50	0.8
	Annual mean	0.33	11.9	12.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

4.2.4 Impact Assessment for Normal Operation on Gas oil

OCGT Operating Scenario #4 considered < 500 operating hours per year on gas oil. This is the expected operating regime for the Reserve Power plant.

Results are presented for nitrogen dioxide, carbon monoxide, SO_2 and PM_{10} as all are regulated pollutants under the Large Combustion Plant Directive. The results of the runs are presented in Table 4.4a to 4.4b for operation on gas oil for 500 hours per year. Modelling predictions based on annual average emission rates are presented in Tables 4.4a to Table 4.4b for SO_2 and PM_{10}, respectively. Modelling predictions are also presented based on maximum daily emission rates in Table 4.4c to Table 4.4f.

The modelling results show that during normal operation for 500 hours on Gas oil, the predicted ambient concentrations for the most sensitive pollutant, nitrogen dioxide, expressed as the Process Contribution will not exceed the air quality standard for the 99.8 percentile of one-hour concentrations.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

Table 4.4a Predicted SO_2 concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	38.4	9.0	47.4	350	11.0
	99.2 %ile of 24-hour means	15.6	4.5	20.1	125	12.5
	Annual mean	0.32	4.5	4.8	20	1.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4b Predicted PM_{10} concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	28.9	11.9	41.8	50	57.8
	Annual mean	0.32	11.9	12.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4c Predicted NO_2 concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) $\mu g/m^3$	Background concentration $\mu g/m^3$	Predicted Environmental Concentration (PEC) $\mu g/m^3$	Air Quality Standard $\mu g/m^3$	PC as % of Air Quality Standard
2019 - 2023	99.8^{th} %ile of 1-hour means	38.3	13.8	52.1	200	19.2
	Annual mean	0.31	6.9	7.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4d Predicted CO concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) $\mu g/m^3$	Background concentration $\mu g/m^3$	Predicted Environmental Concentration (PEC) $\mu g/m^3$	Air Quality Standard $\mu g/m^3$	PC as % of Air Quality Standard
2019 - 2023	Maximum 8-hour mean	57	500	557	10,000	0.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4e Predicted SO_2 concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	38.4	9.0	47.4	350	11.0
	99.2 %ile of 24-hour means	15.6	4.5	20.1	125	12.5
	Annual mean	0.32	4.5	4.8	20	1.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4f Predicted PM_{10} concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	28.9	11.9	40.8	50	57.8
	Annual mean	0.32	11.9	12.3	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

4.3 Impact of emissions to atmosphere on ecosystems

4.3.1 Introduction

This element of the assessment considers the following scenarios which are representative of potential worst case operating scenarios:

- OCGT Operating Scenario #2: Natural gas fuel (Worst Case full time operation); annual average emissions
- OCGT Operating Scenario #3: Gas oil fuel (Worst Case full time operation); maximum daily emissions

Any other operating scenarios such as shorter operating times represent less significant emissions scenarios with reduced air quality impact relative to the scenarios assessed.

The assessment of impact is based on consideration of the predicted ground level airborne concentration of nitrogen oxides on the environment and on designated ecological sites as well as considering the impact of nitrogen and sulfur dioxide deposition on the environment and on designated ecological sites. One element of the assessment considered all receptors outside the site boundary regardless of designated status, and the second element of the assessment considered the designated sites specifically.

Designated ecological sites within 15km of the site were identified and included in the assessment. There were 37 designated ecological sites selected for inclusion in the assessment as shown in Table 4.5 and in Figure 4.3.

Receptors within these designated sites were included in the dispersion modelling assessments and detailed modelling predictions are contained in Appendix III.

Table 4.5 Ecological Receptors within the Study Area for assessment

Receptor	Identification and designation
E1	Lough Derg, North-east Shore SAC (002241)
E2	Barroughter Bog SAC (000231)
E3	Rosturra Wood SAC (001313)
E4	Cloonmoylan Bog SAC (000248)
E5	Kilcarren-Firville Bog SAC (000647)
E6	Redwood Bog SAC (002353)
E7	Derrycrag Wood Nature Reserve SAC (000261)
E8	Pollnaknockaun Wood Nature Reserve SAC (00319)
E9	River Shannon Callows SAC (000216)
E10	Ardgraigue Bog SAC (002356)
E11	River Little Brosna Callows SPA (004086) & NHA (000564)
E12	Middle Shannon Callows SPA (004096)
E13	Slieve Aughty Mountains SPA (004168)
E14	Lough Derg (Shannon) SPA (004058)
E15	River Little Brosna Callows SPA (004086) & NHA (000564)
E16	Lorrha Bog NHA (001684)
E17	Derryoober Bog NHA (002379)
E18	Ballymacegan Bog NHA (000642)
E19	Meeneen Bog NHA (000310)
E20	Slieve Aughty Bog NHA (001229)
E21	Capira/Derrew Bog NHA (001240)
E22	Moorfield Bog NHA (001303)
E23	Cloonoolish Bog NHA (000249)
E24	Eskerboy Bog NHA (001264)
E25	Ardgraigue Bog pNHA (001224)
E26	Pollnaknockaun Wood Nature Reserve pNHA (000319)
E27	Derrycrag Wood Nature Reserve pNHA (000261)
E28	River Shannon Callows pNHA (000216)
E29	Cloonmoylan Bog pNHA (000248)
E30	Lough Derg pNHA (000011)
E31	Barroughter Bog pNHA (000231)
E32	Rosturra Wood pNHA (001313)
E33	Friar's Lough pNHA (000933)
E34	Redwood Bog pNHA (000654)
E35	Kilcarren-Firville Bog pNHA (000647)
E36	Spring Park Wetlands pNHA (000941)
E37	Lough Avan pNHA (001995)

Figure 4.3a Ecological receptors for detailed study (SAC)

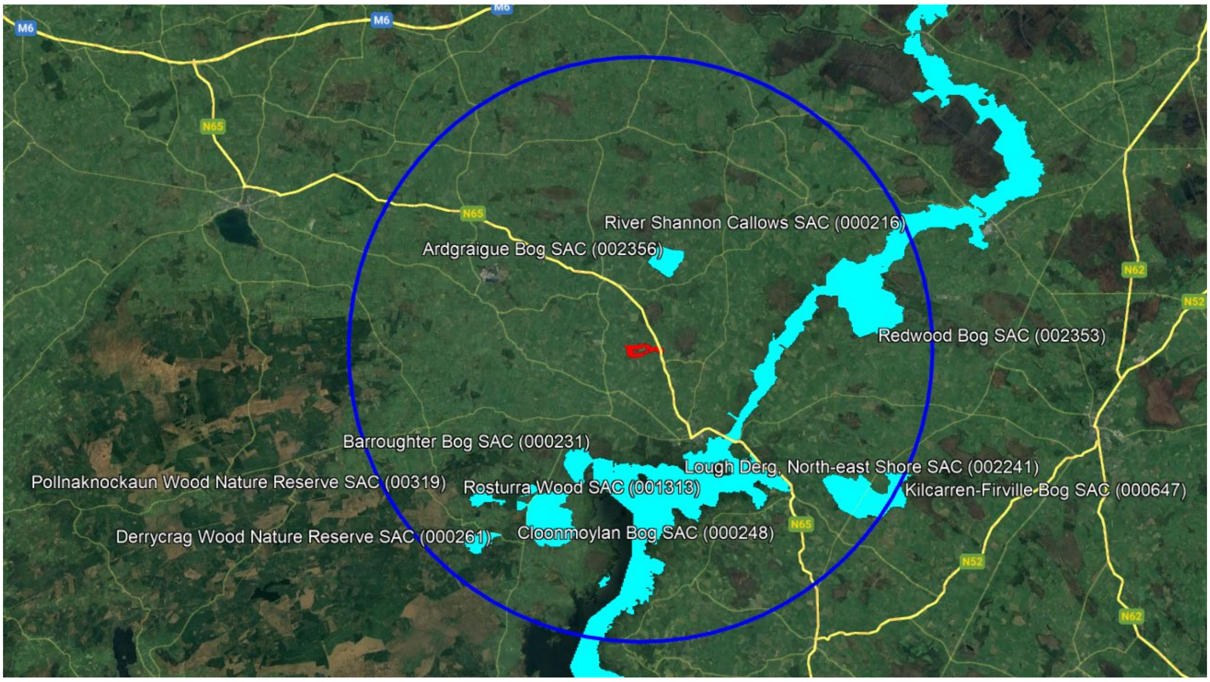


Figure 4.3b Ecological receptors for detailed study (SPA)

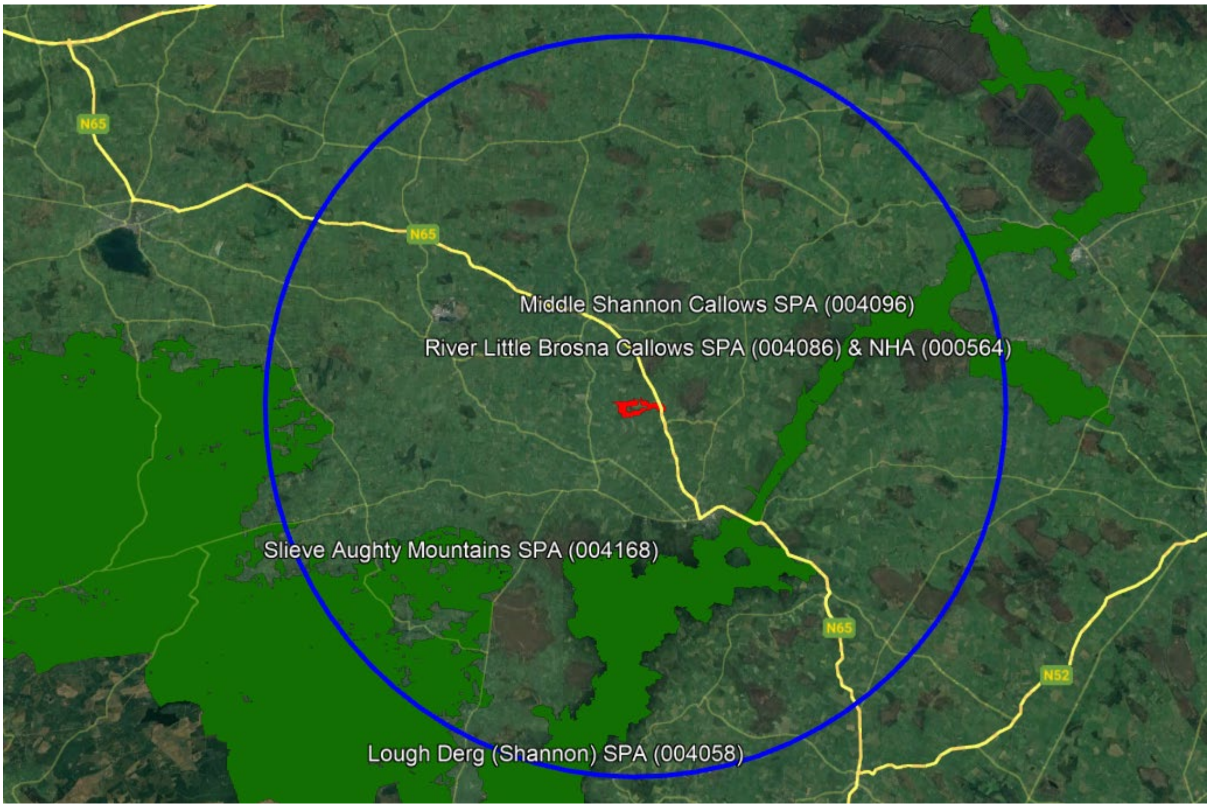


Figure 4.3c Ecological receptors for detailed study (NHA)

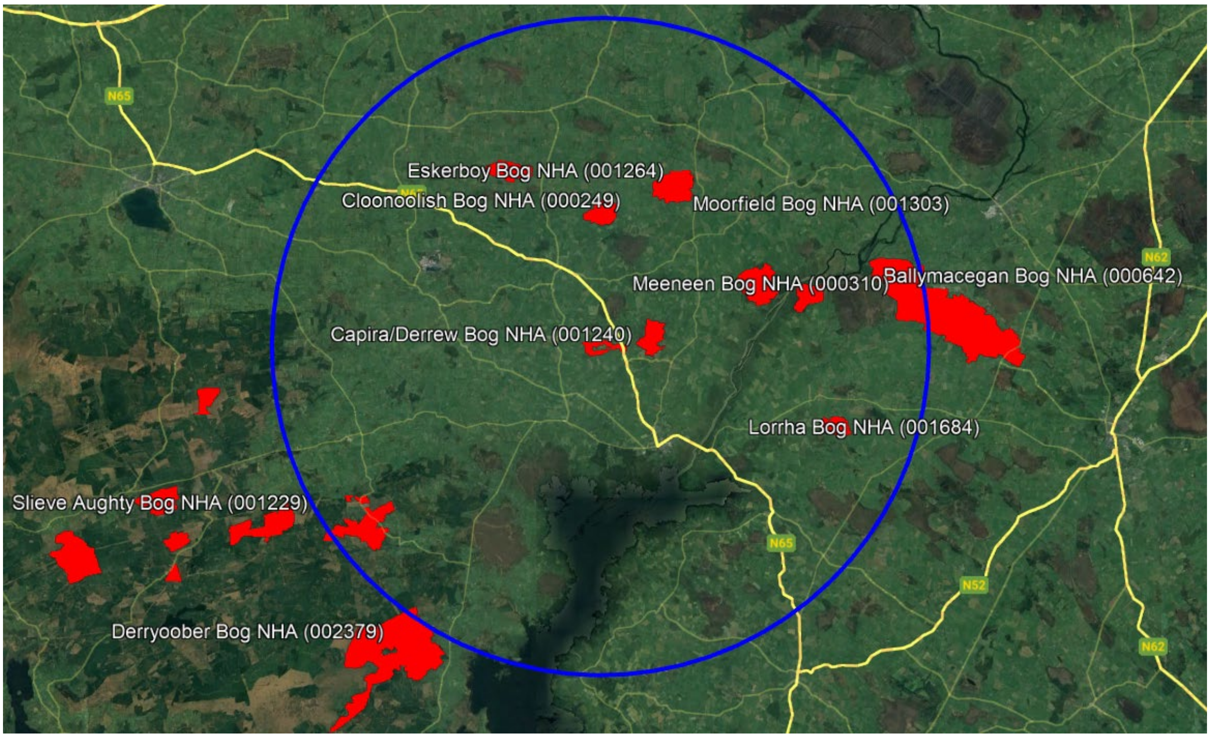
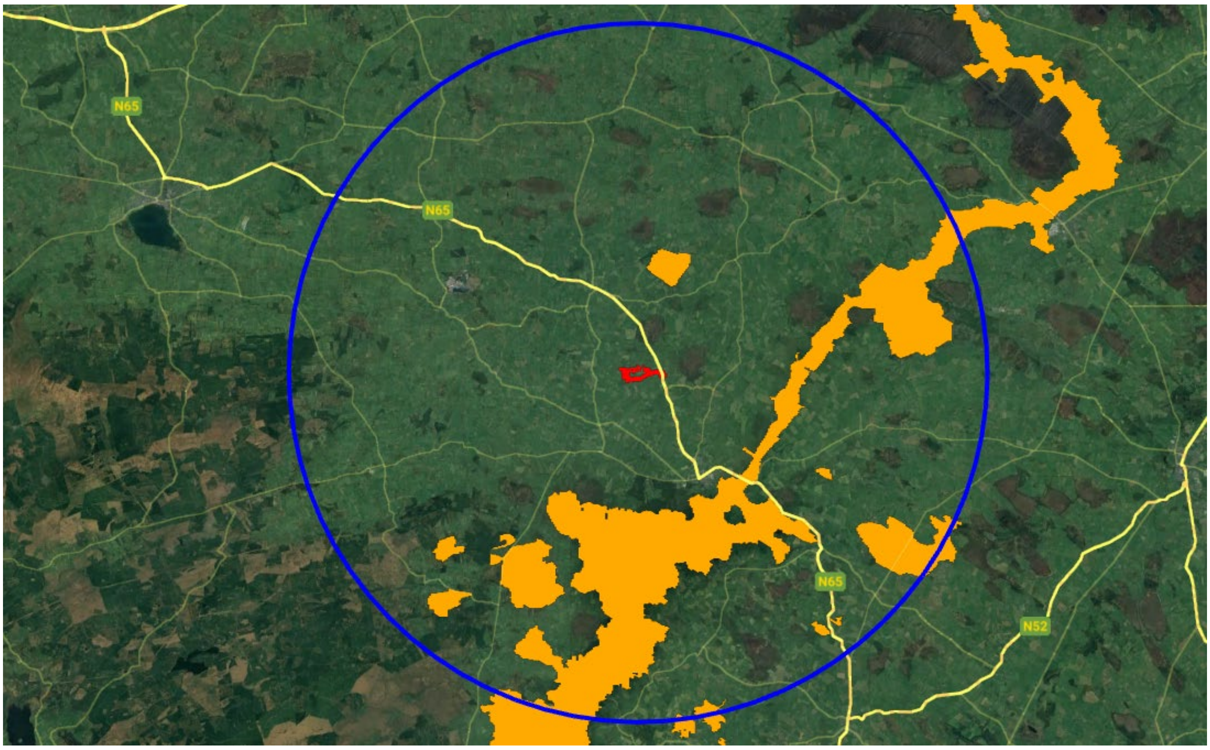


Figure 4.3d Ecological receptors for detailed study (pNHA)



4.3.2 Impact of Fulltime operation on natural gas fuel on ecosystems

The impact of nitrogen oxides (NOx) emissions on sensitive ecosystems was assessed by modelling the NOx emissions from the worst case scenario with the turbines operating full time on natural gas. This is not the most likely operating scenario for the facility but it represents maximum potential impact on ecosystems and was therefore considered as a conservative approach to the assessment. The assessment considers all locations outside the site boundary and receptors located in the designated ecological sites.

The impact predictions for the concentration of nitrogen oxides in air at ground level are presented in Table 4.6. The predictions presented in Table 4.6 are the highest concentrations predicted at the designated ecological sites.

Table 4.6 Predicted NO_x concentrations for Worst Case Operation on Natural Gas (Ecological sites)

Highest concentrations predicted at any designated ecological site for full time operation on natural gas, annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	Annual mean	0.18	14.7	14.9	30	0.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions.

The maximum predicted Process Contributions are considered with the background concentrations to arrive at a Predicted Environmental Concentration (PEC). The background concentration selected is for the areas closest to the site where maximum predicted Process Contributions (PCs) arise which is likely to be conservative given the surrounding land uses and the dominating influence of traffic from the road network on ambient air quality. Areas removed from the road network would be expected to show lower concentrations of traffic-related pollutants such as NO_2 and NO_x. The background concentrations of NOx as determined from the long term EPA monitoring data for rural Ireland (Table 3.5) compare well with the site specific data presented in Tables 3.6, Table 3.7 and Table 3.10, although the site specific data is lower than the level chosen as background for the area in this study.

The results indicate that the cumulative impact of the proposed development with existing activities will not exceed the air quality standard of 30 µg/m^3 expressed as an annual mean for ground level concentration of NO_x. The results therefore indicate that the emissions from the facility will not exert a significant adverse impact on any receptor outside the site boundary or, specifically, any designated ecosystems. The maximum predicted process contribution to ground level concentration as a result of the proposed development is less than 1% of the Air Quality Standard for full time operation on natural gas at designated ecological sites. The results indicate that the cumulative impact of the proposed development with existing activities will not exceed the air quality standard.

4.3.3 Impact of Fulltime operation on Gas oil fuel on ecosystems

The impact of nitrogen oxides (NOx) emissions on sensitive ecosystems was assessed by modelling the NOx emissions from the worst case scenario with the turbines operating full time on Gas oil. This is an unlikely operating scenario for the facility, but inclusion of the scenario in this assessment is considered prudent. The assessment considers all locations outside the site boundary and separately receptors located in the designated ecological sites.

The impact predictions for the concentration of nitrogen oxides in air at ground level are presented in Table 4.7 for maximum ground level concentrations predicted at the designated ecological sites.

The maximum predicted Process Contributions are considered with the background concentrations to arrive at a Predicted Environmental Concentration (PEC). The background concentration selected is for the areas closest to the site where maximum predicted Process Contributions (PCs) arise which is likely to be conservative given the surrounding land uses and the dominating influence of traffic from the road network on ambient air quality.

The results indicate that the cumulative impact of the proposed development with existing activities will not exceed the air quality standard of 30 µg/m^3 expressed as an annual mean for ground level concentration of NO_x. The results therefore indicate that the emissions from the facility will not exert a significant adverse impact on any designated ecosystems. The maximum predicted process contribution to ground level concentration as a result of the proposed development is 3.7% of the Air Quality Standard for full time operation on Gas oil at any designated ecological site for full time operation on gas oil.

Table 4.7 Predicted NO_x concentrations for Worst Case Operation on Gas oil (Ecological sites)

Highest concentrations predicted at any designated ecological site for full time operation on gas oil, annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	Annual mean	1.1	14.7	15.8	30	3.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions.

4.3.4 Impact of nitrogen deposition from the proposed facility on ecosystems

The potential impact of the emissions on ecosystems is also considered using the projected nitrogen deposition rate which is derived from the gaseous nitrogen oxides concentration. The most sensitive habitat for this purpose is bog ecosystems and a recommendation of 5kg N ha^{-1} $year^{-1}$ has been made [UNECE 5 – 10 kg N ha^{-1} $year^{-1}$ and EPA *Research Report 390: Nitrogen–Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats (2016-CCRP-MS.43)* 5kg N ha^{-1} $year^{-1}$] as the critical load for habitat protection. The maximum rate of deposition of total nitrogen at any of the designated ecological receptors within 15km of the proposed site was determined from dispersion modelling as follows with data provided for the highest concentration predicted from the five years of meteorological data for any receptor at the designated ecological sites represented by E1 – E37.

The predicted deposition rates for the worst case operating scenario are well within the critical loads. The contribution from the process to the nitrogen deposition rate is less than 7% of the recommended level under maximum adverse conditions. The levels may also be considered in the context of measured nitrogen deposition rates at Valentia Observatory [EPA *Research Report 390: Nitrogen–Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats (2016-CCRP-MS.43)*]. This study estimated deposition rates of 8.3 kg N ha−1 y−1 for 2006 - 2015, with a maximum deposition of 19.3 kg N ha−1 y−1 during 2009. The Research Report found that dry deposition made up 40% of total deposition, which was dominated by reduced species (56%), that is, wet ammonium, dry particulate ammonium and dry gaseous ammonia. None of these species are significant in the current study but it is useful to note that nitrogen oxides are not the dominant contributor to nitrogen deposition in Ireland. Agricultural emissions are a much more significant source of deposition in rural environments than traffic or any facility of the type proposed here.

When these concentrations are converted to nitrogen deposition rates following the methodology outlined in the EPA Guidance Note AG4, and using the specified deposition velocities of 0.0015 (grassland) or 0.003 (forest), the assessment predicted a maximum potential nitrogen deposition rate at ecological sites as shown in Table 4.8. The data presented in Table 4.8 shows that even if the plant runs continuously on either gas or Gas oil, with Gas oil being the worst case scenario, the maximum potential impact at any location in the protected ecological sites, is significantly lower than the relevant critical loads as set out above.

Table 4.8 Total Nitrogen deposition at designated ecological sites as a result of emissions from the proposed Reserve Power plant: worst case operating scenario (Gas oil full time operation, maximum daily emissions)

Maximum impacted Ecological Receptor	**Maximum Total nitrogen deposition, kg N ha^{-1} $year^{-1}$**	
	Deposition velocity 0.0015m/sec	**Deposition velocity 0.003m/sec**
Process Contribution	0.158	0.316
Contribution from background	2.11	4.23
Total environmental contribution	2.26	4.54

Note

This data is for Site E19 Meneen Bog NHA where maximum impact is observed. Data for all sites is presented in Appendix III.

4.3.5 Impact of SO_2 deposition from the proposed facility on ecosystems

Nitrogen oxide emissions are significant in the emissions and the principal pollutant with potential to impact ecosystems is nitrogen oxides which are assessed in the report. Emissions to atmosphere of SO_2 are negligible when burning natural gas as fuel. As a result the potential impact on ecosystems is negligible and is not further considered. Emissions of SO_2 when using gas oil as fuel are higher than when using natural gas due to the higher sulfur content in the fuel. But the emission rates are still extremely low and unlikely to exert a measurable impact on ecosystems. Although SO_2 emissions are not expected to exert a measurable impact when burning gas oil as fuel, this section of the report considers the impact of sulfur dioxide on ecosystems. There are no other emissions, and specifically no ammonia or acid gases (HCl, H_2SO_4, HNO_3) in the emission stream so no further emissions require assessment.

The potential impact of SO_2 emissions on ecosystems is assessed using (a) the predicted ground level concentration of SO_2 and (b) the projected SO_2 deposition rate which is derived from the gaseous sulfur dioxide concentration. The predicted ground level concentrations of SO_2 as a result of emissions during the worst case scenario of operating full time on gas oil are presented in Table 4.4a and Table 4.4e where it is shown that the maximum annual mean predicted ground level concentration of SO_2 is 1.6% of the Air Quality Standard from the Process emissions with background levels more than 10 times higher. The overall predicted environmental concentration from the small Process contribution combined with the background contribution does not exceed the relevant Air Quality Standard for protection of ecosystems.

The maximum rate of deposition of total SO_2 at any of the designated ecological receptors within 15km of the proposed site was determined from dispersion modelling as follows with data provided for the highest concentration predicted from the five years of meteorological data for any receptor at the designated ecological sites represented by E1 – E37.

Table 4.9 Total SO_2 deposition at designated ecological sites as a result of emissions from the proposed Reserve Power plant: worst case operating scenario (Gas oil full time operation, annual average emissions)

Maximum impacted Ecological Receptor	**Maximum Total SO_2 deposition, keq ha^{-1} $year^{-1}$**	
	Deposition velocity 0.012m/sec Grassland	**Deposition velocity 0.024m/sec Forest**
Process Contribution	0.0567	0.1134
Contribution from background	0.5196	1.039
Total environmental contribution	0.5763	1.1524

There are no universal critical loads for habitat protection for SO_2 deposition. Critical Levels for SO_2 are set in the UK according to the Publication *UKCLAG, 1996. Critical levels of air pollutants for the United Kingdom*. UK Critical Loads Advisory Group, Institute of Terrestrial Ecology, Edinburgh. The Critical Level for forestry and natural vegetation as a winter mean concentration, 15 ug m^{-3}, is set for the critical level in areas with colder winter climates, because SO_2 is known to be more damaging under these conditions. This low temperature area is mainly confined to Scotland and northern England. The limit would not be relevant in Ireland but if it were applicable, the highest level of SO_2 predicted to occur as a result of the Process is 0.32ug./m^3 which is less than 2% of this advisory limit. Certain groups of lichen are the most sensitive known organisms to SO_2; so a critical level of an annual mean of 10 ug m^{-3} has been set to protect the most sensitive of these organisms. The highest level of SO_2 predicted to occur as a result of the Process is 0.32 ug./m^3 which is just 3% of this advisory limit. The background concentration of SO_2 is nearly four times higher than the Process contribution but the combined concentrations still do not exceed the advisory limits of 10 and 15mg/m3. There is therefore no adverse impact from the deposition of SO_2 from the Process on agriculture or ecosystems.

4.4 Assessment of cumulative impact Predicted Environmental Concentrations (PEC)

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area. The background concentration is the annual mean when evaluating annual or daily predictions and is taken as twice the annual mean when evaluating hourly or daily predictions.

The results are presented in Tables 4.1 to 4.4 for the potential operating scenarios. The modelling predictions for these potential operating scenarios indicate that the cumulative impact of the operation of the sources with existing activities will not exceed the Air Quality Standards. As is evident from the contour plots presented in Appendix II, the highest predicted PCs are close to the facility with concentrations reducing with distance from the source as expected.

4.5 Sensitivity analysis

Sensitivity checks on the modelling assumptions were checked as follows:

- Meteorological data selection
- Stack height
- Influence of terrain

The detailed results of those assessments are presented with the detailed modelling results in Appendix III. A summary of the principal findings is given here.

(i) The sensitivity of the modelling predictions to the choice of meteorological data was evaluated by comparing the results o modelling using meteorological data from Shannon Airport, Knock, Mullingar and Casement Aerodrome. Predictions for the 99.8%ile of 1-hour GLC for nitrogen dioxide were lower using the alternative data sets than those obtained using the Shannon meteorological data set. The assessment therefore presents a conservative assessment of air quality impacts of the proposed development.

(ii) Stack heights of 35m to 55m were investigated. As shown in Table 4.10 there is very little difference between the predictions. The minimum height of 35m represents the lowest stack height consistent with best practice as it is 3m above the height of the roof. The relatively high exit temperature and exit gas velocity results in very effective dispersion of emissions once the best practice height of 3m above the roof height is reached.

Table 4.10 Influence of stack height on model predictions

Parameter	**Averaging Interval**	**Stack height, m**	**Predicted Process Contribution to GLC, ug/m^3**
NO_2	99.8 %ile of 1-hour average	35	39.4
		40	38.9
		45	38.5
		50	38.4
		55	38.3

(iii) The influence of terrain was investigated by completing model runs with and without detailed terrain data. There was very little difference between the two sets of predictions indicating that terrain is not the dominant influence on dispersion of emissions for the project.

5.0 CONCLUSIONS

The impact of emissions to atmosphere has been investigated using a dispersion modelling approach. The assessment considered a stack height of 45m and demonstrated that this stack height is adequate to ensure the effective dispersion of the emissions. The assessment shows that the predicted concentrations are not predicted to exceed the Air Quality Standards for the normal and conservative worst-case operating scenarios assessed. There is therefore predicted to be no significant adverse impact on human health or on ecosystems as a result of the emissions.

Appendix 9.1

Diffusion Tube Air Quality Monitoring Surveys at Coolpowra Site

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: ICH
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 14.03.2024
place: passam ag

test report
created on: 15.03.2024
created by: K. Bodei
checked on: 18.03.2024
checked by: T. Hangartner
file name: ICH12-S-2401
pages: 1

SWISS ACCREDITATION
sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-1	IHC-1	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-102	2	2	45287	45301	08/02/2024		336.0	< 0.05	0.03	< 0.05	< 2.5	1.8	< 3.2	
AS-103	3	3	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-104	4	4	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-105	5	5	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement ICH12-S-2401

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	IHC-1	08/02/2024		22/02/2024		10		NA
AS-102	2	2	08/02/2024		22/02/2024		10		NA
AS-103	3	3	08/02/2024		22/02/2024		10		NA
AS-104	4	4	08/02/2024		22/02/2024		10		NA
AS-105	5	5	08/02/2024		22/02/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 12.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102401
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
			start		end		exp. time	blank	sample		m analyte/ sampler	C SO2	
	label	lot no.	date	time	date	time	[h]	[ppm]	dilution	value [ppm]	[ug]	[ug/m3]	
AS-101	IHC-1	45306-4	08/02/2024	15:30	22/02/2024	09:00	329.5	0.251	-	0.253	< 0.72	< 2	
AS-102	2	45306-4	08/02/2024	16:00	22/02/2024	09:15	329.3	0.251	-	0.270	< 0.72	< 2	
AS-103	3	45306-4	08/02/2024	16:15	22/02/2024	09:30	329.3	0.251	-	0.250	< 0.72	< 2	
AS-104	4	45306-4	08/02/2024	16:30	22/02/2024	09:45	329.3	0.251	-	0.260	< 0.72	< 2	
AS-105	5	45306-4	08/02/2024	17:15	22/02/2024	10:00	328.8	0.251	-	0.262	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102401

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information Temp [°C]	Optional information air pressure [hPa]	Optional information Comment on sampling
AS-101	IHC-1	08/02/2024	15:30	22/02/2024	09:00	4		NA
AS-102	2	08/02/2024	16:00	22/02/2024	09:15	4		NA
AS-103	3	08/02/2024	16:15	22/02/2024	09:30	4		NA
AS-104	4	08/02/2024	16:30	22/02/2024	09:45	4		NA
AS-105	5	08/02/2024	17:15	22/02/2024	10:00	4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112401
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ABS]	sample dilution	sample value [ABS]	m analyte/ sampler [ug]	C NH3 [ug/m3]	
AS-101	IHC-1	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.133	0.55	0.8	
AS-102	IHC-2	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.416	2.47	3.7	sampler uncapped
AS-103	IHC-3	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.124	0.49	0.7	
AS-104	IHC-4	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.147	0.65	1.0	
AS-105	IHC-5	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.164	0.76	1.1	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112401

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
	label	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	08/02/2024		22/02/2024		4		NA
AS-102	IHC-2	08/02/2024		22/02/2024		4		NA
AS-103	IHC-3	08/02/2024		22/02/2024		4		NA
AS-104	IHC-4	08/02/2024		22/02/2024		4		NA
AS-105	IHC-5	08/02/2024		22/02/2024		4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 14.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 22.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC12-S-2402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-6	IHC-6	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.1	< 3.2	
AS-102	IHC-7	IHC-7	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-103	IHC-8	IHC-8	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-104	IHC-9	IHC-9	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-105	IHC-10	IHC-10	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2402

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 14.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102402
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-6	45306-4	22/02/2024	09:00	07/03/2024	10:00	337.0	0.251	-	0.250	< 0.72	< 2	
AS-102	7	45306-4	22/02/2024	09:15	07/03/2024	10:15	337.0	0.251	-	0.256	< 0.72	< 2	
AS-103	8	45306-4	22/02/2024	09:30	07/03/2024	10:30	337.0	0.251	-	0.260	< 0.72	< 2	
AS-104	9	45306-4	22/02/2024	09:45	07/03/2024	10:45	337.0	0.251	-	0.264	< 0.72	< 2	
AS-105	10	45306-4	22/02/2024	10:00	07/03/2024	11:00	337.0	0.251	-	0.254	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102402

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information Temp [°C]	Optional information air pressure [hPa]	Optional information Comment on sampling
AS-101	IHC-6	22/02/2024	09:00	07/03/2024	10:00	10		NA
AS-102	7	22/02/2024	09:15	07/03/2024	10:15	10		NA
AS-103	8	22/02/2024	09:30	07/03/2024	10:30	10		NA
AS-104	9	22/02/2024	09:45	07/03/2024	10:45	10		NA
AS-105	10	22/02/2024	10:00	07/03/2024	11:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Mr.Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
			start		end		exp. time	blank	sample		m analyte/ sampler	C NH3	
	label	lot no.	date	time	date	time	[h]	[ABS]	dilution	value [ABS]	[ug]	[ug/m3]	
AS-101	IHC-6	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.137	0.58	0.9	
AS-102	IHC-7	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.136	0.57	0.9	
AS-103	IHC-8	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.099	< 0.34	< 0.5	
AS-104	IHC-9	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.145	0.64	0.9	
AS-105	IHC-10	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.117	0.45	0.7	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112402

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 28.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 11.04.2024
place: passam ag

test report
created on: 11.04.2024
created by: U. Kunz
checked on: 11.04.2024
checked by: T. Hangartner
file name: IHC12-S-2403
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-11	IHC-11	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-102	IHC-12	IHC-12	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-103	IHC-13	IHC-13	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	Back with green membrane, uncapped!
AS-104	IHC-14	IHC-14	45287	45301	07/03/2024	11:00	358.0	0.09	0.02	0.12	4.5	1.4	6.0	Back with green membrane, uncapped!
AS-105	IHC-15	IHC-15	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2403

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 28.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102403
pages: 1

note: *applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch*

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-11	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.263	< 0.72	< 1.9	
AS-102	12	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.264	< 0.72	< 1.9	
AS-103	13	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.262	< 0.72	< 1.9	
AS-104	14	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.265	< 0.72	< 1.9	
AS-105	15	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.268	< 0.72	< 1.9	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102403

passam ag

air quality monitoring

SO_2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
	label	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 28.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 04.04.2024
place: passam ag

test report
created on: 04.04.2024
created by: U. Kunz
checked on: 04.04.2024
checked by: T. Hangartner
file name: IHC112403
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
			start		end		exp. time	blank	sample		m analyte/ sampler	C NH3	
	label	lot no.	date	time	date	time	[h]	[ABS]	dilution	value [ABS]	[ug]	[ug/m3]	
AS-101	IHC-11	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.337	1.95	2.7	
AS-102	IHC-12	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.189	0.94	1.3	
AS-103	IHC-13	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.173	0.83	1.2	
AS-104	IHC-14	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.150	0.68	0.9	
AS-105	IHC-15	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.192	0.96	1.3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112403

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information: Temp [°C]	air pressure [hPa]	Comment on sampling
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Appendix 9.2

Continuous Ambient Air Quality Monitoring Surveys at Coolpowra Site

Figure A9.2.1 Continuous monitoring results NO_2

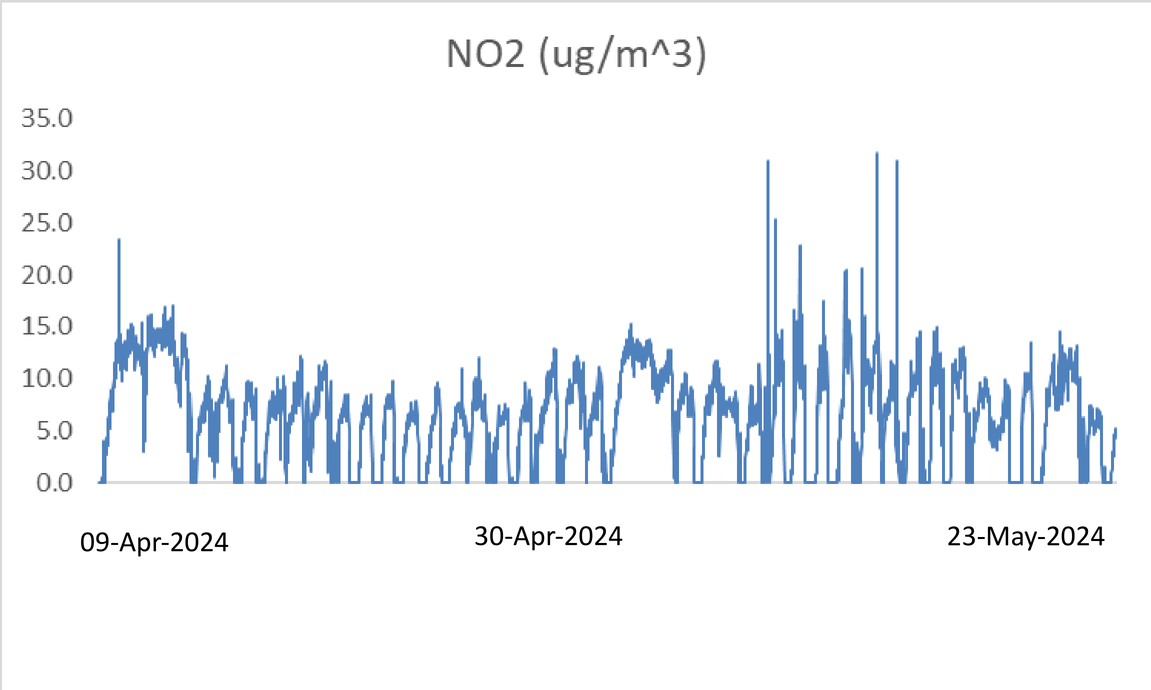


Figure A9.2.2 Continuous monitoring results NO

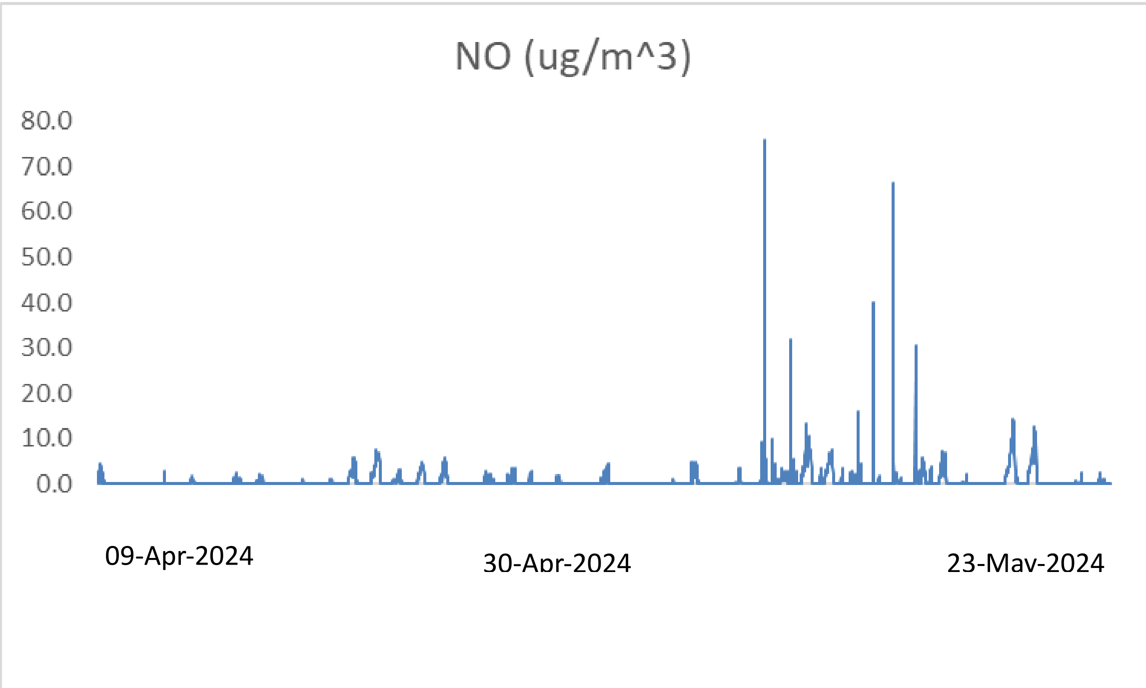
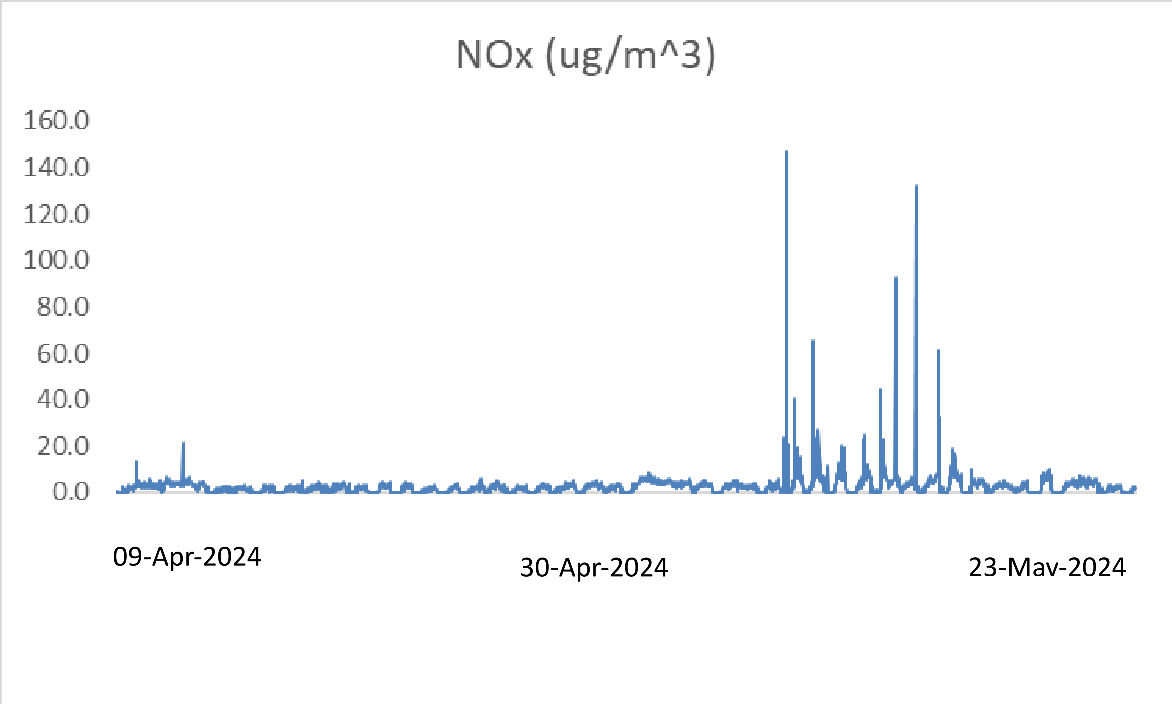


Figure A9.2.3 Continuous monitoring results NO_x



Date	PM10	PM1	PM2.5
09/04/2024	3.56	1.68	3.5
10/04/2024	2.18	1.31	2.15
11/04/2024	6.86	4.4	6.85
12/04/2024	1.76	0.93	1.65
13/04/2024	4.56	2.38	4.51
14/04/2024	4.92	2.45	4.88
15/04/2024	6.48	3.54	6.47
16/04/2024	4.67	2.47	4.66
17/04/2024	4.37	2.07	4.31
18/04/2024	4.41	2.39	4.39
19/04/2024	1.66	0.89	1.63
20/04/2024	2.92	1.87	2.87
21/04/2024	3.85	2.68	3.81
22/04/2024	2.8	1.69	2.71
23/04/2024	2.08	1.06	2.04
24/04/2024	4.73	2.39	4.67
25/04/2024	3.14	1.69	3.12
26/04/2024	2.16	1.44	2.13
27/04/2024	2.1	1.46	2.03
28/04/2024	2.04	1.25	1.93
29/04/2024	1.51	0.77	1.45
30/04/2024	1.78	0.9	1.66
01/05/2024	1.88	0.97	1.84
02/05/2024	2.38	1.62	2.32
03/05/2024	1.66	0.75	1.52
04/05/2024	1.94	1.01	1.89
05/05/2024	1.88	1.1	1.75
06/05/2024	2.66	1.7	2.58
07/05/2024	4.27	2.28	4.2
08/05/2024	3.44	2.16	3.33
09/05/2024	2.93	2.11	2.83
10/05/2024	3.45	2.49	3.39
11/05/2024	5.18	4.1	5.17
12/05/2024	5.61	4.44	5.53
13/05/2024	1.36	0.74	1.25
14/05/2024	2.63	1.58	2.54
15/05/2024	1.66	1.04	1.64
16/05/2024	3.64	2.66	3.45
17/05/2024	3.75	2.49	3.68
18/05/2024	2.91	1.93	2.88
19/05/2024	1.85	1	1.65
20/05/2024	3.09	2	3
21/05/2024	2.57	1.96	2.44
22/05/2024	1	1.87	1.69
23/05/2024	1.58	3.18	3.05
Average 24-hr	***3.1***	***2.2***	***3.0***

Appendix I

Gridded and sensitive receptors

Table 1 Ecological and Human Sensitive Receptor locations

1	D1	Sensitive	550238.28	5887215.5
2	D2	Sensitive	550259.78	5887188.74
3	D3	Sensitive	550315.72	5887186.07
4	D4	Sensitive	550228.9	5887156.05
5	D5	Sensitive	550198.29	5887140.41
6	D6	Sensitive	550173.32	5887117.96
7	D7	Sensitive	550139.9	5887100.77
8	D8	Sensitive	550252.96	5887074.96
9	D9	Sensitive	549976	5886926.63
10	D10	Sensitive	549975.11	5886743.88
11	D11	Sensitive	550090.75	5886606.65
12	D12	Sensitive	550217.14	5886434.61
13	D13	Sensitive	550415.62	5886524.65
14	D14	Sensitive	549969.78	5886405.1
15	D15	Sensitive	549642.04	5885990.65
16	D16	Sensitive	549637.06	5885902.72
17	D17	Sensitive	549668.23	5885874.46
18	D18	Sensitive	549515.59	5885967.26
19	D19	Sensitive	549409.58	5885985.75
20	D20	Sensitive	549239.55	5885787.96
21	D21	Sensitive	549647.2	5885541.19
22	D22	Sensitive	549468	5885232.28
23	D23	Sensitive	549449.16	5885192.76
24	D24	Sensitive	549506.84	5885125.68
25	D25	Sensitive	549381.61	5885042.53
26	D26	Sensitive	549288.83	5884982.25
27	D27	Sensitive	549289.38	5885040.19
28	D28	Sensitive	549213.42	5885009.48
29	D29	Sensitive	550934.39	5885652.77
30	D30	Sensitive	550862.18	5885572.12

31	D31	Sensitive	550872.23	5885540.31
32	D32	Sensitive	550875.79	5885513.42
33	D33	Sensitive	550898.13	5885356.16
34	D34	Sensitive	551082.74	5885439.72
35	D35	Sensitive	551320.11	5885271.64
36	D36	Sensitive	551184.04	5885776.36
37	D37	Sensitive	551584.91	5885633.73
38	D38	Sensitive	550863.42	5885940.68
39	D39	Sensitive	550782.09	5886031.32
40	D40	Sensitive	550882.07	5886428.66
41	D41	Sensitive	550857.02	5886416.68
42	D42	Sensitive	550657.17	5886484.87
43	D43	Sensitive	550610.9	5886647.37
44	D44	Sensitive	550906.12	5886729.95
45	D45	Sensitive	550988.18	5886666.87
46	D46	Sensitive	551267.33	5886629.4
47	D47	Sensitive	551308.41	5886695.15
48	D48	Sensitive	551415.31	5886687.73
49	D49	Sensitive	551526.34	5886722.7
50	D50	Sensitive	551734.06	5886685.02
51	D51	Sensitive	552258.1	5887366.04
52	D52	Sensitive	552222.94	5887437.15
53	D53	Sensitive	551054.48	5887185.25
54	D54	Sensitive	551040.38	5887196.43
55	D55	Sensitive	551036.9	5887170.04
56	D56	Sensitive	551022.12	5887181.79
57	D57	Sensitive	550942.67	5888292.65
58	D58	Sensitive	550861.78	5888534.33
59	D59	Sensitive	551044.59	5888606.9
60	D60	Sensitive	551106.44	5888623.22
61	D61	Sensitive	551129.34	5888700.34

62	D62	Sensitive	549039.8	5888667.86
63	D63	Sensitive	548995.23	5888582.25
64	D64	Sensitive	547663.96	5888675.09
65	D65	Sensitive	547691.72	5888616.01
66	D66	Sensitive	547351.19	5888591.09
67	D67	Sensitive	547566.57	5888367.26
68	D68	Sensitive	547458.14	5888229.68
69	D69	Sensitive	548204.65	5888367.65
70	D70	Sensitive	548168.33	5888377.37
71	D71	Sensitive	548179.82	5888278.63
72	D72	Sensitive	548104.52	5888268.71
73	D73	Sensitive	548087.47	5888276.36
74	D74	Sensitive	548868.17	5887758.17
75	D75	Sensitive	548932.55	5887734.96
76	D76	Sensitive	549199.24	5887833.92
77	D77	Sensitive	550495.61	5887325.05
78	D78	Sensitive	550500.41	5887387.84
79	D79	Sensitive	550324.34	5887658.02
80	D80	Sensitive	550175.96	5887816.96
81	D81	Sensitive	550106.32	5888040.14
82	D82	Sensitive	550280.35	5888035.46
83	D83	Sensitive	549719.64	5888322.66
84	D84	Sensitive	550545.39	5886943.5
85	D85	Sensitive	550599.07	5886878.3
86	D86	Sensitive	550619.22	5886841.34
87	D87	Sensitive	548906.29	5886220.01
88	D88	Sensitive	548844.43	5886058.89
89	D89	Sensitive	548839.4	5886201.26
90	D90	Sensitive	548639.01	5886039.21
91	D91	Sensitive	548457.06	5885821.85
92	D92	Sensitive	548636.36	5886389.69

93	D93	Sensitive	548550.81	5886329.39
94	D94	Sensitive	548404.21	5886782.59
95	D95	Sensitive	548561.83	5886939.6
96	D96	Sensitive	548586.03	5886957.59
97	D97	Sensitive	548556.26	5887008.94
98	D98	Sensitive	548224.25	5886961.36
99	D99	Sensitive	548116.65	5886941.38
100	D100	Sensitive	548087.24	5886915.09
101	D101	Sensitive	548113.24	5886863.86
102	D102	Sensitive	547992.86	5886857.51
103	D103	Sensitive	548373.1	5886229.54
104	D104	Sensitive	548315.25	5886403.1
105	D105	Sensitive	548253.79	5886441.06
106	D106	Sensitive	548247.85	5886176.71
107	D107	Sensitive	548064.53	5886343.47
108	D108	Sensitive	547947.28	5886392.37
109	D109	Sensitive	548165.83	5886496.65
110	D110	Sensitive	548134.46	5886519.2
111	D111	Sensitive	547594.52	5886657.91
112	D112	Sensitive	547536.51	5886681.77
113	D113	Sensitive	547525.32	5886511.09
114	D114	Sensitive	547436.19	5886434.21
115	D115	Sensitive	547394.27	5886356.07
116	D116	Sensitive	547393	5886274
117	D117	Sensitive	547411.53	5886169.04
118	D118	Sensitive	547492.55	5886171.13
119	D119	Sensitive	547529.35	5885997.54
120	D120	Sensitive	547691.21	5885902.94
121	D121	Sensitive	547645.19	5885843.72
122	D122	Sensitive	547560.95	5887071.56
123	D123	Sensitive	547383.27	5887132.26

124	D124	Sensitive	547413.41	5887307.74
125	D125	Sensitive	547393.44	5887360.91
126	D126	Sensitive	547302.14	5887355.52
127	D127	Sensitive	547631.17	5887537.79
128	D128	Sensitive	547372.57	5887669.84
129	D129	Sensitive	547368.9	5887729.98
130	D130	Sensitive	547438.5	5887804.15
131	D131	Sensitive	547456.16	5887824.58
132	D132	Sensitive	547397.26	5887838.43
133	D133	Sensitive	547410.19	5887955.6
134	D134	Sensitive	547799.97	5885520.29
135	D135	Sensitive	547571.76	5885597.33
136	D136	Eco	551884.21	5881704.2
137	D137	Eco	546527.06	5881880.45
138	D138	Eco	543816.93	5880059.04
139	D139	Eco	545150.28	5879719.17
140	D140	Eco	559365.2	5880456.71
141	D141	Eco	560340	5889038
142	D142	Eco	541379.32	5877638.83
143	D143	Eco	541300.32	5879918.27
144	D144	Eco	555616.19	5886093.94
145	D145	Eco	550298.35	5891462.71
146	D146	Eco	561994.19	5891020.25
147	D147	Eco	555437.33	5886114.82
148	D148	Eco	542991.35	5881595.79
149	D149	Eco	551884.21	5881704.2
150	D150	Eco	561994.19	5891020.25
151	D151	Eco	559741.58	5883918.76
152	D152	Eco	540941.97	5874951.22
153	D153	Eco	558525.98	5889087.12
154	D154	Eco	556301.24	5889539.18

155	D155	Eco	539758.39	5879730.61
156	D156	Eco	551090	5887399
157	D157	Eco	552364.44	5893986.85
158	D158	Eco	549265.41	5892929.3
159	D159	Eco	545140.56	5894870.35
160	D160	Eco	550704.49	5891147.68
161	D161	Eco	541376.79	5879816.57
162	D162	Eco	541908.61	5877530.76
163	D163	Eco	555393.6	5886068.88
164	D164	Eco	545229.73	5879802.95
165	D165	Eco	551855.31	5881738.96
166	D166	Eco	546514.36	5881881.51
167	D167	Eco	543873.72	5880034.93
168	D168	Eco	557259.87	5883050.94
169	D169	Eco	560329.65	5888858.8
170	D170	Eco	559146.6	5880560.82
171	D171	Eco	557151.63	5876359.38
172	D172	Eco	552518.66	5872845.96
173	D173		536692	5873573.9

Figure 1 Gridded Receptors