4.1.A3.3.7 Output Receptors

In the first instance, the dispersion model was run to determine ground level pollutant concentrations and deposition rates at a limited number of locations, representing particularly sensitive receptors in the areas where the highest impact of Corus' Scunthorpe installation would be expected. These locations are detailed in Table 4.1.A3.2 and illustrated in Figure 4.1.4 of the main assessment report. In the cases of PM10 and sulphur dioxide, the overall impact was assessed to be potentially significant at one or more of the sensitive receptors, and so the impact over a wider area was determined to allow the pattern of dispersion to be illustrated. In order to cover a large area (10 x 9 kilometres), but still have a fine resolution over the areas of most interest, a variable output grid was specified.

4.1.A3.3.8 Meteorological Data

Meteorological data is commonly available either as sequential (hour-by-hour) data files, or statistically analysed data. Statistical data is most useful in calculating long term averages over many years, as it greatly reduces the model run-time. However, the process of analysing the meteorological data effectively removes the most extreme weather conditions that may lead to the highest short-term concentrations, and so where short averaging periods are of interest, as is the case in this study, sequential data is more appropriate. The model was run using sequential data for five complete years; each year's data being run as a separate model. At every output receptor around the Corus installation, the ground-level pollutant concentrations and deposition rates were calculated for each hour of the year, and average levels and percentiles were determined for comparison with the relevant EQSs and EALs.

To account for the significant amount of heat generated from the urban area and industrial activities around Scunthorpe, which limits the stability of the atmosphere (the "urban heat island" effect), the option within ADMS 3 to specify a minimum value of the Monin-Obukhov length was used. The default value for "Mixed urban/industrial" areas of 30 metres was selected.

4.1.A3.3.9 Output Parameters

Objectives for ambient levels of PM10, SO_2, NO_2, CO, Benzene and Lead are included in the current Air Quality Regulations[11], and the averaging times and percentiles specified in those regulations were used for the dispersion modelling output and are listed in Table 4.1.A3.3. For most other species, the annual average and the highest hourly average concentration were calculated; the exceptions are noted in Table 4.1.A3.3.

4.1.A3.4 Input Data

4.1.A3.4.1 Source Data

The source data input to the ADMS 3 model for each source is included in Appendix 4.1.2. For the dispersion modelling, the typical pollutant emission rates during plant operation (apart from emissions from the blast furnace hoppers) were input to the model, since these are necessary for the assessment of short-term impacts. This assumption means that annual average concentrations and deposition rates will be somewhat overestimated. For the blast furnace hoppers, typical pollutant emission rates during the course of the year were input to the model as the hoppers operate for very short periods of time on a regular basis. The specific heat capacity and mean molecular weight of all releases were left at the default values of 1012 J/°C/kg and 28.96 kg/kmol respectively.

4.1.A3.4.2 Meteorological Data

The two Meteorological Office stations closest to Corus' Scunthorpe installation where all the data required for the ADMS 3 model have been collected are at Finningley, an inland airfield 30 km SSW of the site and at Waddington, another airfield near Lincoln, 45 km S. The Finningley station closed in 1994, and since it was desirable to model years when good quality background pollutant levels were available from the NETCEN station, which did not commence operation until January 1998, data for Waddington was used for this exercise. Data for the period 1995 to 1999 (hourly sequential data covering wind speed and direction, cloud cover, surface temperature, precipitation and relative humidity) were obtained. The surface roughness at the Meteorological Office site is 0.2 metres, whilst the surface roughness around the Scunthorpe site is estimated as 0.3 metres. The option within

ADMS 3 to specify the surface roughness at the meteorological site was used to allow the software to make allowance for the different surface roughness.

4.1.A3.4.3 Topographical Data

The Scunthorpe installation is at approximately 53.5 °N, 0.5 °W. As discussed in section 4.1.A3.3.2 above, flat terrain was assumed for this exercise.

4.1.A3.5 Sensitivity Analysis

To test the sensitivity of the modelling results to some of the assumptions made in the model set-up, a limited number of modelling runs were undertaken with different parameters to determine the influence on the final results.

Fugitive Sources

As discussed in section 4.1.A3.3.6, fugitive sources have been represented as point sources in this modelling. To check the validity of this assumption, a model was run for one year of meteorological data including only the two stockyards, firstly as point sources and then as area sources. Table 4.1.A3.4 details the emissions for the two cases and Table 4.1.A3.5 the results for each of the sensitive receptors. This demonstrates that the assumption that the stockyards can be represented as point sources does not lead to significant errors at the chosen receptors - within the stockyards area, this assumption would have a greater effect, but this is not the area of interest for this study. The uncertainty in the emissions estimates for the stockyards and other fugitive sources is likely to be far greater than the possible error introduced by assuming that they can be represented as point sources in the dispersion model.

4.1.A3.6 Uncertainty of Modelling Results

The dispersion modelling results may not reflect the true contribution of the releases from Corus' Scunthorpe installation to ambient pollutant concentrations for reasons including the following:

- The inherent uncertainty in dispersion modelling. Guidance issued by DETR for Local Authorities in the UK[6] suggests as a rule of thumb that a difference of ± 50% between predicted and measured values would not be unusual. Validation studies of ADMS 3[3,4] have demonstrated better accuracy than that.
- Uncertainty in emission rates, particularly from fugitive sources. In the modelling undertaken at Corus' Scunthorpe installation, fugitive sources represent a significant proportion of the emissions of particulates and PM10, and since they are often low level sources with little buoyancy, they are likely to contribute a large proportion of the whole-site impact for these species. Errors in fugitive emission rates will therefore have a significant effect on the overall modelling results. Stack emissions are generally better characterised, but there will be variations in emission rates that have not been taken into account in this modelling exercise. In addition, for the majority of sources typical pollutant emission rates during plant operation were input to the model, and this assumption means that annual average concentrations and deposition rates will be somewhat overestimated (see Section 4.1.A3.4.1).

4.1.A3.7 Quality Assurance of Models

ADMS 3 is a commercial model and detailed technical specifications and validation studies are available from the developers, Cambridge Environmental Research Consultants.

4.1.A3.8 Auditability

The data input to the ADMS 3 dispersion model is saved electronically in ".APL" files; these can be provided on request, as can the file containing details of the variable surface roughness used. These files include all the data necessary to reproduce the modelling runs reported here, except for:

- Meteorological data - the data files used are available commercially from the Meteorological Office and are protected by copyright

4.1.A3.9 Dispersion Modelling Results

Tables 4.1.A3.6 to 4.1.A3.8 detail the dispersion modelling results for every sensitive receptor included in the model. Five years' meteorological data were used in the modelling, and so for each location five concentrations were calculated for each species and for each averaging time - the values in the Tables are the greatest of the concentrations obtained. Table 4.1.A3.6 includes the species for which objectives are specified in the current Air Quality Regulations[11]. Table 4.1.A3.7 includes other metals and Table 4.1.A3.7 the remaining species modelled. The assessment of these results is discussed in the main Environmental Impact Assessment report.

References

1 "Atmospheric Dispersion Modelling: Guidelines on the Justification of Choice and Use of Models, and the Communication and Reporting of Results", Royal Meteorological Society Policy Statement, May 1995

2 "Validation of the UK-ADMS Dispersion Model and Assessment of its Performance Relative to R-91 and ISC using Archived LIDAR Data", Report No. DoE/HMIP/RR/95/022, Her Majesty's Inspectorate of Pollution, March 1996

3 "ADMS 3 Validation Summary", Cambridge Environmental Research Consultants *http://www.cerc.co.uk/software/pubs/2 - ADMS 3 Validation Summary.pdf*

4 Hanna, S.R., Egan, B.A, Purdum, J. and Wagler, J., "Evaluation of the ADMS, AERMOD and ISC3 Dispersion Models with the Optex, Duke Forest, Kincaid, Indianapolis and Lovett Field Data Sets", American Petroleum Institute *http://www.cerc.co.uk/software/pubs/9 - ADMS Aermod and ISC evaluation.pdf*

5 Hall, D.J., Spanton, A.M., Dunkerley, F., Bennett, M. and Griffiths, R.F., "A Review of Dispersion Model Inter-comparison Studies Using ISC, R91, AERMOD and ADMS", Technical Report No. P353, Environment Agency, September 2000

6 "Selection and Use of Dispersion Models", Report No. LAQM.TG3(98), Department of the Environment, Transport and the Regions, April 1998

7 "Releases and Their Dispersion in the Environment", p59, Environmental Analysis Co-operative, 1996

8 "ADMS User Guide", Cambridge Environmental Research Consultants Ltd., February 1999

9 "Best Practicable Environmental Option Assessments for Integrated Pollution Control", Technical Guidance Note E1, Environment Agency, 1997

10 Review and Assessment: Pollutant Specific Guidance", Report No. LAQM.TG4(00), Department of the Environment, Transport and the Regions, May 2000

11 "The Air Quality (England) Regulations 2000", Statutory Instrument 2000 No. 928, March 2000

12 Council Directive 80/779/EEC, "on air quality limit values and guide values for sulphur dioxide and suspended particulates", July 1980

TABLE 4.1.A3.5

RESULTS OF SENSITIVITY ANALYSIS - FUGITIVE SOURCES

	Modelled PM10 Concentration at Each Receptor (µg/m³)					
	Annual Average			90th Percentile of Daily Means		
Receptor	Point Sources	Area Sources	Difference	Point Sources	Area Sources	Difference
Scunthorpe 1	1.8	1.8	0.5%	6.1	6.0	0.8%
Scunthorpe 2	1.8	1.8	0.2%	6.3	6.2	0.3%
Scunthorpe 3	2.1	2.1	-0.5%	7.0	7.4	-5.3%
Scunthorpe 4	1.5	1.6	-4.6%	5.4	6.0	-8.9%
Scunthorpe 5	0.7	0.6	1.2%	2.5	2.4	2.3%
Scunthorpe 6	0.6	0.6	-0.5%	2.3	2.3	0.7%
Scunthorpe 7	0.6	0.6	-0.1%	2.1	2.1	-0.5%
Scunthorpe 8	0.4	0.3	0.8%	1.2	1.2	-1.8%
Santon	2.9	2.9	1.0%	7.9	7.7	3.2%
Dragonby	1.1	1.1	4.1%	3.6	3.4	6.0%
High Risby	0.8	0.8	3.2%	2.4	2.4	4.0%
Low Risby	0.9	0.9	4.3%	2.4	2.3	5.4%
Appleby	0.9	0.8	2.8%	2.1	2.0	2.9%
Broughton	1.1	1.1	-0.8%	3.5	3.5	-0.8%
Winterton	0.2	0.2	2.3%	0.7	0.7	1.9%
Scawby	0.5	0.5	1.7%	1.8	1.7	1.3%
Risby Warren 1	4.2	4.0	7.0%	10.7	9.7	10.5%
Risby Warren 2	1.0	1.0	3.6%	3.1	3.0	5.3%
Risby Warren 3	1.3	1.3	4.5%	3.4	3.2	4.7%
Conesby Quarry	0.8	0.7	3.2%	2.3	2.3	4.3%
Broughton Far Wood	1.3	1.3	1.0%	4.1	4.0	0.9%
Manton and Twigmoor	0.4	0.4	-0.8%	1.2	1.2	-2.3%
Humber Flats and Marshes	0.2	0.2	2.1%	0.6	0.5	2.9%
Scunthorpe 9	3.6	3.6	-0.4%	12.7	13.3	-4.6%
Scunthorpe 10	2.9	3.2	-11.0%	10.4	11.8	-12.3%
Scunthorpe 11	2.9	3.1	-6.1%	10.6	11.1	-4.3%
Scunthorpe NETCEN Station	2.7	2.7	1.3%	8.0	8.2	-1.6%