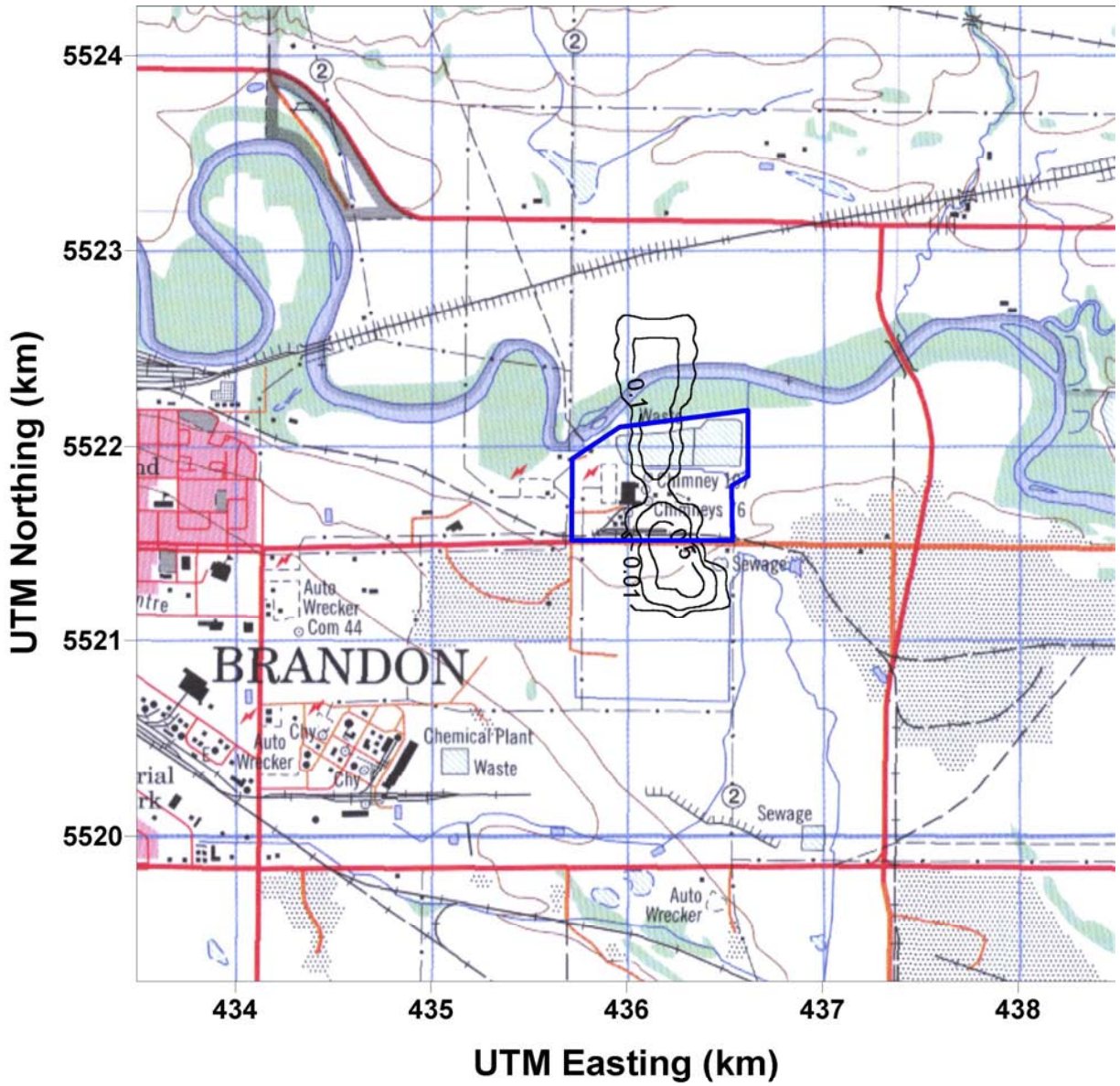


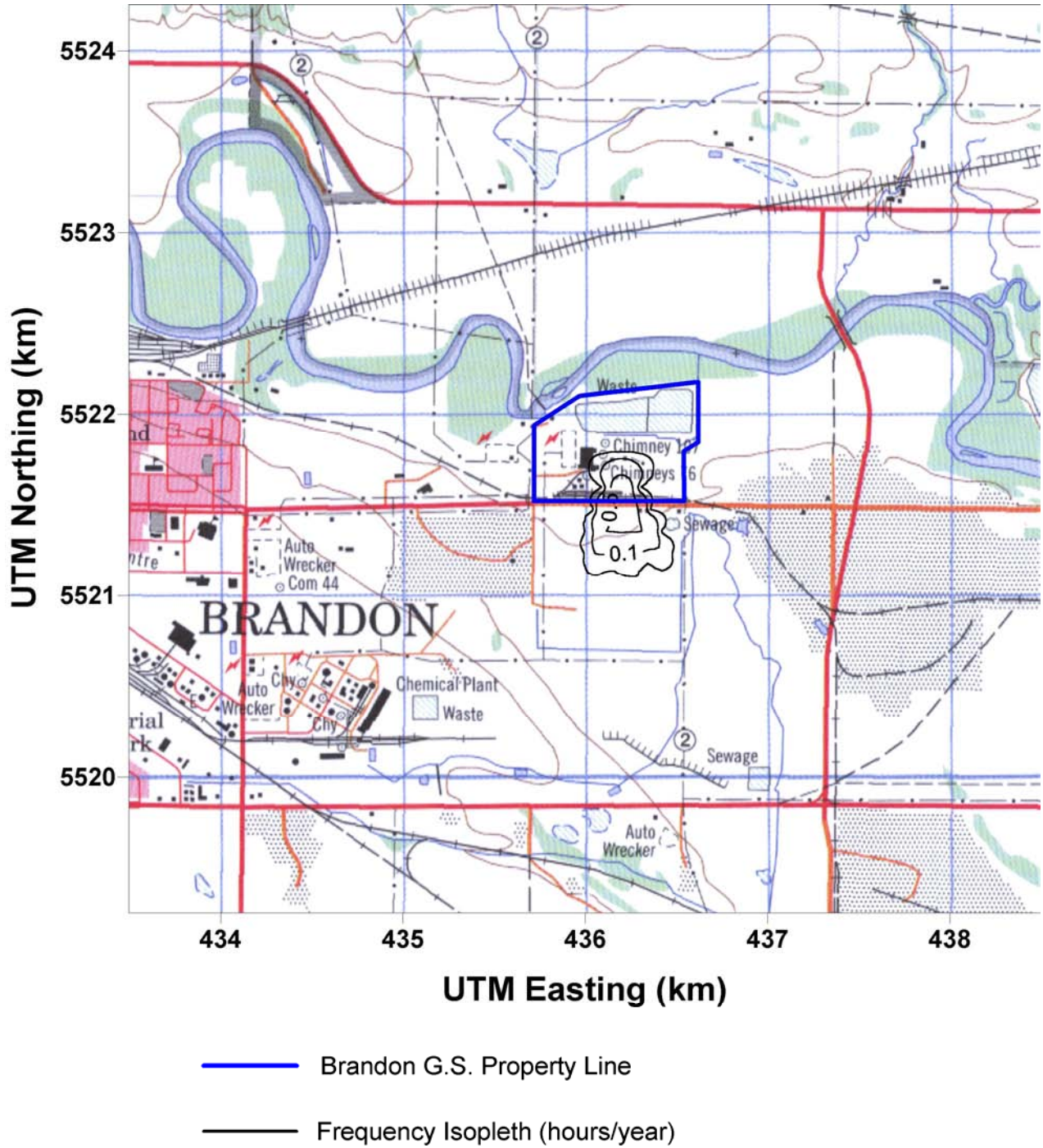
**Figure 5.27**  
**Annual Hours of Fogging due to Cooling Tower Emissions**



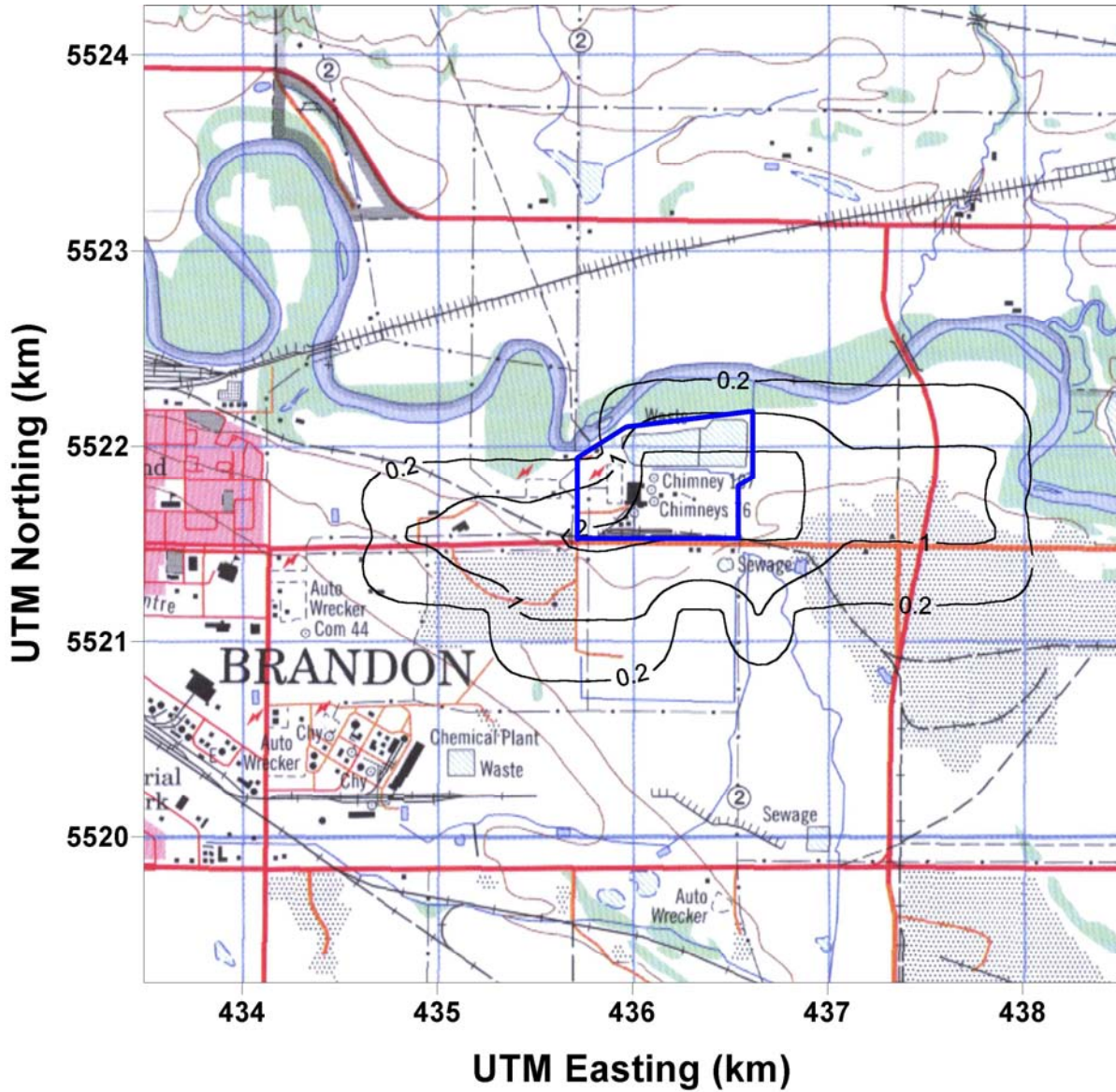
— Brandon G.S. Property Line

— Concentration Isopleth

**Figure 5.28**  
**Annual Hours of Icing due to Cooling Tower Emissions**



**Figure 5.29**  
**Annual Plume Length Frequencies due to Cooling Tower Emissions**



- Brandon G.S. Property Line
- Frequency Isopleth (% of time)

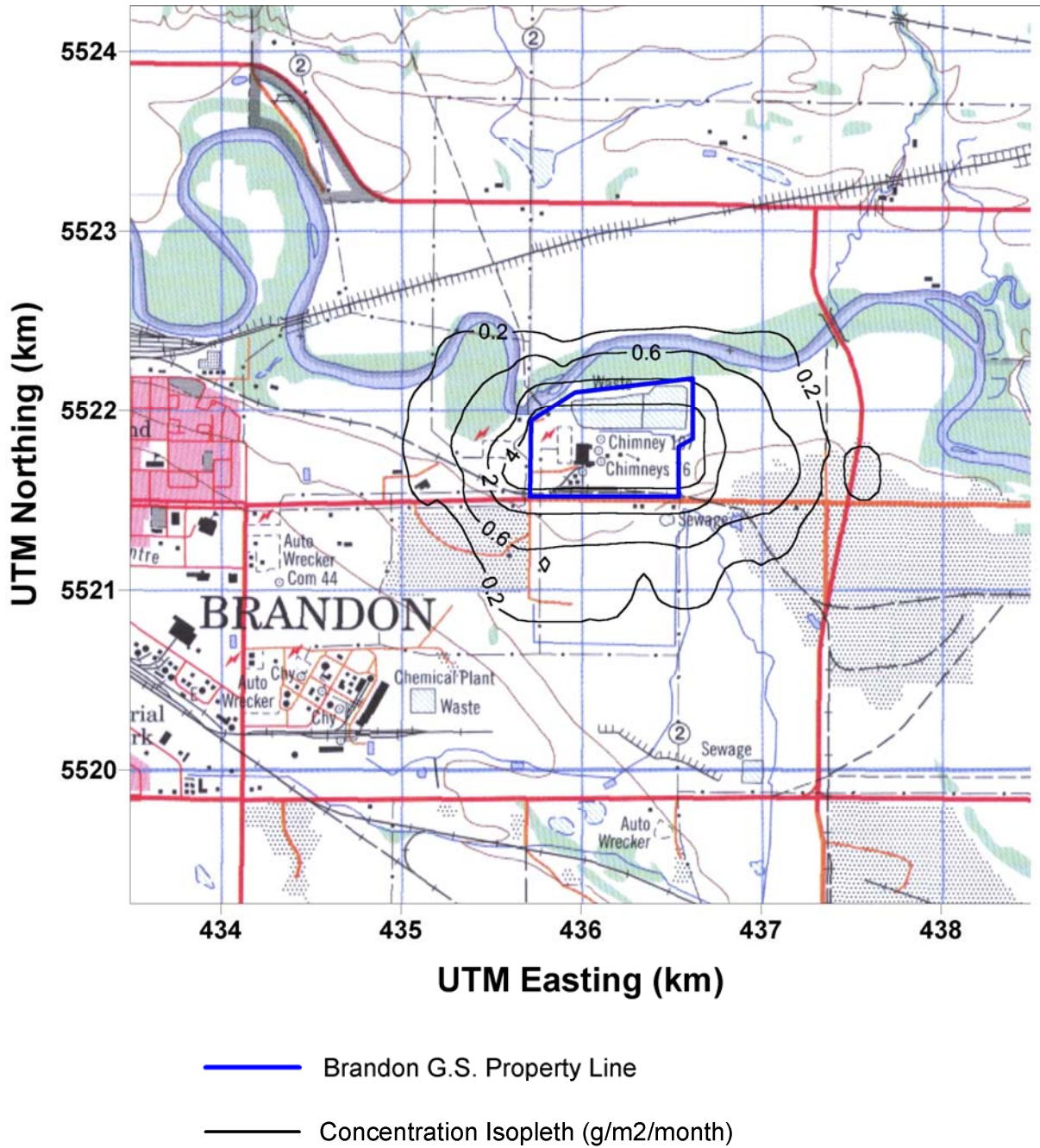
### **5.5.3 Water and Salt Deposition**

The SACTI model predicts the amount of both water and salt deposition on terrain surrounding a cooling tower. The amount of deposition depends on the volume of cooling water circulating through the tower and prevailing meteorological conditions. For salt deposition, there is also a dependence on the salt content of the cooling water. SACTI determines salt emissions from the water coolant drift rate (loss) and the salt density of the water.

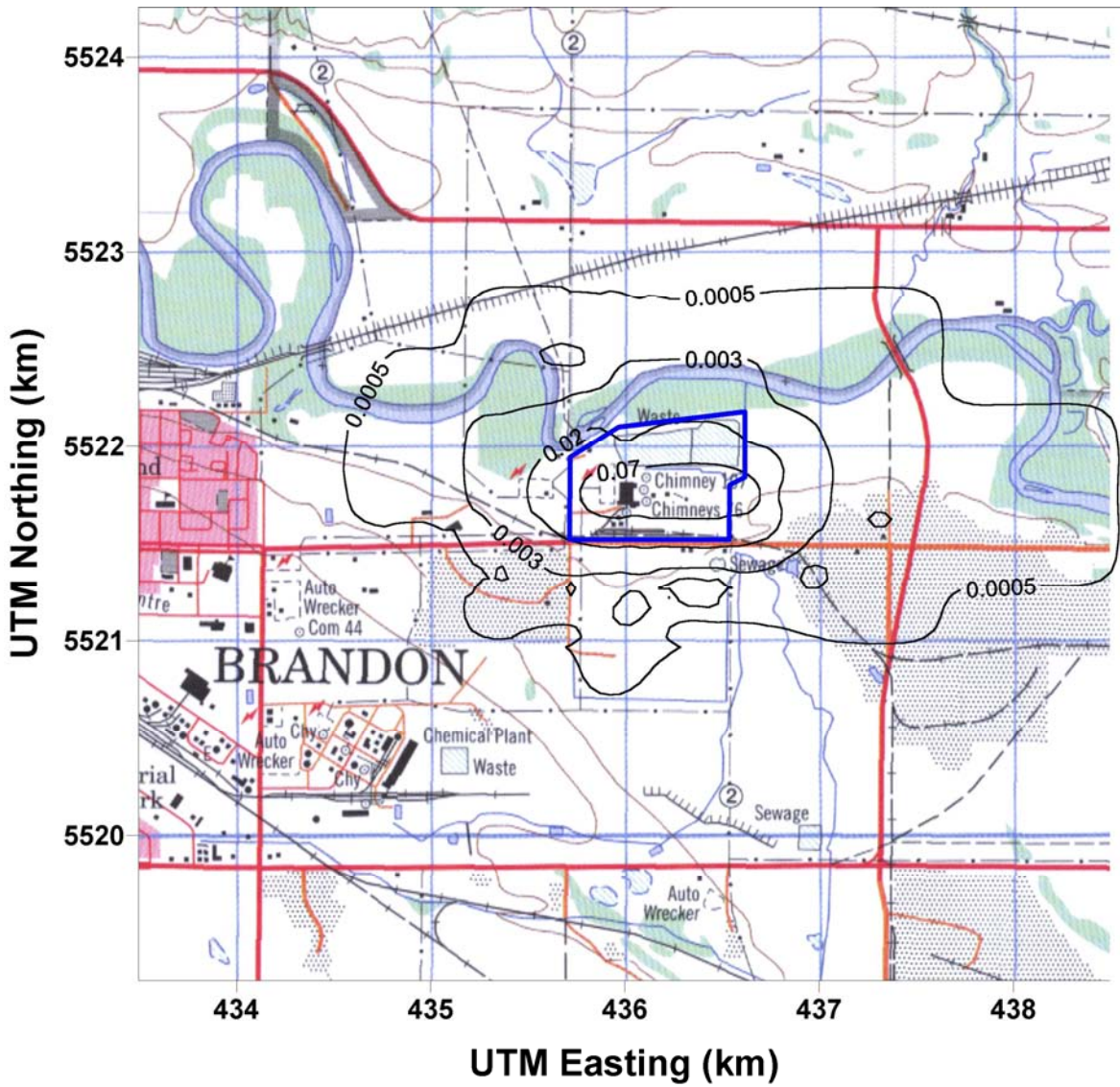
Figure 5.30 shows the annual average water deposition in  $\text{g/m}^2/\text{month}$ . The annual average precipitation in Brandon is 472 mm/yr (Environment Canada 2005). Using an average volume density for water of  $1000 \text{ kg/m}^3$ , this amount corresponds to  $39\,000 \text{ g/m}^2/\text{month}$ . Figure 5.30 shows that the maximum off-site water deposition due to the cooling towers is slightly in excess of  $4 \text{ g/m}^2/\text{month}$ , which represents a tiny fraction of the natural precipitation for the region.

The SACTI model calculates the deposition rate of salts from drift deposition. There are no standards or guidelines for salt deposition on land. According to a report prepared by the Federal/Provincial Research and Monitoring Coordinating Committee, the aquatic threshold for the deposition of *sulphuric* salts is  $20 \text{ kg/ha/yr}$  or  $0.167 \text{ g/m}^2/\text{month}$  (RMCC 1990). It has been estimated that there are no effects on aquatic systems at salt deposition rates below this value. The estimated plume salt deposition rates are shown in Figure 5.31. The maximum off-site deposition rate is approximately  $0.07 \text{ g/m}^2/\text{month}$ , which is lower than the threshold mentioned above. In addition, this deposition rate is inclusive of all salts, so the sulphuric salt portion will be considerably lower. It is not expected that salt deposition will have an appreciable effect on areas near the Brandon G.S.

**Figure 5.30**  
**Water Deposition due to Cooling Tower Emissions ( $\text{g}/\text{m}^2/\text{month}$ )**



**Figure 5.31**  
**Salt Deposition due to Cooling Tower Emissions ( $\text{g}/\text{m}^2/\text{month}$ )**



- Brandon G.S. Property Line
- Concentration Isopleth ( $\text{g}/\text{m}^2/\text{month}$ )

Aquatic threshold for deposition of sulphuric salts =  $0.167 \text{ g}/\text{m}^2/\text{month}$

## 5.6 COMBUSTION TURBINE (CT) EMISSIONS

Emissions from the two on-site CTs were evaluated both independently of other emission sources, and in combination with emissions from Unit #5, for CO, NO<sub>x</sub> and PM<sub>2.5</sub>.

### 5.6.1 Air Quality due to CT Emissions

Table 5.15 provides the maximum estimated off-site air concentrations at ground-level, corresponding to the CTs operating at full capacity. Maximum concentrations are shown for a 25% load scenario for CO, since emissions of CO are significantly higher at lower turbine loads.

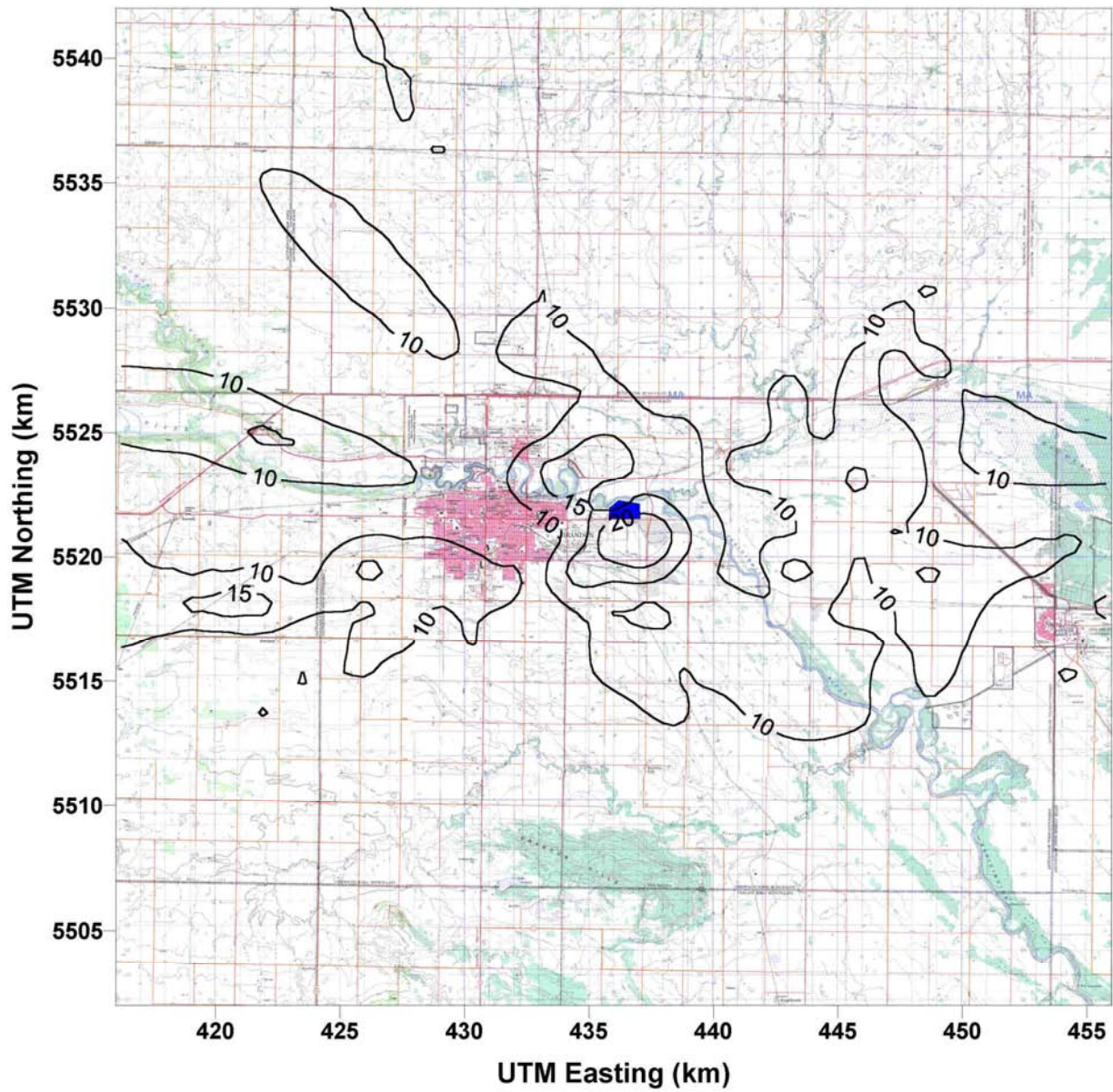
**Table 5.15: Maximum Predicted Incremental Short-term Concentrations for CT Operations**

Receptor	Maximum Short-term Air Concentrations (µg/m <sup>3</sup> )						
	NO <sub>2</sub> (100% conversion NO to NO <sub>2</sub> )		NO <sub>2</sub> (Janssen Method)*		CO (25% load)		PM <sub>2.5</sub>
	1-hour	24-hour	1-hour	24-hour	1-hour	8-hour	24-hour
AAQC	400	200	400	200	35,000	15,000	30
Max. POI	29.08	4.34	16.11	1.55	187.97	63.23	0.53
R1	8.77	0.97	5.68	0.63	56.66	14.95	0.12
R2	15.76	1.54	11.98	1.17	101.85	29.77	0.19
R3	9.51	1.03	4.94	0.54	61.46	17.91	0.13
R4	8.72	0.88	4.54	0.46	56.38	12.50	0.11
R5	8.69	0.92	5.63	0.60	56.15	11.72	0.11
R6	7.50	0.96	4.86	0.62	48.50	16.70	0.12
R7	12.20	1.32	9.27	1.00	78.85	19.02	0.16
R8	7.86	0.93	5.97	0.70	50.80	13.61	0.11
R9	4.93	0.57	3.20	0.37	31.89	8.25	0.07
R10	6.43	0.71	5.61	0.62	41.58	11.92	0.09
R11	6.66	0.88	5.81	0.77	43.07	15.21	0.11

\*Assumes that 20% of primary NO<sub>x</sub> emissions are NO<sub>2</sub> and the remainder undergoes transformation after release.  
AAQC – ambient air quality criterion

Maximum NO<sub>2</sub> concentrations are presented using the same two NO/NO<sub>2</sub> conversion methodologies described and used for Unit #5 emissions. However, there are no direct NO<sub>2</sub> emission data as is the case with Unit #5. With use of the Janssen method, it was assumed that 20% of the direct NO<sub>x</sub> emissions are NO<sub>2</sub>, with the remaining 80% as NO. Similar to the air quality predictions for Unit #5, the maximum point of impingement for 1-hour concentrations is very near the Brandon G.S. property line and occurs on the same hour of the same day. The maximum 1-hour NO<sub>2</sub> concentration using the Janssen method occurs several kilometres to the west-south-west of the Brandon facility. Maximum 1-hour, 8-hour (CO only) and 24-hour concentrations in the areas surrounding the Brandon G.S. are plotted in Figures 5.32 to 5.38.

**Figure 5.32**  
**Maximum Predicted Incremental 1-hour Average NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**  
**due to CT Emissions**  
**100% Conversion of NO to NO<sub>2</sub>**



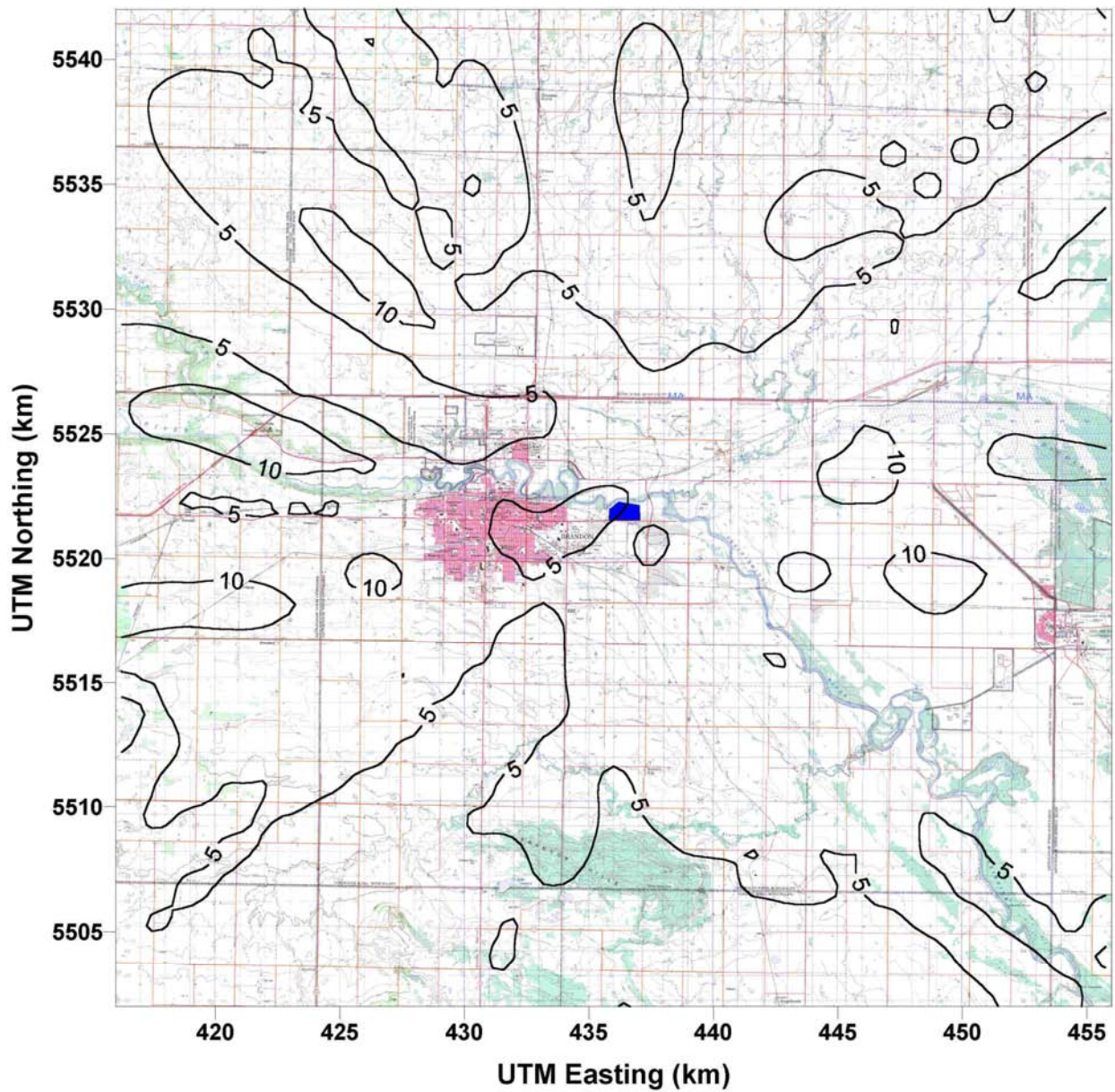
 Brandon Generating Station

 Concentration Isopleth

Provincial Objective: 400 µg/m<sup>3</sup>



**Figure 5.33**  
**Maximum Predicted Incremental 1-hour Average NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**  
**due to CT Emissions**  
**Janssen Method**

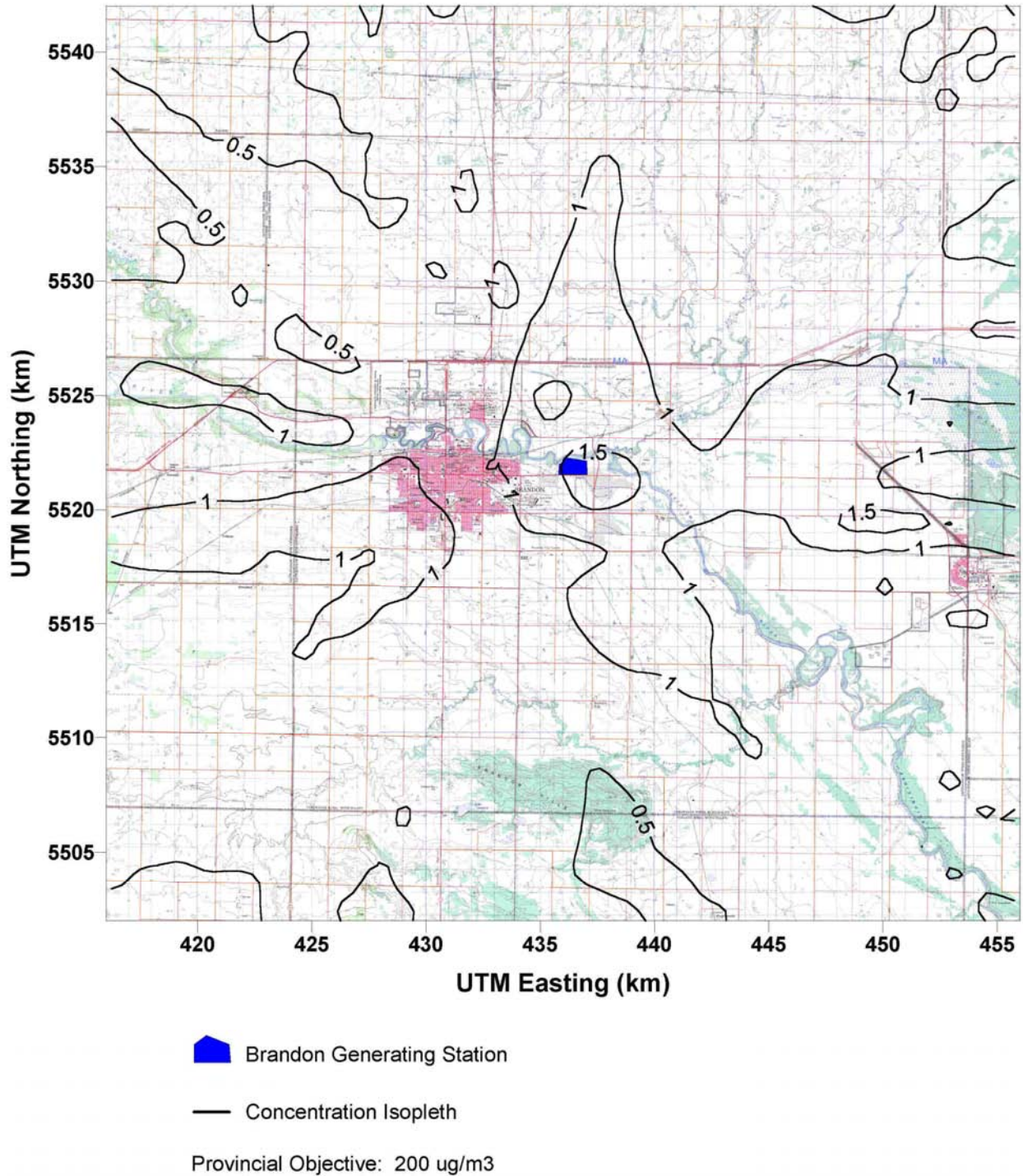


 Brandon Generating Station

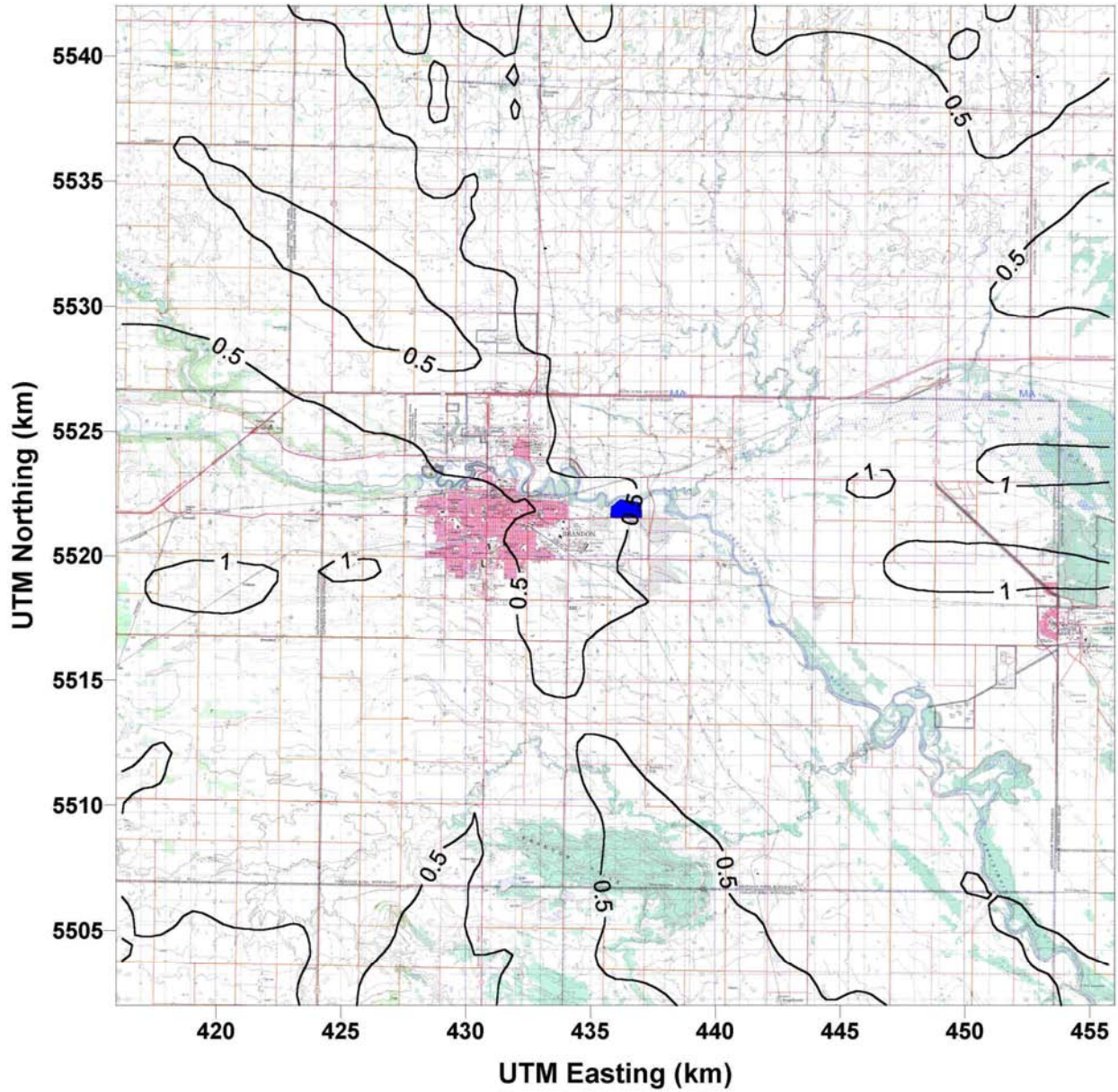
 Concentration Isopleth

Provincial Objective: 400 µg/m<sup>3</sup>

**Figure 5.34**  
**Maximum Predicted Incremental 24-hour Average NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**  
**due to CT Emissions**  
**100% Conversion of NO to NO<sub>2</sub>**



**Figure 5.35**  
**Maximum Predicted Incremental 24-hour Average NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**  
**due to CT Emissions**  
**Janssen Method**

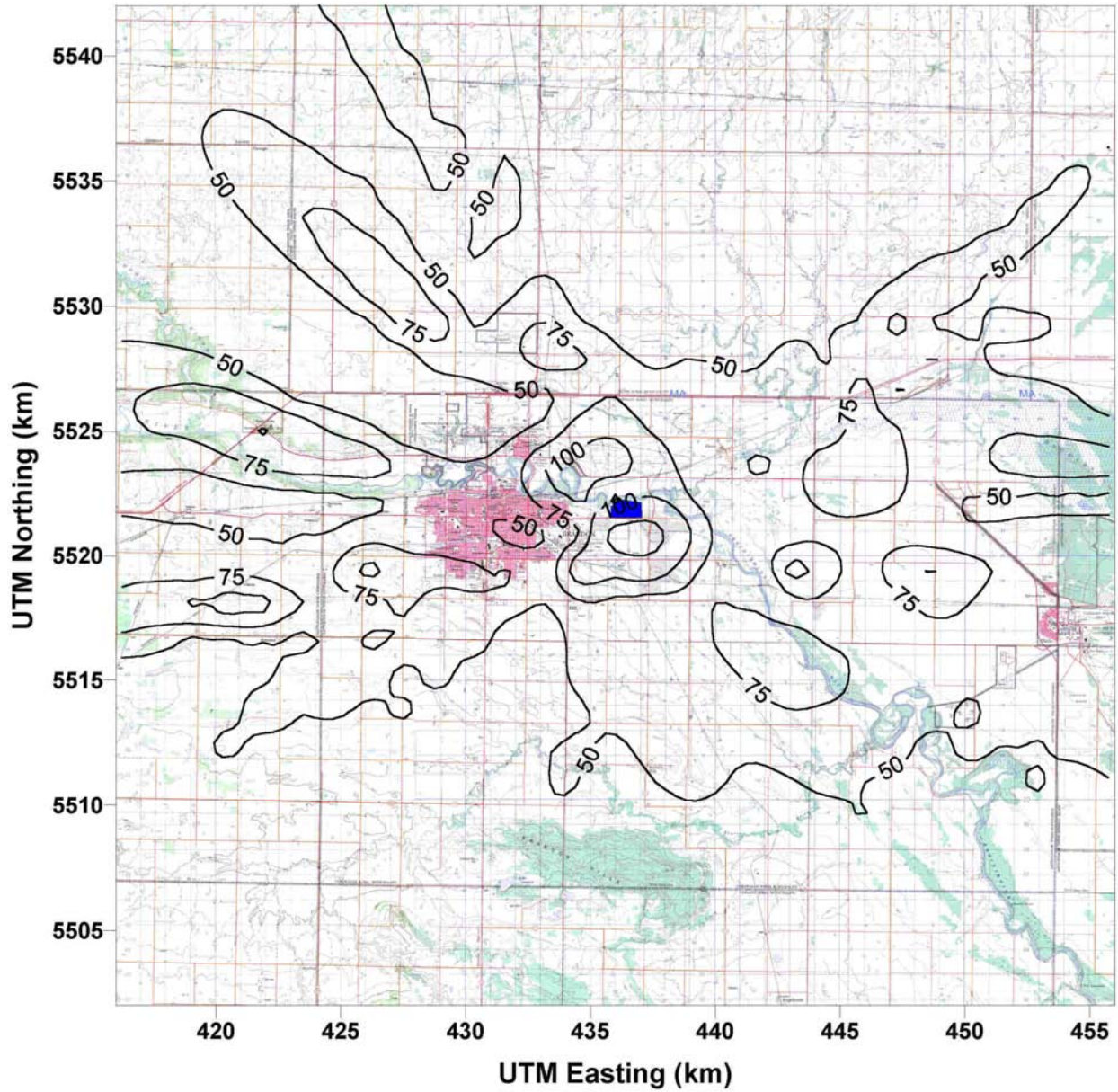


 Brandon Generating Station

 Concentration Isopleth

Provincial Objective: 200 µg/m<sup>3</sup>

**Figure 5.36**  
**Maximum Predicted Incremental 1-hour Average CO Concentrations ( $\mu\text{g}/\text{m}^3$ )  
due to CT Emissions**

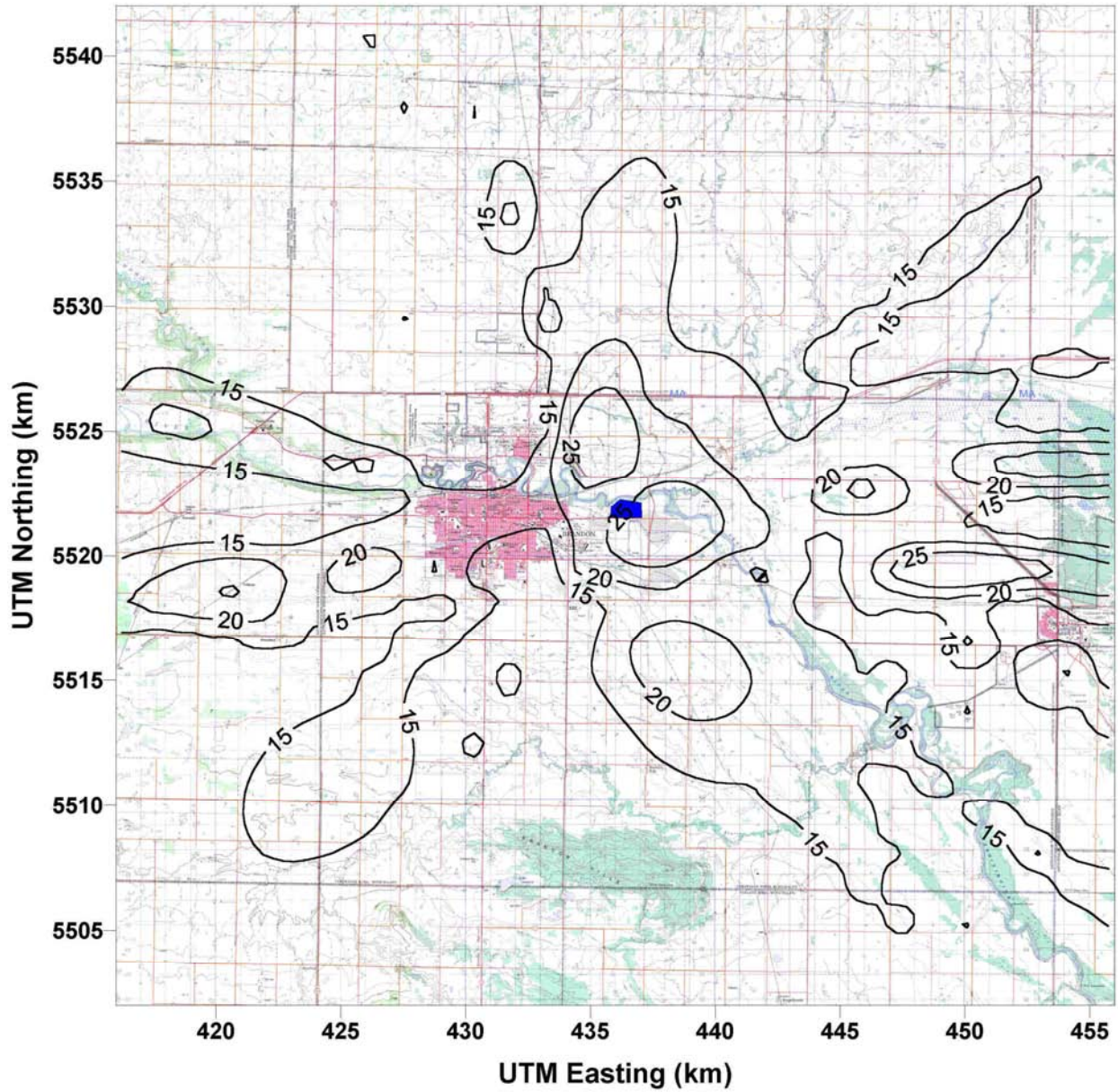


 Brandon Generating Station

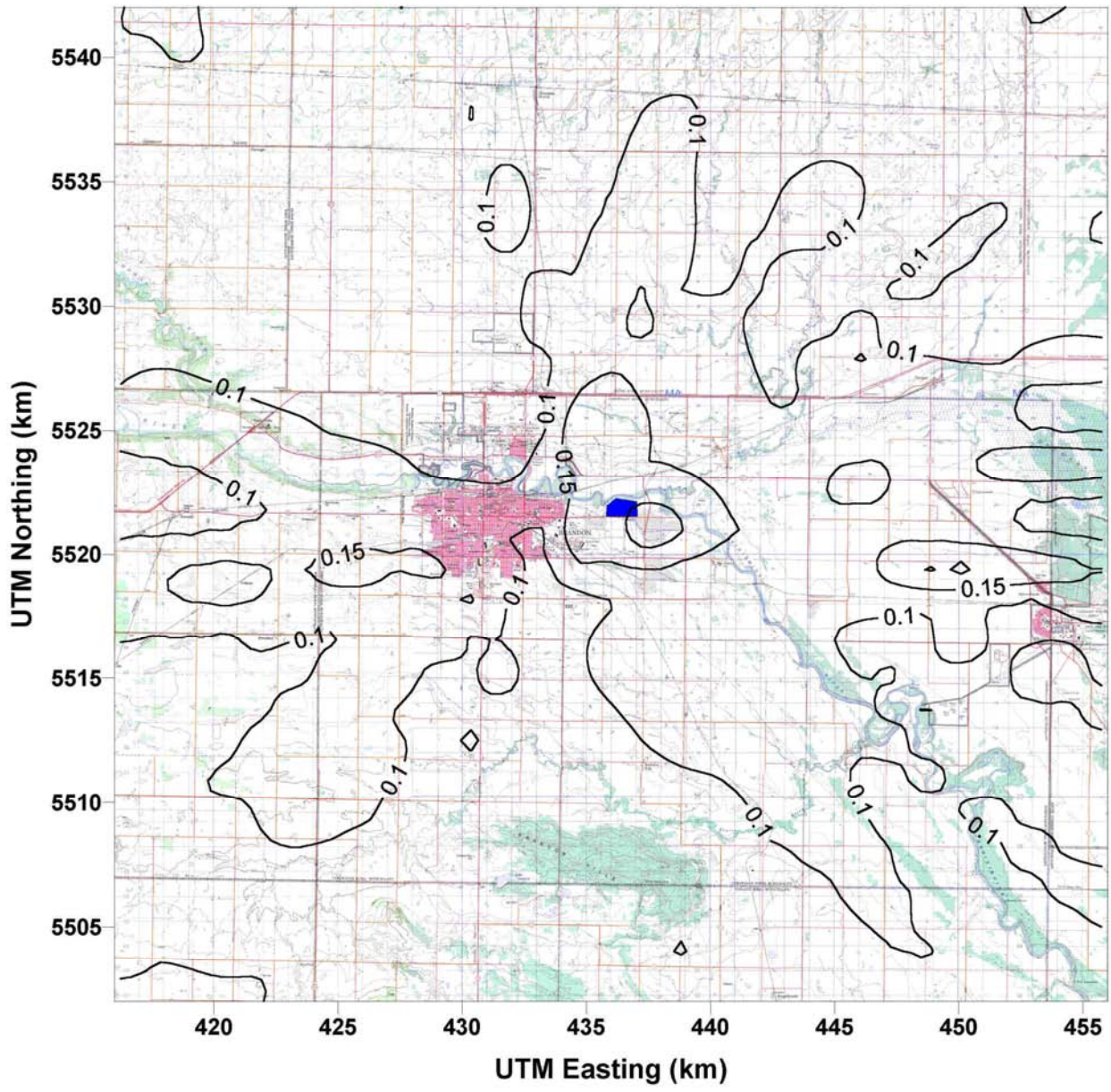
 Concentration Isopleth

Provincial Objective: 35,000  $\mu\text{g}/\text{m}^3$

**Figure 5.37**  
**Maximum Predicted Incremental 8-hour Average CO Concentrations ( $\mu\text{g}/\text{m}^3$ )  
due to CT Emissions**



**Figure 5.38**  
**Maximum Predicted Incremental 24-hour Average PM<sub>2.5</sub> Concentrations (µg/m<sup>3</sup>)  
due to CT Emissions**



### 5.6.2 CT Emissions Combined with Unit #5 Emissions

Separate air quality modelling analyses were conducted to assess the potential maximum impacts in the event that both Unit #5 and the two CTs operate at the same time. Table 5.16 provides the maximum predicted 1-hour, 8-hour (CO only) and 24-hour concentrations resulting from Unit #5 operating at the higher NO<sub>x</sub> emission rates for OS2 and the CTs operating at capacity.

**Table 5.16  
Maximum Predicted Incremental Short-term Concentrations for Combined Unit #5 (OS2)  
and CT Operations**

Receptor	Maximum Short-term Air Concentrations (µg/m <sup>3</sup> )						
	NO <sub>2</sub> 100% Conversion NO to NO <sub>2</sub>		NO <sub>2</sub> Janssen Method		CO		PM <sub>2.5</sub>
	1-hour	24-hour	1-hour	24-hour	1-hour	8-hour	24-hour
AAQC	400	200	400	200	35,000	15,000	30
Max. POI	359.91	24.47	119.10	10.57	192.02	63.23	0.53
R1	68.25	9.25	46.25	2.99	56.75	15.73	0.19
R2	52.18	5.65	39.36	1.84	104.02	30.39	0.17
R3	46.96	9.57	26.32	0.87	63.16	18.58	0.23
R4	56.16	12.20	31.47	1.06	57.53	12.94	0.29
R5	41.91	10.44	28.32	1.04	57.09	12.09	0.22
R6	42.36	14.07	28.63	2.46	49.82	17.20	0.29
R7	50.36	11.18	38.75	2.63	81.12	20.10	0.28
R8	51.83	5.88	40.37	2.86	51.35	13.82	0.14
R9	39.28	4.96	26.63	1.08	32.10	8.47	0.11
R10	21.60	3.63	19.09	1.52	41.59	11.99	0.08
R11	45.12	6.52	19.58	2.58	43.55	15.70	0.14

Maximum CO concentrations are very similar to those presented in Table 5.15, since the CT emissions of this air contaminant are far higher than those from Unit #5, when the CTs are operated at 25% capacity. This is also the case for PM<sub>2.5</sub>, since the emissions of this air contaminant are low for both sources. Maximum 1-hour concentrations of NO<sub>2</sub> increase substantially from the concentrations due to the CTs alone. The 24-hour concentrations also increase, but remain relatively low compared to the provincial 24-hour objective of 200 µg/m<sup>3</sup>.

NO<sub>2</sub> concentrations were determined assuming 100% of NO is converted to NO<sub>2</sub> at stack top (100% conversion method) and using the Janssen method described earlier. As for the CT emissions analysed in Section 5.5, it was assumed that 20% of the NO<sub>x</sub> emissions from the CTs were NO<sub>2</sub>. The Janssen method in this case is an effective addition of both direct NO<sub>2</sub> emissions

from the two sources, and transitional rates of NO to NO<sub>2</sub> conversion (which change with distance from the plant).

As with the case for the maximum predicted 1-hour average NO<sub>2</sub> concentrations for Unit #5 emissions alone (see Section 5.2.1), the provincial Maximum Acceptable objective of 400 µg/m<sup>3</sup> could potentially be exceeded for the combined operations of Unit #5 and the CTs if the background NO<sub>2</sub> concentration is assumed to be in the range of 39-102 µg/m<sup>3</sup>, and if it is assumed that all of the NO<sub>x</sub> is emitted as NO<sub>2</sub>. However, based on the more realistic assumption of gradual NO to NO<sub>2</sub> conversion using the Janssen method, no such exceedence would occur.

The frequency distribution shown in Table 5.17 supports the assertion that relatively high short-term concentrations occur very infrequently. The maximum predicted 1-hour average NO<sub>2</sub> concentration of 360 µg/m<sup>3</sup> (100% conversion method) is predicted to occur during only one hour per year. Concentrations in excess of 85 µg/m<sup>3</sup> are predicted to occur on only 4 hours per year even with both the CTs and Unit #5 operating at 100% capacity factor for the entire year, which cannot occur in practice.

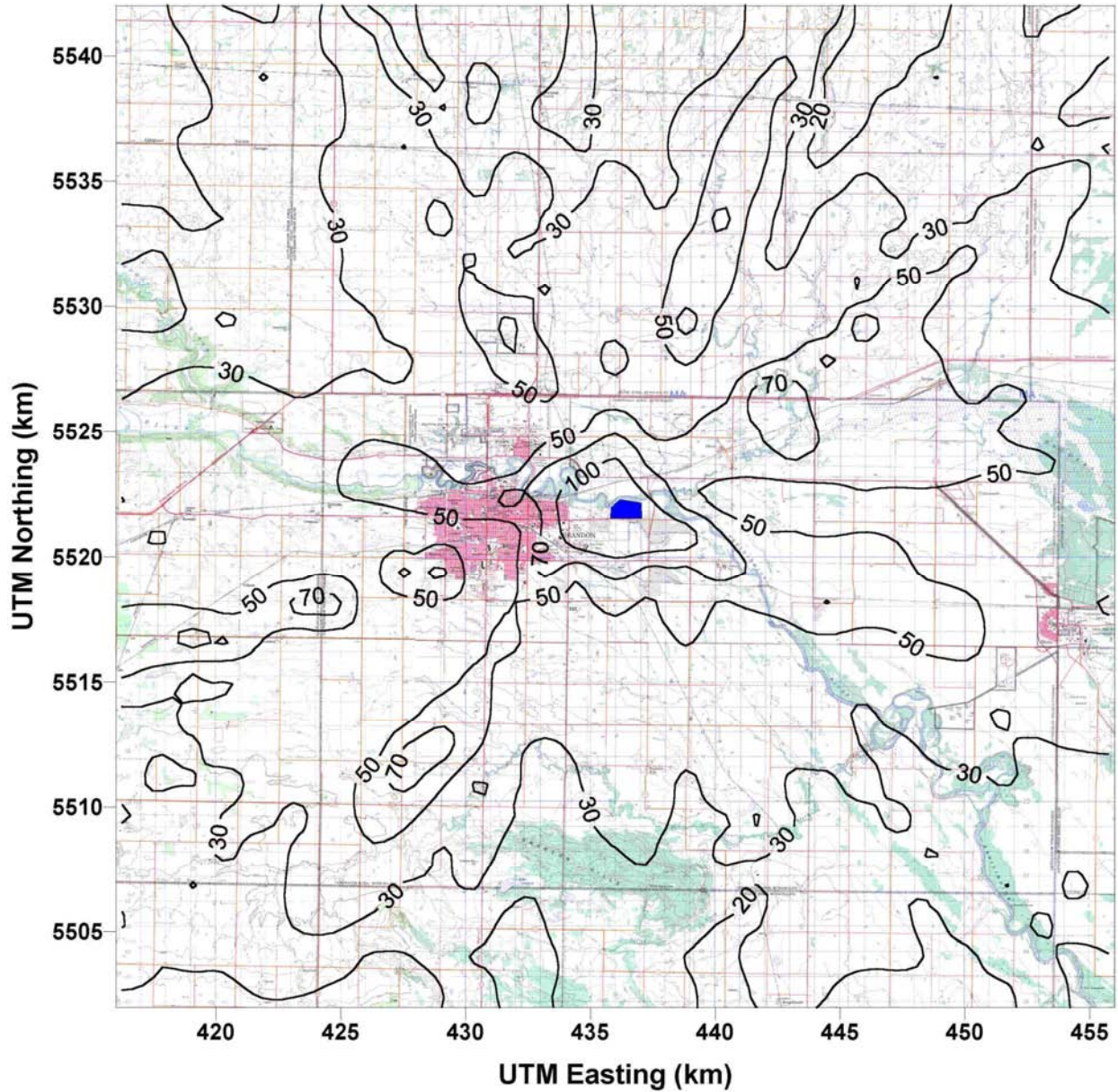
**Table 5.17  
Frequency Distribution of Maximum Predicted NO<sub>2</sub> Concentrations  
Due to Combined Emissions from Unit #5 (OS2) and CTs**

Percentile Concentration	Maximum 1-hour Concentration (µg/m <sup>3</sup> )		Maximum 24-hour Concentration (µg/m <sup>3</sup> )	
	100% Conversion	Janssen Method	100% Conversion	Janssen Method
<b>100</b>	360	119	24	11
<b>99.95</b>	84	26	23	11
<b>99.9</b>	53	17	20	8
<b>99.5</b>	21	6	10	5
<b>99</b>	12	3	6	5
<b>98</b>	5	0.7	4	3
<b>90</b>	0.2	0.1	0.4	1
<b>50</b>	0.0	0.0	0.0	0.0

Figures 5.39 and 5.40 present the maximum 1-hour average concentrations of NO<sub>2</sub> when both Unit #5 and the CTs are firing at capacity over the entire year. Figure 5.39 represents model predictions with the conservative assumption that all NO is converted to NO<sub>2</sub> at stack top, while Figure 5.40 represents model predictions when utilizing the Janssen conversion rates of NO to NO<sub>2</sub>.



**Figure 5.39**  
**Maximum Predicted Incremental 1-hour Average NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**  
**Due to Combined Emissions from Unit #5 (OS2) and CTs**  
**100% conversion NO to NO<sub>2</sub>**

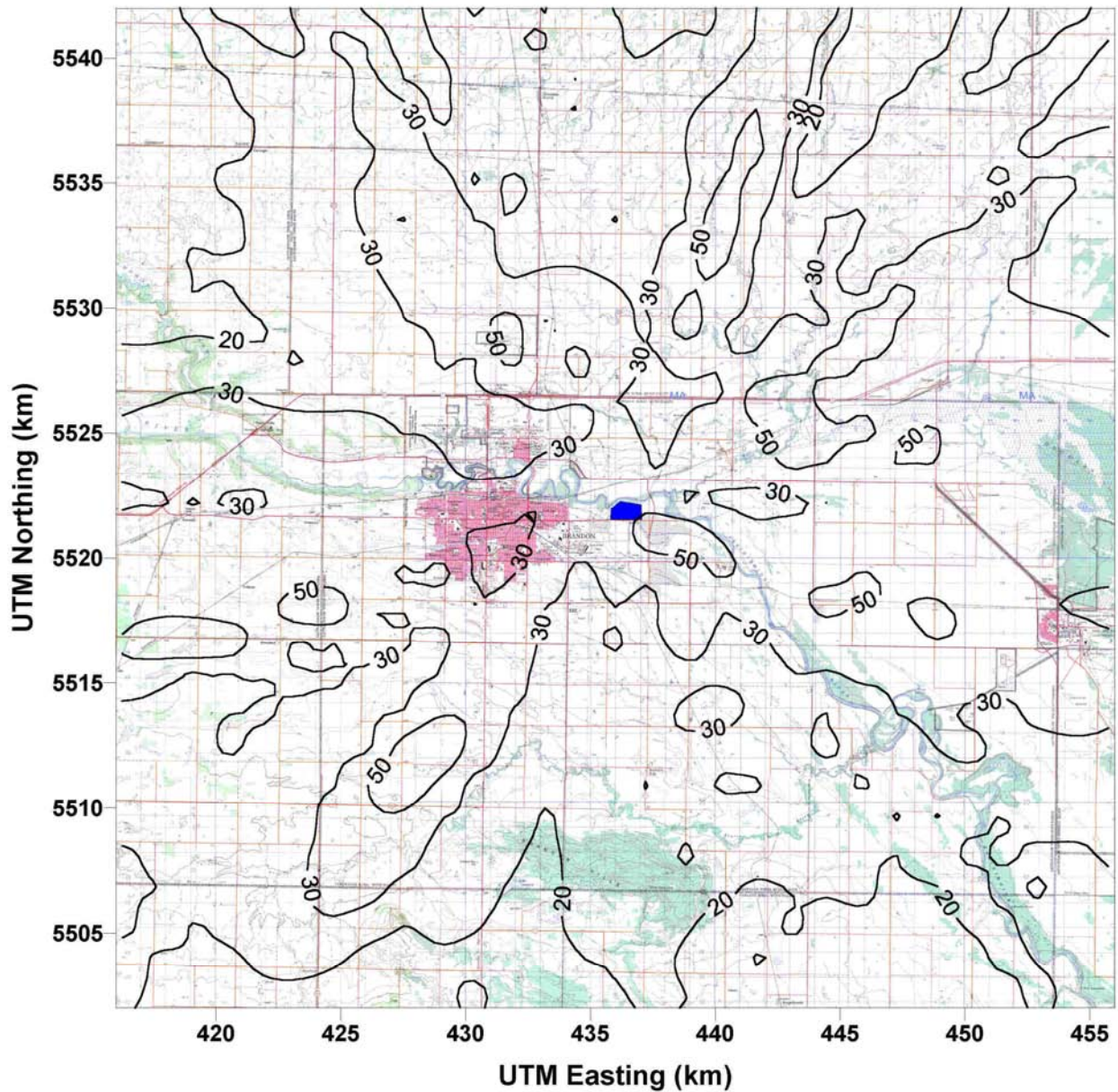


 Brandon Generating Station

 Concentration Isopleth

Provincial Objective: 400 µg/m<sup>3</sup>

**Figure 5.40**  
**Maximum Predicted Incremental 1-hour Average NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**  
**Due to Combined Emissions from Unit #5 (OS2) and CTs**  
**Janssen Method**



 Brandon Generating Station

 Concentration Isopleth

Provincial Objective: 400 µg/m<sup>3</sup>

## **6.0 CONCLUSIONS**

The impact of air pollutant emissions on the ambient air quality in the vicinity of the Brandon G.S. was evaluated using the CALPUFF dispersion model for the stack emissions from Unit #5 and the ISCST3 model for fugitive dust emissions. The assessment considered emissions of common air contaminants, volatile organic compounds, and trace inorganic and organic (PAH, dioxins and furans) species. A sensitivity analysis was conducted to evaluate maximum potential increases in emissions of sulphur dioxide, particulate matter, and trace organic and inorganic constituents due to the use of other sub-bituminous coal suppliers. In addition, the assessment of cooling tower emissions was evaluated using the SACTI model to predict maximum off-site impacts such as plume visibility, fogging, icing and salt deposition. Although the assessment specifically focussed on the coal-fired operations of Unit #5, the impacts for selected common air contaminants due to combined operations of Unit #5 and the two on-site combustion turbines (CTs) were also evaluated.

The results of the CALPUFF dispersion modelling analysis for the common air contaminants indicate that the maximum predicted incremental impacts due to emissions from the Brandon G.S. are generally below the Manitoba Maximum Acceptable Level air quality objectives or guidelines. The exception would be for the conservative assumption that 100% of the NO is instantaneously converted to NO<sub>2</sub> as the exhaust gases exit the Unit #5 stack. Use of this assumption suggests that, when combined with measured background NO<sub>2</sub> concentrations, the Maximum Acceptable 1-hour average NO<sub>2</sub> objective might be exceeded one hour per year at the maximum point of impingement, which is in an industrial zone, and not at sensitive receptor locations. However, a more realistic assessment using the Janssen method to estimate gradual in-plume conversion of NO to NO<sub>2</sub> indicates that the provincial objective would not, in fact, be exceeded at any location. This is also the case for impacts due to combined operation of Unit #5 in conjunction with the two combustion turbines. On this basis, it is concluded that operation of the Unit #5 meets the ambient air quality objectives and guidelines defined by the Province of Manitoba.

The maximum predicted pollutant concentrations at the discrete receptor locations are listed in Attachment C. These values were used in the assessment of risks to human health and ecosystems in a separate report (Appendix N). The following sections summarize the assessment results for common air contaminants, trace organic and inorganic species, greenhouse gases, fugitive dust emissions, and cooling tower emissions discussed in the preceding sections of this report.

## **6.1 Nitrogen Dioxide**

### **6.1.1 1-hour Average NO<sub>2</sub> Concentrations**

At the measured NO<sub>x</sub> emission rates for Unit #5, the highest off-site 1-hour average NO<sub>2</sub> concentration would be 322 µg/m<sup>3</sup>, if the analysis is based on the assumption that all of the NO is instantaneously converted to NO<sub>2</sub> as the exhaust gas leaves the stack. This value is predicted to occur on one hour per year at a location SE of the Brandon G.S., near the sewage treatment plant. However, 99.95 percent of the time the predicted NO<sub>2</sub> concentration would be less than 75 µg/m<sup>3</sup> at this location. Moreover, the maximum predicted concentration of 322 µg/m<sup>3</sup> is associated with emissions using the less efficient OS2 burner row configuration, which is only used 10% of the time. The maximum predicted 1-hour average NO<sub>2</sub> concentration using the preferred OS1 configuration produces a maximum predicted concentration of only 243 µg/m<sup>3</sup>.

The maximum measured background NO<sub>2</sub> concentrations in Brandon over the five-year period 2000-2004 ranged from 86 µg/m<sup>3</sup> in 2003 to as high as 149 µg/m<sup>3</sup> in 2001. These values are well below the provincial Maximum Acceptable objective of 400 µg/m<sup>3</sup>. However, these values also include the contribution of emissions from Unit #5. Based on the CALPUFF modelling analysis conducted for this assessment, the maximum contribution of Unit #5 emissions to the 1-hour average NO<sub>2</sub> concentrations measured in Brandon would range from as high as 47 µg/m<sup>3</sup> based on the higher emissions from OS2 and assuming 100% conversion of NO to NO<sub>2</sub>, to as low as 33 µg/m<sup>3</sup> (100% conversion method) for the preferred OS1. If these assumed contributions due to Unit #5 emissions are subtracted from the measured NO<sub>2</sub> concentrations in Brandon, the maximum 'background' 1-hour averaged NO<sub>2</sub> concentration could be on the order of 39-102 µg/m<sup>3</sup>. If the lower of these values is added to the maximum predicted NO<sub>2</sub> concentration of 322 µg/m<sup>3</sup> for OS2, then the provincial objective would not be exceeded. If the higher number of 102 µg/m<sup>3</sup> is assumed to be representative of background concentrations from other sources, then the provincial 1-hour average NO<sub>2</sub> objective would be exceeded on one day per year if Unit #5 operated using OS2 all of the time. On the other hand, using the preferred OS1, the addition of a background NO<sub>2</sub> concentration of 102 µg/m<sup>3</sup> to the maximum predicted concentration of 243 µg/m<sup>3</sup> would not result in an exceedance of the provincial Maximum Acceptable objective.

The assumption that 100% of the NO released from the stack is instantaneously converted to NO<sub>2</sub> is considered to be overly conservative in that it overpredicts actual NO<sub>2</sub> impacts. A more realistic assessment of maximum potential NO<sub>2</sub> impacts was estimated using the Janssen method. Based on the latter, the maximum predicted 1-hour average NO<sub>2</sub> concentrations due to Unit #5 emissions would be 91 µg/m<sup>3</sup> for the preferred OS1, and 119 µg/m<sup>3</sup> using OS2. For either of these results, simply adding the maximum measured NO<sub>2</sub> concentration in Brandon as an

estimate of background levels would not cause any exceedance of the provincial Maximum Acceptable NO<sub>2</sub> objective of 400 µg/m<sup>3</sup>.

For the case of combined emissions from Unit #5 and the two CTs, the maximum predicted 1-hour average NO<sub>2</sub> concentration is 360 µg/m<sup>3</sup>, which is predicted to occur on only one day per year if it is assumed that all of the NO from Unit #5 and the CTs is immediately converted to NO<sub>2</sub> upon leaving the stacks, which is a conservative assumption. With the additional, conservative assumption that all three units are operated at 100% capacity factor, the CALPUFF model predicts the maximum incremental NO<sub>2</sub> concentration would not exceed 85 µg/m<sup>3</sup> on more than 4 hours per year. If the more realistic Janssen conversion method is used, the maximum predicted 1-hour average NO<sub>2</sub> concentration for combined operations would be only 119 µg/m<sup>3</sup>. If the background NO<sub>2</sub> concentration is assumed to be 102 µg/m<sup>3</sup> as described above, then the provincial Maximum Acceptable objective of 400 µg/m<sup>3</sup> could be exceeded on one hour per year. However, the objective would not be exceeded for the lower bound estimate of background NO<sub>2</sub> concentration. Moreover, the objective would not be exceeded even if the maximum measured NO<sub>2</sub> concentration in Brandon were added to the results based on the Janssen conversion method.

In summary, the provincial Maximum Acceptable objective of 400 µg/m<sup>3</sup> could theoretically be exceeded on up to one hour per year if:

- Unit #5 were to operate in OS2 configuration 100% of the time for a full year; and
- the assumption of 100% NO to NO<sub>2</sub> conversion is applied to the modelling analysis; and,
- the contribution of all other background sources is greater than 40 µg/m<sup>3</sup> when Unit #5 operates in conjunction with both CTs, or is greater than 78 µg/m<sup>3</sup> when Unit #5 is operating on its own.

All three conditions listed above must be satisfied in order for the predicted NO<sub>2</sub> concentrations to exceed the provincial objective. Use of the preferred OS1, and/or the use of the Janssen method to estimate realistic NO<sub>2</sub> concentrations, would not cause the objective to be exceeded even if Unit #5 were to operate in conjunction with both CTs. Therefore, while this one hour exceedance is a hypothetically possible, given the above conservative assumptions, in reality a monitoring station located at the predicted one hour maximum site would likely not register an exceedance of the provincial Maximum Acceptable objective of 400 µg/m<sup>3</sup>

### **6.1.2 24-Hour Average NO<sub>2</sub> Concentrations**

Using measured NO<sub>x</sub> emission rates and assuming 100% conversion of NO to NO<sub>2</sub> at the stack, the maximum predicted 24-hour average NO<sub>2</sub> concentration is estimated to be 24 µg/m<sup>3</sup> for OS2, and 17 µg/m<sup>3</sup> for OS1. A more realistic estimate assuming gradual conversion of NO to NO<sub>2</sub> yields a maximum predicted 24-hour average NO<sub>2</sub> concentration of about 8-10 µg/m<sup>3</sup> for the two operating scenarios. If the highest 24-hour average NO<sub>2</sub> concentration of 57 µg/m<sup>3</sup> recorded in Brandon over the 5-year period 2000-2004 is assumed to be representative of background NO<sub>2</sub> levels at the maximum point of impingement for the Unit #5 plume, the combined impact of background levels plus emissions from Unit #5 would not exceed the Maximum Acceptable objective of 200 µg/m<sup>3</sup>. Moreover, the maximum 24-hour average NO<sub>2</sub> concentration of 24 µg/m<sup>3</sup> for combined operations of Unit #5 and the two CTs is no greater than the maximum impact from Unit #5 alone because the maximum point of impingement for Unit #5 does not occur in the same location as for the two CTs. Therefore, the provincial Maximum Acceptable objective would not be exceeded at any location even with the combined emissions of all three units.

### **6.1.3 Annual Average NO<sub>2</sub> Concentrations**

The maximum predicted annual average NO<sub>2</sub> concentration due to emissions from the Brandon G.S. is estimated to provide an insignificant contribution of less than 1 µg/m<sup>3</sup> to overall NO<sub>2</sub> levels in the Brandon area for both the 100% conversion method and the Janssen method.

## **6.2 Sulphur Dioxide**

### **6.2.1 1-hour Average SO<sub>2</sub> Concentrations**

For power generation using the current coal supplied from the Spring Creek mine, maximum predicted 1-hour average SO<sub>2</sub> concentrations range from 200 µg/m<sup>3</sup> for OS2 to 190 µg/m<sup>3</sup> for the preferred OS1. An assessment of potential emissions from sub-bituminous coals with up to 33% higher sulphur content suggests that maximum 1-hour average SO<sub>2</sub> concentrations would not exceed 265.5 µg/m<sup>3</sup>. As there are no other major sources of SO<sub>2</sub> in the area, the maximum predicted concentrations due to emissions from Unit #5 can be directly compared to the provincial Maximum Acceptable objective of 900 µg/m<sup>3</sup>. The results indicate that the provincial objective would not be exceeded either for current or potential future operations using coal with a higher sulphur content.

### **6.2.2 24-hour Average SO<sub>2</sub> Concentrations**

The maximum predicted 24-hour average SO<sub>2</sub> concentrations of 13.9 µg/m<sup>3</sup> for OS1 and 14.6 µg/m<sup>3</sup> for OS2 are well below the provincial Maximum Acceptable objective of 300 µg/m<sup>3</sup>. Even if in the future the plant were to burn a coal with 33% more sulphur, the predicted concentrations of 18.5 µg/m<sup>3</sup> and 19.5 µg/m<sup>3</sup> for the two operating scenarios, respectively, would still be well below the provincial objective.

### **6.2.3 Annual Average SO<sub>2</sub> Concentrations**

The maximum predicted annual average SO<sub>2</sub> concentration due to emissions from the Brandon G.S. is estimated to provide an insignificant contribution of less than 1 µg/m<sup>3</sup> to overall SO<sub>2</sub> levels in the Brandon area for either current operations or future operations using coal with 33% greater sulphur content.

## **6.3 CARBON MONOXIDE**

The maximum predicted 1-hour average CO concentrations of 19.1 µg/m<sup>3</sup> for OS2 and 16.1 µg/m<sup>3</sup> for OS1 are insignificant compared with the provincial Maximum Acceptable objective of 35,000 µg/m<sup>3</sup>. Furthermore, the objective would not be exceeded even if the background CO concentration in Brandon were as high as that reported for Station 9118 in Winnipeg of 7,980 µg/m<sup>3</sup>.

Similarly, the maximum predicted 8-hour average CO concentrations of 4.2 µg/m<sup>3</sup> for OS2 and 3.5 µg/m<sup>3</sup> for OS1 are insignificant compared with the provincial Maximum Acceptable objective of 15,000 µg/m<sup>3</sup>. The objective would not be exceeded even if the background CO concentration in Brandon were as high as that reported for Station 9118 in Winnipeg of 4,560 µg/m<sup>3</sup>.

Maximum Predicted CO concentrations for combined emissions from Unit #5 and the two CTs results in much higher 1-hour and 8-hour average CO concentrations due to the higher impacts of the CO emissions from the CTs. For example, the maximum predicted 1-hour average CO concentration for combined emissions is 192 µg/m<sup>3</sup>, consisting primarily of 188 µg/m<sup>3</sup> from the two CTs. Similarly, the maximum predicted 8-hour average CO concentration of 63 µg/m<sup>3</sup> for combined emissions is entirely derived from the CTs because the contribution of Unit #5 emissions to total CO concentration is insignificant at the maximum point of impingement for the emissions from the two CTs. Nevertheless, even with the higher predicted concentrations for the combined emissions from Unit #5 and the two combustion turbines, the provincial objectives for 1-hour and 8-hour averaged CO concentrations would not be exceeded at any time.

## **6.4 PARTICULATE MATTER**

### **6.4.1 PM<sub>2.5</sub> Concentrations**

At 16  $\mu\text{g}/\text{m}^3$  in 2004, the current observed PM<sub>2.5</sub> concentrations in Brandon are well below the CWS parameter value of 30  $\mu\text{g}/\text{m}^3$  (98<sup>th</sup> percentile, averaged over 3 years). The maximum PM<sub>2.5</sub> concentration measured at the Assiniboine Community College in Brandon over the period 2001-2004 was 26  $\mu\text{g}/\text{m}^3$ , while the 98<sup>th</sup> percentile values in any given year range from 15  $\mu\text{g}/\text{m}^3$  to 18  $\mu\text{g}/\text{m}^3$ .

At the maximum point of impingement, the highest predicted 24-hour average PM<sub>2.5</sub> concentration due to emissions from the Brandon G.S. Unit #5 stack is 0.5  $\mu\text{g}/\text{m}^3$  for current coal supplied from the Spring Creek mine, and would not be greater than 0.7  $\mu\text{g}/\text{m}^3$  for potential fuel supplied from other mines that Manitoba Hydro might consider in the future. Therefore, the Unit #5 stack emissions contribute a relatively minor amount of material to the PM<sub>2.5</sub> levels in the Brandon area. In fact, the accuracy of PM<sub>2.5</sub> monitoring equipment is such that an increase in PM<sub>2.5</sub> concentrations of less than 1  $\mu\text{g}/\text{m}^3$  would be undetectable. Even with combined emissions from Unit #5 and the two CTs, the maximum predicted PM<sub>2.5</sub> concentration would still be less than 1  $\mu\text{g}/\text{m}^3$ .

The maximum predicted PM<sub>2.5</sub> concentrations for fugitive dust from coal and ash storage are conservatively estimated at 15  $\mu\text{g}/\text{m}^3$  and 1  $\mu\text{g}/\text{m}^3$ , respectively. At the point of maximum predicted concentration, the 98<sup>th</sup> percentile 24-hour average concentration for fugitive coal dust is only 1.7  $\mu\text{g}/\text{m}^3$ , while that for ash is much less than 1  $\mu\text{g}/\text{m}^3$ . Although the maximum point of impingement for the Unit #5 stack emissions and fugitive coal/ash emissions do not occur at the same location, the CWS in the area would not be exceeded even if they did coincide and were added to the 98<sup>th</sup> percentile levels measured at the Assiniboine Community College in Brandon.

### **6.4.2 PM<sub>10</sub> Concentrations**

The maximum measured 24-hour average PM<sub>10</sub> concentrations at the Assiniboine Community College in Brandon over the period 1998-2004 consistently exceeded the Manitoba guideline value of 50  $\mu\text{g}/\text{m}^3$ . Maximum 24-hour average PM<sub>10</sub> concentrations ranged from 127  $\mu\text{g}/\text{m}^3$  in 1998 to 229  $\mu\text{g}/\text{m}^3$  in 2002. Annual average PM<sub>10</sub> concentrations over the same period ranged from 20  $\mu\text{g}/\text{m}^3$  to 23  $\mu\text{g}/\text{m}^3$ . The primary cause for the high levels of PM<sub>10</sub> in the Brandon area is believed to be fugitive dust emissions from agricultural activity, as well as possibly seasonal burning of agricultural waste and stubble in fields.



For PM<sub>10</sub> emissions from the Unit #5 stack, the maximum predicted 24-hour average incremental concentration is 0.8 µg/m<sup>3</sup> for OS2 using coal from the Spring Creek mine, and 0.5 µg/m<sup>3</sup> for OS1. Based on potential future coal supplies having up to 35% higher ash content, the respective maximum predicted 24-hour average PM<sub>10</sub> concentrations would be 1.1 µg/m<sup>3</sup> for OS2 and 0.7 µg/m<sup>3</sup> for the preferred OS1. These values are at or below the measurement accuracy of a PM<sub>10</sub> monitor. Therefore, the contributions of particulate matter emissions from the Unit #5 stack do not significantly contribute to the exceedances of the PM<sub>10</sub> guideline of 50 µg/m<sup>3</sup> recorded at the PM<sub>10</sub> monitor in Brandon.

The maximum predicted PM<sub>10</sub> concentrations for fugitive dust emissions are conservatively estimated at 27 µg/m<sup>3</sup> for coal dust and 7 µg/m<sup>3</sup> for ash from the ash storage area. Ninety-nine percent (99%) of the time, the maximum contribution of fugitive coal dust to ambient PM<sub>10</sub> levels anywhere in the area would be less than 15 µg/m<sup>3</sup>. Moreover, the maximum predicted PM<sub>10</sub> concentrations are less than 0.5 µg/m<sup>3</sup> at the Riverview Elementary School (i.e., in the closest residential area west of the Brandon G.S. and near the air quality monitoring station at the Assiniboine Community College), as well as at the nearest residence east of the plant. As such, the PM<sub>10</sub> concentrations due to fugitive dust emissions would not be measurable at the nearest residences, and the fugitive emissions from the Brandon G.S. alone would not be sufficient to cause the high PM<sub>10</sub> concentrations measured in Brandon.

### **6.4.3 SPM Concentrations**

Background SPM concentrations in the Brandon area are not measured. However, since the maximum measured 24-hour average ambient PM<sub>10</sub> levels in Brandon have been reported to be as high as 229 µg/m<sup>3</sup>, it is reasonable to assume that maximum 24-hour background SPM concentrations greater than 200 µg/m<sup>3</sup> are not uncommon. Therefore, it is likely that the Maximum Acceptable ambient air quality objective for SPM of 120 µg/m<sup>3</sup> (24-hour average) is exceeded every year in the Brandon area.

Using Spring Creek coal and OS2, the maximum 24-hour average incremental SPM concentrations of 0.8 µg/m<sup>3</sup> due to Unit #5 stack emissions is predicted to occur near the northwest corner of the Brandon G.S. property line. If the ash content of future coals that might be burned at the plant were up to 35% higher than for Spring Creek coal, the maximum predicted concentration would be 1.1 µg/m<sup>3</sup>. As such, the maximum contribution of Spring Creek coal to measured SPM levels in the Brandon area is negligible.

Maximum predicted SPM concentrations for fugitive dust from the coal and ash storage areas are 105 µg/m<sup>3</sup> and 8 µg/m<sup>3</sup>, respectively. The estimate of fugitive coal dust contributions to ambient SPM concentrations is considered to be conservative, in that the estimated SPM emission rates