Permit Air Quality Impact Assessment

Permit Variation

PREPARED FOR

Kemira Chemicals UK Ltd

DATE

24th January 2025

REFERENCE

0729623

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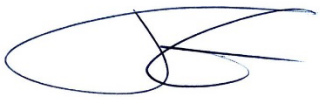
Air Quality Impact Assessment for Kemira

AQIA – Goole_001

0729623



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CONTENTS

1.	PERMIT CHECKLIST	5
2.	INTRODUCTION	7
2.1	OVERVIEW	7
2.2	PROJECT DESCRIPTION AND SITE LOCATION	7
3.	METHODOLOGY	10
3.1	AIR QUALITY STANDARDS	10
3.2	SIGNIFICANCE CRITERIA	10
3.3	BASELINE	11
3.4	MODEL METHODOLOGY	11
3.5	EMISSIONS DATA	13
4.	RESULTS	15
4.1	FUTURE OPERATIONS	15
4.2	MODEL UNCERTAINTY	17
4.3	SENSITIVITY TESTING	17
5.	CONCLUSIONS	19
6.	APPENDIX 1: CONTOUR PLOTS	20

LIST OF TABLES

TABLE 1.1: PERMIT CHECKLIST	5
TABLE 3.1: AIR QUALITY STANDARDS	10
TABLE 3.2: MODEL PARAMETERS	11
TABLE 3.3: BUILDING PARAMETERS	12
TABLE 3.4: EMISSION PARAMETERS	14
TABLE 4.1: FUTURE OPERATIONS RESULTS	16
TABLE 4.2: INTERANNUAL VARIABILITY	17
TABLE 4.3: BUILDING DOWNWASH	17
TABLE 4.4: METEOROLOGICAL SITE	18

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1. PERMIT CHECKLIST

Table 1.1 provides a checklist of all of the items required for the Permit Air quality Impact Assessment (AQIA), and the reference within the document.

TABLE 1.1: PERMIT CHECKLIST

Item	**Reference in Document**
Purpose of the study	Section 2.1
Describe the site	Section 2.2
Explain the process, emissions, duration and frequency	Section 2.2 and Table.3.1
Modelling scenarios	Table.3.1
Map of site boundary	Figure 2.1
Map of modelled site area	Figure 3.2
Pollutants of Interest	Section 2.2
Air quality standards	Section 3.1
Baseline	Section 3.3
Model methodology and inputs	Section 3.4
Emissions Inventory	Section 3.5
Source type and assumptions	Section 3.4
Emissions point locations	Table.3.4 and Figure 3.1
Release height	Table.3.4
Exit diameter	Table.3.4
Exit temperature	Table.3.4
Efflux velocity	Table.3.4
Volumetric flow rate (actual)	Table.3.4
Volumetric flow rate (normalised)	Table.3.4
Emissions rate (g/s)	Table.3.4
Moisture	Not detailed
Oxygen	Not detailed
Model domain and receptors	Figure 3.2 and Table.3.2

Item	**Reference in Document**
Meteorological data	Table.3.2
Surface characteristics	Table.3.2
Terrain	Table.3.2
Buildings	Table.3.2
NOx to NO2 conversion	Not required
Model uncertainty	Section 4.2
Sensitivity analysis	Section 4.3
Impact assessment	Section 4.1
Maximum off site	Section 4.1
Maximum at discreet receptors	Not required
Contour plots	Section 6 Appendix 1
Model input files	Appended as a separate ZIP file

2. INTRODUCTION

2.1 OVERVIEW

Kemira hold an Environmental Permit for their process in Goole, Ref: TP3135PX. In order to undertake planned updates to the process, Kemira have been requested by the Environment Agency to provide a Substantial Variation in support of the Permit update. In support of the Permit Variation, ERM commissioned ERM to undertake an Air Quality Impact Assessment (AQIA) for the proposed project.

The AQIA has been undertaken in line with Environment Agency Guidance document: "Environmental permitting: air dispersion modelling reports".

2.2 PROJECT DESCRIPTION AND SITE LOCATION

The Kemira site is located in Goole, as illustrated in Figure 2.1.

FIGURE 2.1 KEMIRA SITE LOCATION

The project is being undertaken to increase the production capacity. Currently there is one emission point on site (EP01) which is a combined outlet for the existing process. This emission point will be decommissioned and replaced by five new emission points (EP01, EP02, EP03, EP04 and EP05) corresponding to an increase in site production capacity.

The pollutants of interest from the process are:

- Sulphur dioxide
- Particulate matter

One scenario has been assessed, this being the future scenario with the five emission points active. The existing scenario was not modelled, assuming that all emissions were new represents the worst case.

3. METHODOLOGY

3.1 AIR QUALITY STANDARDS

The Air Quality Standards (AQS) relevant for PM and SO_2 are set out in Table 3.1. In terms of PM, the conservative assumption is made that all of the PM emissions occur in the PM_{10} and $PM_{2.5}$ size fraction.

TABLE 3.1: AIR QUALITY STANDARDS

Pollutant	Averaging Period	Units	Value
PM_{10}	Annual mean	$\mu g/m^3$	40
	24 hour mean (as 90.4th percentile)	$\mu g/m^3$	50
$PM_{2.5}$	Annual mean	$\mu g/m^3$	25
SO_2	1 hour mean	$\mu g/m^3$	350
	24 hour mean	$\mu g/m^3$	125

3.2 SIGNIFICANCE CRITERIA

Following Environment Agency Permitting guidance [1] the following significance criteria were used. The criteria refer to the Process Contribution (PC) and Predicted Environmental Concentration (PEC), this being the PC+Baseline:

- Long Term:
  - PC<1% of AQS – Insignificant
  - PC>1% of AQS, PEC<70% - Significant but acceptable
  - PC>1% of AQS, PEC>70% - Significant and unacceptable
- Short Term:
  - PC<10% of AQS – Insignificant
  - PC>10% of AQS - Significant and potentially unacceptable

[1] Environment Agency (Accessed January 2025) Air emissions risk assessment for your environmental permit

3.3 BASELINE

Baseline air quality for PM_{10}, $PM_{2.5}$ and SO_2 were derived from Defra mapping grid location 472500, 423500. The annual mean baseline concentrations used in the study are:

- PM10:17.4µg/m^3
- $PM_{2.5}$: 10.4µg/m^3
- SO_2: 5.0µg/m^3

3.4 MODEL METHODOLOGY

The model parameters used in the AQIA are summarised in Table 3.2.

TABLE 3.2: MODEL PARAMETERS

Parameter	Value	Notes
Dispersion model	CERC ADMS 6.1	-
Number of model scenarios	1	One model scenario was run with the future configuration of five stacks
Operational hours	8760	Assumed continuous emission as the worst case
Model domain	5 km x 5 km	This model domain captures nearby sensitive human receptors. No assessment of ecological receptors was undertaken due to the anticipated negligible impacts of SO2 emissions
Receptor grid resolution	10	Resolution is <1.5 x lowest stack height
Discrete receptors	None	Discrete receptors were not included in the model. Instead the assessment was based on the maximum offsite impacts as the worst case
Buildings	Included, see Table 3.3 and Figure 3.1	The main plant structures were include as these are >1/3rd stack height within 5 x the stack height
Terrain	Not included	There are no sustained gradients of >1:10 within the 5km x 5km model domain. Therefore, terrain effects will not be significant.
Meteorological data	Leconfield, 2019 – 2023 inclusive	1 hour sequential data.
Surface Roughness	1m (site) 0.3m (meteorological site)	Surface roughness representative of suburban areas

The site plan including buildings are set out in Figure 3.1, and detailed in Table 3.3.

FIGURE 3.1 BUILDINGS AND SITE LAYOUT

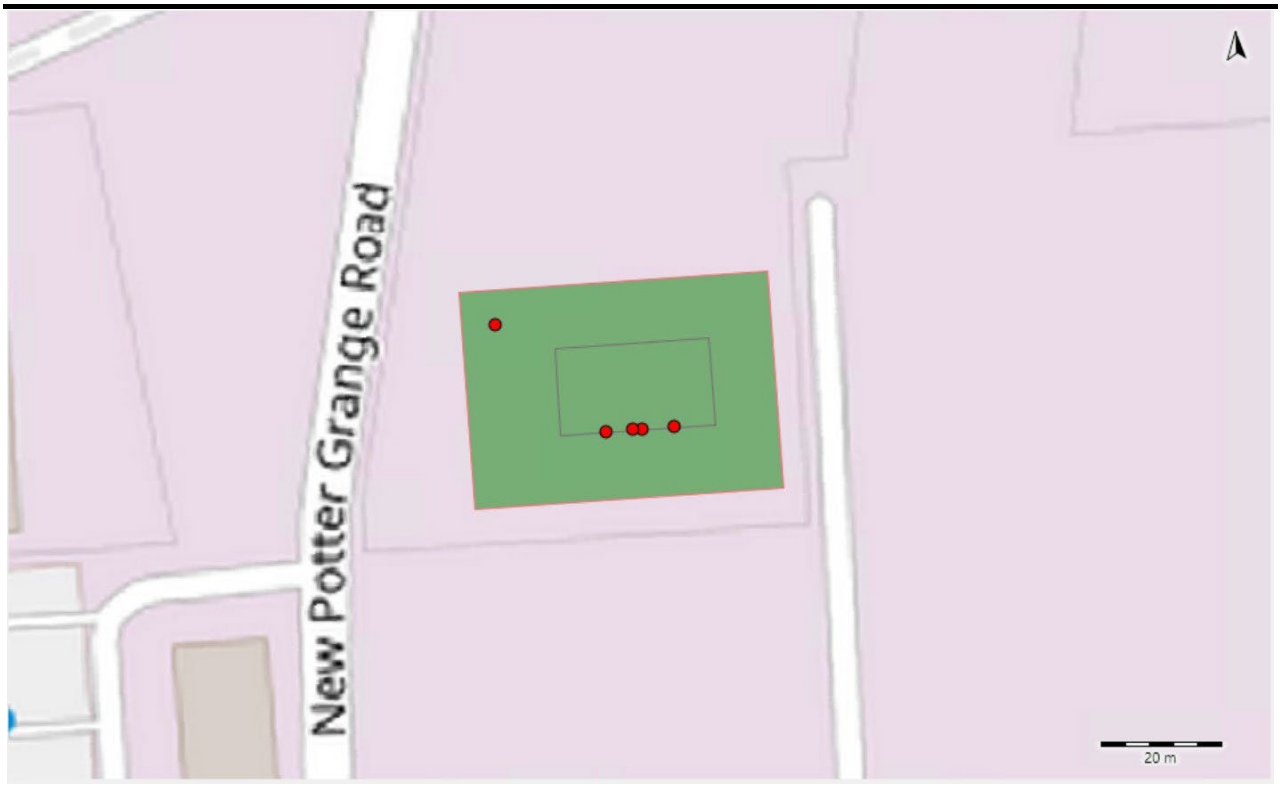
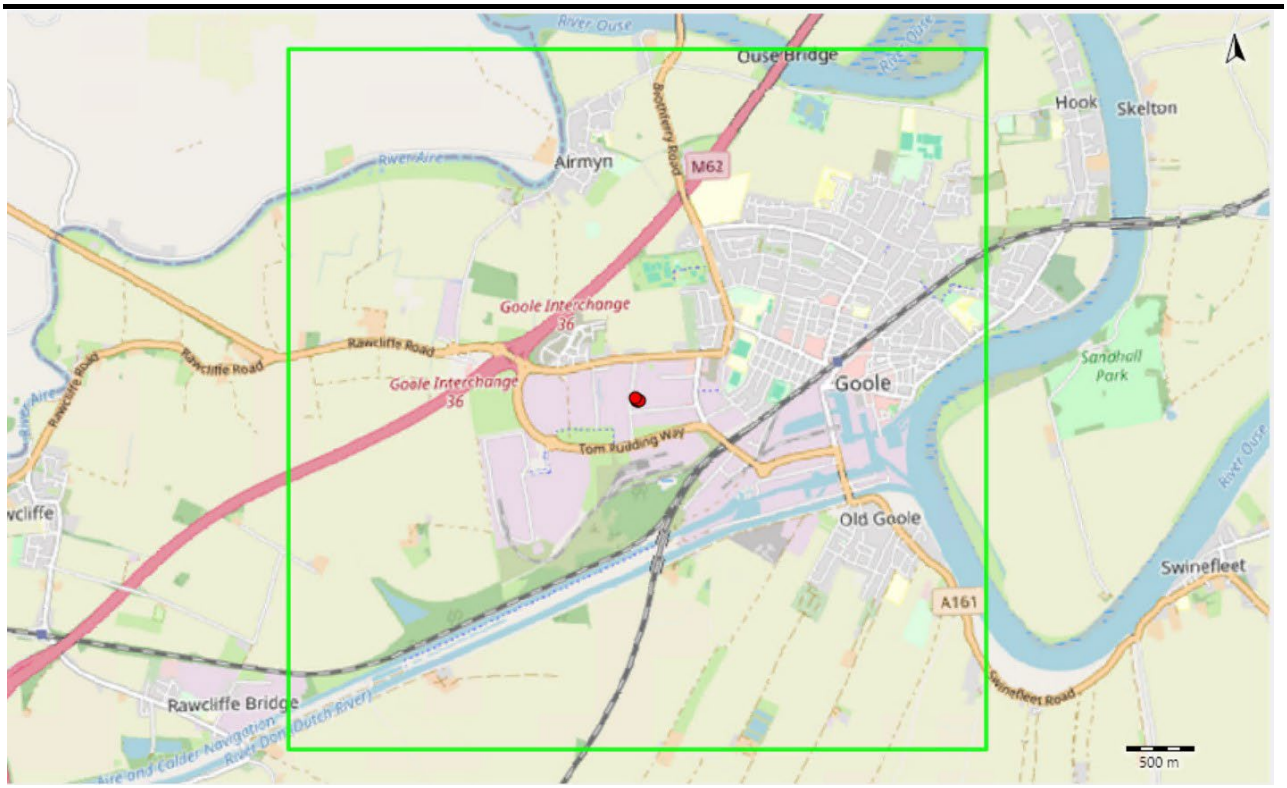


TABLE 3.3: BUILDING PARAMETERS

Building	Units	Easting (x)	Northing (y)
Centre (east)	m	472969	472971
Centre (north)	m	423514	423514
Height	m	7.3	13.5
Width	m	50	25
Length	m	35	14
Angle to north	Deg	176	176

The model domain is set out in Figure 3.2.

FIGURE 3.2 MODEL DOMAIN



3.5EMISSIONS DATA

Kemira provided ERM with emissions data, stack parameters and buildings design data for the proposed plant [2]. The grams per second data were obtained from the A1 emission point at the site. The remaining parameters were derived from engineering specifications for the new emission points. As such, some parameters, such as oxygen and moisture content were not available. The data are summarised in Table 3.4.

[2] Email from Gary Pickard, Kemira to Christie Hazell-Marshall, ERM, "RE: Air Quality Assessment – Proposal, 13 March 2024 @13.06

TABLE 3.4: EMISSION PARAMETERS

Parameter	Units	EP 01	EP 02	EP 03	EP 04	EP 05
Stack Parameters						
Stack location (east)	m	472972	472971	472966	472977	472950
Stack location (north)	m	423508	423508	423507	423508	423525
Stack height	m	17.43	17.43	17.50	17.40	8.22
Stack diameter	m	0.2678	0.2678	0.317	0.317	0.213
Exit velocity	m/s	15.79	15.79	16.90	16.90	0.58
Volumetric Flow Rate	Am^3/s	0.89	0.89	1.33	1.33	0.021
Normalised Volumetric Flow Rate	Nm^3/s	0.70	0.70	1.05	1.05	0.016
Temperature	Celsius	75	75	75	75	75
Oxygen Content	Not Available					
Moisture Content	Not Available					
Emission Rates						
PM	g/s	0.00108	0.00108	0.00108	0.00108	0.00108
SO_2	g/s	0.000103	0.000103	0.000103	0.000103	0.000103

4. RESULTS

4.1 FUTURE OPERATIONS

The results of the AQIA are set out in Table 4.1. The results are presented for the maximum off site. As the maximum off site are substantially below the threshold of significance, no consideration has been made of discreet sensitive receptors, on the basis that the maximum off site represents the worst case.

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TABLE 4.1: FUTURE OPERATIONS RESULTS

Pollutant	Averaging Period	Baseline (µg/m³)	AQS (µg/m³)	PC (µg/m³)	PC/AQS (%)	PEC (µg/m³)	PEC/AQS (%)	Significance
PM_{10}	Annual mean	40	17.4	0.0927	0.23%	17.5	44%	Not Significant
	24 hour mean, 90.4th %ile	50	34.8	0.272	0.54%	35.1	70%	Not Significant
$PM_{2.5}$	Annual mean	25	10.4	0.0917	0.37%	10.5	42%	Not Significant
SO_2	15 minute, 99.9%ile	266	10.1	0.128	0.0483%	10.2	3.8%	Not Significant
	1 hour, 99.8%ile	350	10.1	0.0876	0.025%	10.1	2.9%	Not Significant
	24 hour,99.2%ile	125	10.1	0.0388	0.031%	10.1	8.1%	Not Significant

Contour Plots are set out in Annex 1 for:

- Annual mean PM_{10} PEC
- 24 hour PM_{10} PEC
- Annual mean $PM_{2.5}$ PEC
- 1 hour 99.7th percentile SO_2 PEC
- 24 hour 99.2nd percentile SO_2 PEC

4.2 MODEL UNCERTAINTY

As with any dispersion modelling there is a degree of uncertainty. Typically uncertainly is greater for the short term period, where there is significant building downwash and where there are terrain effects. In this case, the stacks are close to building height and therefore there is significant building downwash effects. However, the results are sufficiently small that even a large error, 1 order of magnitude for example, will not change the conclusions and model uncertainty is therefore considered to not be a material issue in the interpretation of the results and the significance of impacts.

4.3 SENSITIVITY TESTING

Model Sensitivity testing has been undertaken for the following

- Variability in short term and long term impacts across the five years of meteorological data used in the modelling, shown in Table 4.2
- Model run without buildings, shown in Table 4.3
- Model run using meteorological data from Durham, shown in Table 4.4.

TABLE 4.2: INTERANNUAL VARIABILITY

Met Year	Annual Mean PM_{10} ($\mu g/m^3$)	24-Hour Mean PM_{10} ($\mu g/m^3$)	1-Hour SO_2 ($\mu g/m^3$)
2019	0.091	0.238	0.0876
2020	0.090	0.257	0.0806
2021	0.093	0.246	0.0852
2022	0.091	0.272	0.0867
2023	0.086	0.254	0.0832

TABLE 4.3: BUILDING DOWNWASH

Met Year	Buildings?	Annual Mean PM_{10} ($\mu g/m^3$)	24-Hour Mean PM_{10} ($\mu g/m^3$)	1-Hour SO_2 ($\mu g/m^3$)
2021	Yes	0.093	0.246	0.085
2021	No	0.066	0.209	0.118
2022	Yes	0.091	0.272	0.087
2022	No	0.075	0.223	0.098
Change (%)	-	77%	83%	125%

TABLE 4.4: METEOROLOGICAL SITE

Meteorological Dataset	Annual Mean PM_{10} ($\mu g/m^3$)	24-Hour Mean PM_{10} ($\mu g/m^3$)	1-Hour SO_2 ($\mu g/m^3$)
Leconfield 2022	0.091	0.272	0.087
Durham 2022	0.126	0.296	0.076
Change (%)	139%	109%	88%

5. CONCLUSIONS

The AQIA identified that the emissions from the Kemira facility are predicted to have a negligible impact on sensitive human receptors for both PM and SO_2 emissions. On this basis, no mitigation or changes to project design are required, and air quality is not a constraint to the proposed project.

6. APPENDIX 1: CONTOUR PLOTS

A.1:
PEC for Annual PM_{10} ($\mu g/m^3$)

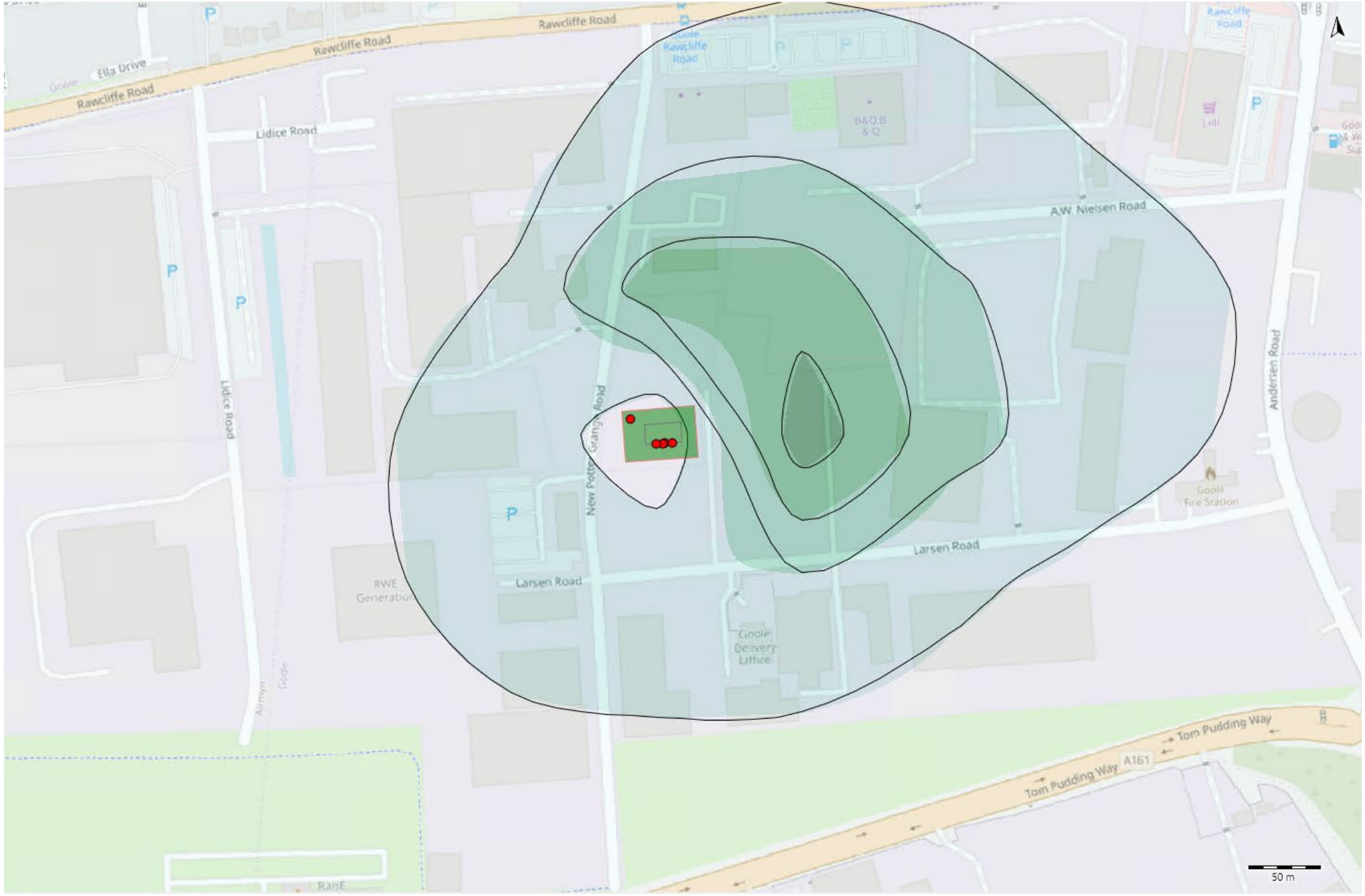
Kemira Chemicals UK Ltd, 5 New Potter Grange Rd, Goole, DN14 6BZ

Legend:

- Modelled Point Source
- Modelled Building

Contour Levels:

- 17.40 $\mu g/m^3$
- 17.42 $\mu g/m^3$
- 17.44 $\mu g/m^3$
- 17.46 $\mu g/m^3$
- 17.48 $\mu g/m^3$



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A.2:
PEC for PM_{10} 24-hour 90.4th Percentile (µg/m^3)

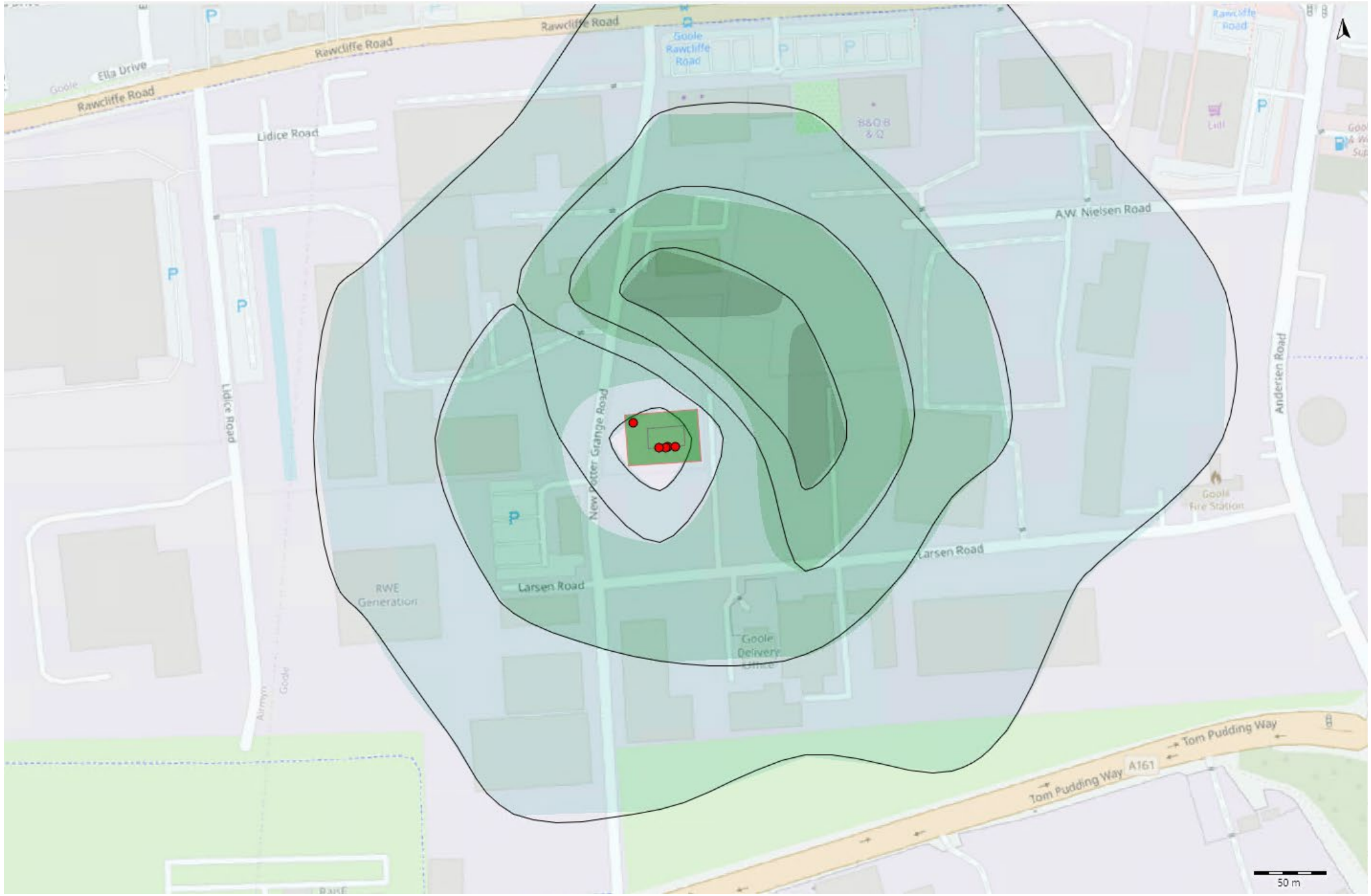
Kemira Chemicals UK Ltd, 5 New Potter Grange Rd, Goole, DN14 6BZ

Legend:

- Modelled Point Source
- Modelled Building

Contour Levels:

- 34.8 µg/m^3
- 34.85 µg/m^3
- 34.9 µg/m^3
- 34.95 µg/m^3
- 35.0 µg/m^3



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A.3:
PEC for Annual $PM_{2.5}$ ($\mu g/m^3$)

Kemira Chemicals UK Ltd, 5 New Potter Grange Rd, Goole, DN14 6BZ

Legend:

- Modelled Point Source
- Modelled Building

Contour Levels:

- 10.4 $\mu g/m^3$
- 10.42 $\mu g/m^3$
- 10.44 $\mu g/m^3$
- 10.46 $\mu g/m^3$
- 10.48 $\mu g/m^3$

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A.4:
PEC for SO_2 1-hour 99.7th Percentile ($\mu g/m^3$)

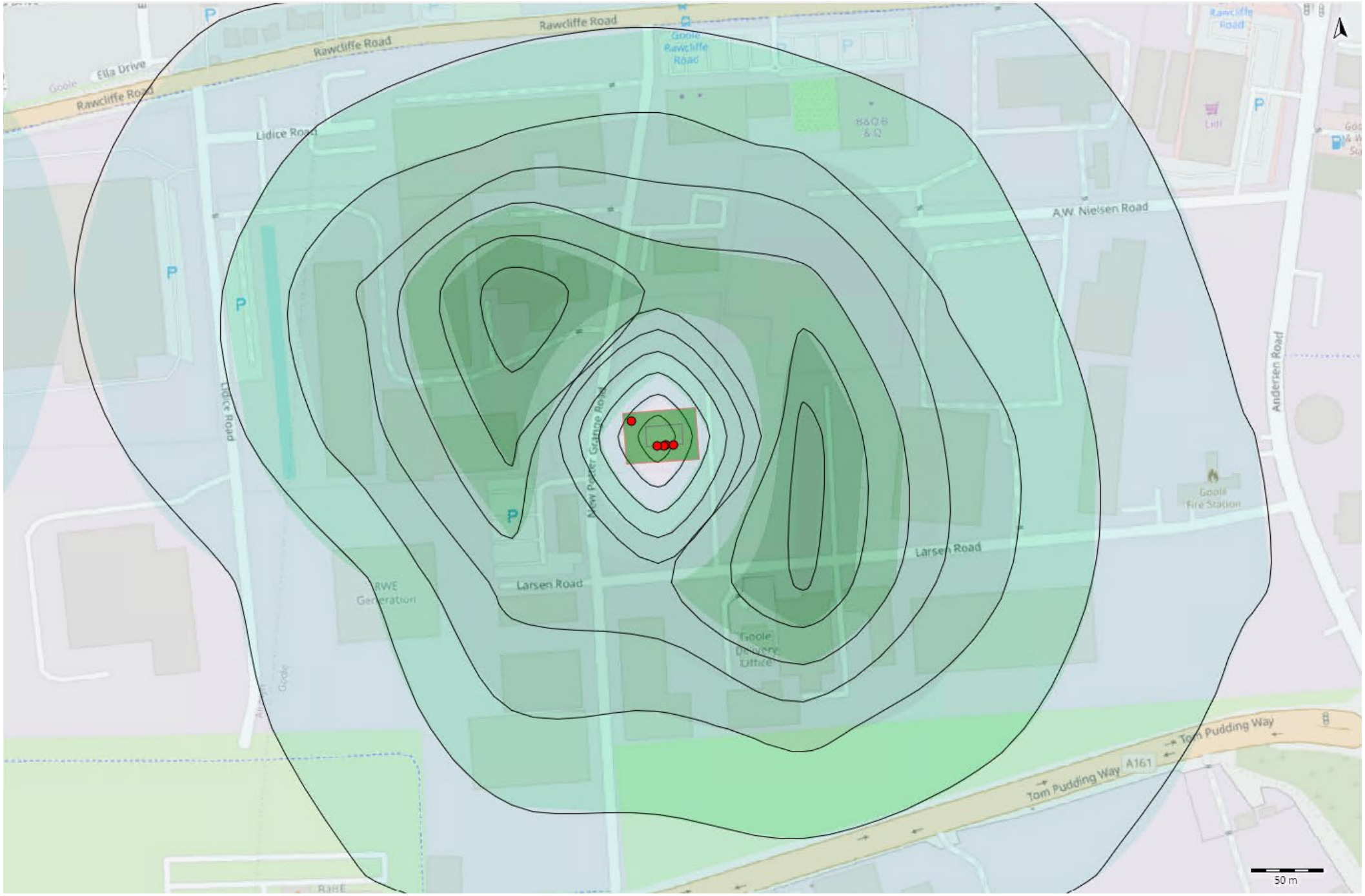
Kemira Chemicals UK Ltd, 5 New Potter Grange Rd, Goole, DN14 6BZ

Legend:

- Modelled Point Source
- Modelled Building

Contour Levels:

- 10.10 $\mu g/m^3$
- 10.11 $\mu g/m^3$
- 10.12 $\mu g/m^3$
- 10.13 $\mu g/m^3$
- 10.14 $\mu g/m^3$
- 10.15 $\mu g/m^3$
- 10.16 $\mu g/m^3$
- 10.17 $\mu g/m^3$
- 10.18 $\mu g/m^3$



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A.5:
PEC for SO_2 24-hour 99.2nd Percentile (µg/m³)

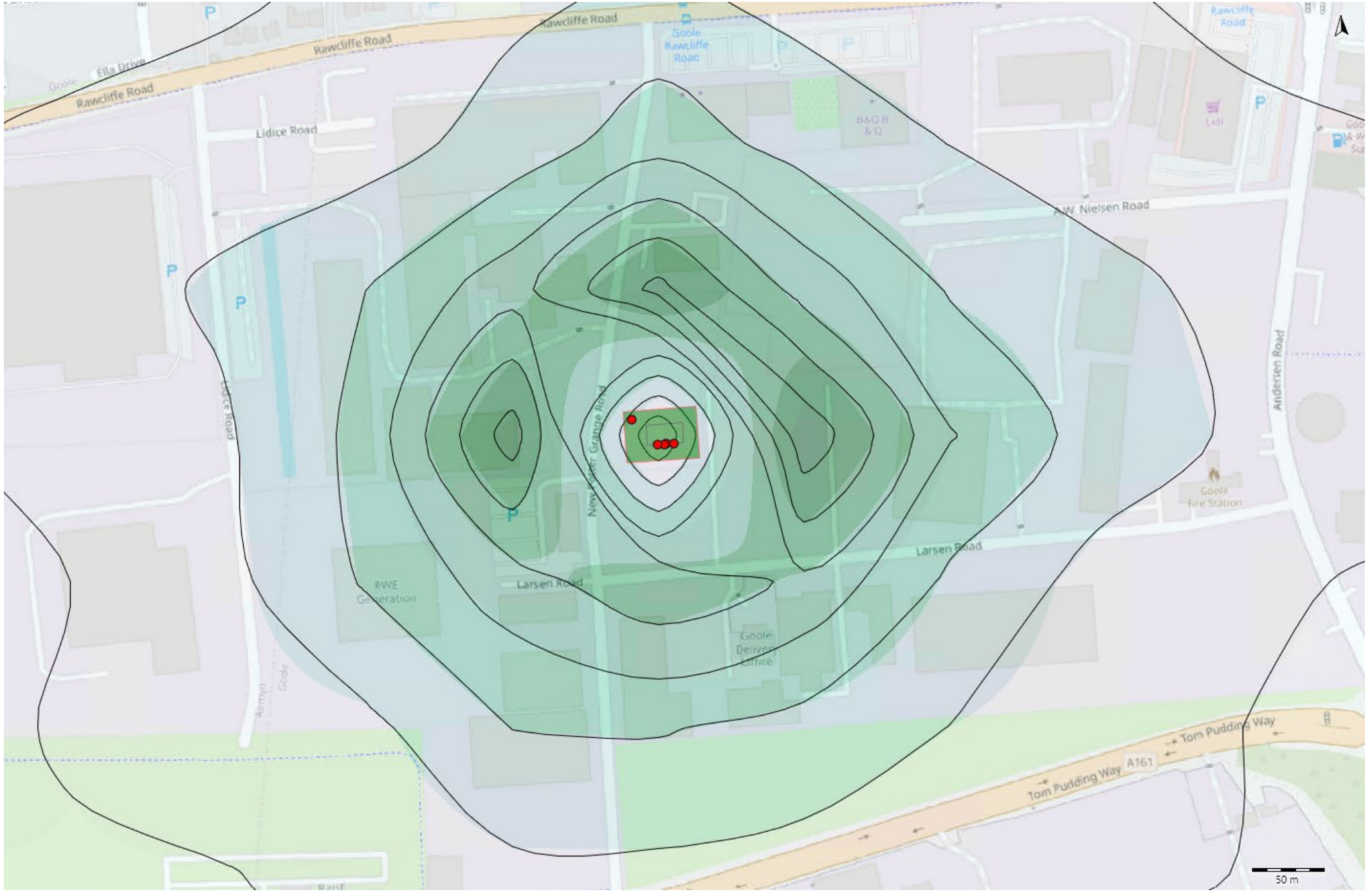
Kemira Chemicals UK Ltd, 5 New Potter Grange Rd, Goole, DN14 6BZ

Legend:

- Modelled Point Source
- Modelled Building

Contour Levels:

- 10.1 µg/m³
- 10.105 µg/m³
- 10.11 µg/m³
- 10.115 µg/m³
- 10.12 µg/m³
- 10.125 µg/m³
- 10.13 µg/m³
- 10.135 µg/m³



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