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M E M O R A N D U M

TO: Craig Dobiech
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FROM: Frank Dobroff
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RE: **Richmond Landfill - Odour Modeling for Mohawks of Bay of Quinte**

This memorandum is a review of odour modeling of the Richmond Landfill site by XCG Consultants Ltd. for the Mohawks of the Bay of Quinte dated May 29, 2009.

The report was prepared after review of previous modeling performed for the landfill, of which the authors had a number of criticisms including:

1) incomplete source assessments by not including fresh waste operations
2) use of ISC model instead of AERMOD
3) inadequate on-site odour measurements of sources
4) source of wind data in modeling

A new assessment was conducted involving modeling by Screen3 and AERMOD employing different emission estimates obtained from literature and utilizing a different meteorological data set. The new emission estimates were only for fresh waste operations and thus differed significantly from the previous modeling by the operators - Waste Management of Canada Corp, who included only landfill gas (LFG) and composting operations in their assessment. The authors indicated that "based on initial calculations" only odour emission estimates from fresh waste operations were significant and chose to use this source alone in its assessments. There was also a non-specified literature source given in a bibliography listing as further evidence for fresh waste operations being dominant and "typically orders of magnitude higher than LFG generation". There was no elaboration on what calculations had been undertaken to arrive at this conclusion. Our experience indicates that the fresh waste sources are not always the greatest.

They selected two area emission estimates (one for each model) from literature sources- the second one being very recent (a single 2008 study) for the AERMOD assessment. I cannot comment on the legitimacy of these estimates or the criticisms of the previous emission estimations. A source testing engineer would need to comment on those.

The Screen3 modeling employed an emission estimate of 0.2 Odour Units/sec/square metre for the working face of the landfill treated as an area source. Based on the 2500 m^2 size of the working face, this translates to a release rate of 500 OU/sec, compared to the 67000 OU/sec value that was used in AERMOD. It is not explained why two disparate emission estimates were used in the two models. The emission was also incorrectly given a release height of 40 metres. The 40 metre height was quoted earlier in the report in Section 2.1.1 as the maximum elevation of the waste mound, found from previous reports that they had reviewed (but probably misinterpreted or misread). Photos of the site indicate the mound is about 40 *feet* in height. I confirmed that the 40 metre height was used when I duplicated the Screen3 model runs and arrived at the same figures quoted in the report in Section 5.1 at various downwind distances. Unfortunately, the authors have misinterpreted the Screen3 outputs and reported predicted concentrations six orders of magnitude too high. The outputs (all 1 hour average) should be interpreted as microOdour Units, not Odour units. Consequently, the actual predicted maximum was 0.04 OU, not 0.371E+5 OU predicted to occur 296 metres from the landfill (in my model). At distances 5 km and 20 km (on Tyendinaga Mohawk Territory (TMT)), concentrations by their modeling were only .0075 and .002 OU respectively, well below the 1.0 OU guideline. However, the improper release height played a role in this estimate, so I reran the model based on a more realistic 12.2 metres release height (40 ft), and this maximum changed to 0.38 OU (139 m from landfill). At distances 5 km and 20 km (on TMT), concentrations were .026 and .005 OU respectively, all well below the 1.0 OU guideline.

I further assessed with Screen3 by running the model with the higher emission rate used in AERMOD calculated to be 26.8 g/sec/m^2 and arrived at a maximum value of 50.8 OU (139 m from landfill) and 3.6 OU at 5 km and 0.6 OU at 20 km (all 1 hour averages). These closer-in values are well above the 1.0 OU guideline. Treating these for 10 minute averaging would increase them of course.

The AERMOD results cannot be checked for accuracy or suitability of inputs, as no data files were provided other than a pictorial output of Odour Unit contours of maximum levels using a very coarse receptor grid with 1000 metre spacing extending out across the TMT. There was no smaller grid around the landfill with short receptor spacing to see the predicted localized landfill impacts as per normal analysis (the focus was on TMT). The emission estimate of 67000 OU/sec was over 100 times greater than what was used in Screen3. A maximum reading of 199 OU (10 minute average) was predicted somewhere on or close to the landfill with predictions of 12 OU at the northeast corner of TMT and 2 OU at the furthest southwest corner of TMT. I can only presume that the same release height of 40 metres above grade was employed which would lead to unrealistic predictions. That is not certain however. It would appear that the authors correctly employed a conversion factor to convert microOU to OU in AERMOD since the predictions were in similar ranges to the Screen3 run with the higher emission rate. The high predictions would need to be compared to complaint records for frequency and location, previous Technical Support odour survey results, and a just completed TAGA survey report, but they do seem to be over-predicted in AERMOD.

I would agree that the 5 year Ministry data set (Ottawa Surface, Maniwaki Upper Air) was better to use in AERMOD than the one year Kingston Airport data set used previously. It is noted in the wind rose pictorials supplied that Kingston Airport wind data are only measured from 6:00am to 11:00pm. This makes the comparisons to the Ottawa wind roses somewhat suspect and at least

partly explains why average wind speeds for Kingston were higher (4.5 m/s vs 3.33 m/s). The missing nighttime hours would generally include very light wind speeds and would likely reduce the Kingston annual wind speed average if they had been included. The frequency of north through to east northeast winds (making TMT downwind of landfill) is higher for the Kingston data than Ottawa (23 vs 18.5% approximately). The difference between the two met data sets was a slight veering in directions and possibly slightly higher wind speeds for Kingston. In the study presented, no frequency of occurrence information was computed, only maxima, so these differences in the met data would not have played a large factor in influencing the predictions. I can only assume that the missing nighttime hours were backfilled with other nearby data in the original assessment as per normal practice when data sets are incomplete. I am advised that the Kingston airport historically measured around the clock until the mid 1990s.

In summary, the modeling information supplied for this review appeared flawed and likely over predicted effects of the landfill and may have been improperly assessed by focusing only on the waste handling operations at the working face. Source testing engineers should review the emission estimations and other source characterizations.

The purpose of the preceding review is to provide advice to the Ministry of the Environment regarding air quality based on a review of the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Frank Dobroff

cc. P.Stewart