Summary Letter

The information supplied in this Report is complete and the choice of model, methodology and interpretation of experiments are scientifically sound. I believe that the Report shows that CALPUFF (and TAPM) are suitable for modelling odour emissions from the Kwinana refinery, and also that odours from the new liquor burner are likely to result in quite low concentrations offsite from the refinery.

It is my opinion that the data analysis and dispersion modelling have been done correctly, with a suitable model CALPUFF, and that the resulting concentrations in the vicinity of the receptors are suitable for input to the health risk assessment.

The actual magnitude of the concentrations from the refinery itself must be considered uncertain, due to the uncertainties in the emissions and observations used to 'validate' CALPUFF and TAPM. As far as these uncertainties are concerned, it is extremely unlikely that the resulting model concentrations are underpredicted by any more than a factor of three. Even an upper limit of three is considered conservative, given some of the assumptions (also conservative) made in the modelling. My opinion is that uncertainties in the odour emissions are not a concern if the acute and chronic Hazard Index values are well below 1.

On the basis of the information provided, I endorse the findings of this Report.

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Review of 'Kwinana Liquor Burner – Air Dispersion Modelling' by SKM Pty. Ltd.

prepared for

Alcoa World Alumina Australia

by

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REPORT

Report C/0989 **June 2004**

Review

The aim of the SKM study is to predict ground-level odour concentrations from the previous and the new liquor burner stack at the Kwinana refinery. Predicted concentrations will be used to provide exposure data for a health screening risk evaluation of areas neighbouring the Kwinana refinery.

This review discusses each modelling section of the Report and then summarises under the four categories outlined in Alcoa's Statement of Work.

In *section 4.1*, CALPUFF is run for the previous and the new configurations of the liquor burner stack, using the same constant emission rate for each. It is ostensibly for NO_x, but it could be for anything as there is no comparison with observed concentrations – I realise that this is not possible as there are many other NO_x sources in the Kwinana complex. The conclusion drawn from this work is that, for the same emission rate, ground-level concentrations will be slightly lower with the new stack parameters than with the previous.

In *section 4.2* AUSPLUME is also run, with the results compared to those from CALPUFF in section 4.1. The magnitude and sign of the difference in predicted concentrations from the two models vary with distance and direction from the source. Little is learned from this section of the Report and it was probably not necessary. The Report states that this is done "as a check on the CALPUFF model predictions….", implying that AUSPLUME is the truth against which other models should be compared. I'm sure that SKM would view this with a wry smile as AUSPLUME is a simpler model which shouldn't be used in coastal situations like Kwinana. In a more-valid "check" on CALPUFF, SKM (2004) reports a comparison of odour predictions for a number of days between CALPUFF and TAPM. It was shown that there was little difference between the models. TAPM is a more complex model than CALPUFF and has been run with the SO_2 emissions inventory for all Kwinana industries and validated against monitoring data at the six monitoring sites, producing good agreement at all sites. It has also performed very well against other models in international comparisons, with the results published in the international peer-reviewed literature. TAPM was rated in the top 2 models for all three data sets. Good validation outcomes have also been obtained on Pilbara and Collie data sets.

In *section 4.3*, CALPUFF is run for three additional input and dispersion options. It is concluded that the original model configuration (used in section 4.1) is the most conservative, i.e. gives the highest 1-hour NO_x concentrations at distances greater than 1 km from the refinery, and for this reason it is used for the odour modelling.

Section 4.4 is good. Predicted NO_x concentrations from CALPUFF and TAPM are compared over a 45-day period, with the conclusion that beyond 500 – 1000 m from the stack there is very little difference between concentrations from the two models, either for hourly concentrations or for the averages over the 45-day period. This is an important finding for CALPUFF as the 13 sensitive receptors, apart from no. 1, are further than 1000 m from the stack, and TAPM is a validated model for Kwinana. On p20 and Figure 23, there is a good assessment as to why CALPUFF (and AUSPLUME) predict higher than TAPM within 500 m of the stack. SKM conclude

that TAPM treats the interaction between plumes and building wakes in a more realistic manner for light wind conditions.

In *section 5.1*, given previous and new odour emission rates, CALPUFF is used to predict 3-minute odour concentrations from the new and previous configurations of the liquor burner operating with and without the rest of the refinery. Results indicate the previous liquor burner is likely to have made a significant contribution to the overall odour concentrations offsite, whereas the new liquor burner is likely to have a very small impact in the same area.

In *section 5.2*, AUSPLUME is run for odour and compared to CALPUFF and to previous AUSPLUME results (Alcoa, 2001). The model is run with and without building wake effects and for slightly different meteorological input files. The considerable differences between the results from each of these runs, and from the CALPUFF results, are a worry and suggest that AUSPLUME should not be persisted with for Kwinana work, especially when models like TAPM and CALPUFF are available.

Comments re four categories in Statement of Work.

Completeness of the information presented
All information needed to assess the modelling methodology and results is included in the Report and in SKM (2004). The latter report was also provided by Alcoa.

Suitability of the measurements performed for assessing the project impacts
The model used to predict ground-level concentrations of odour in this project is CALPUFF. On p.1 of the Report, it is referred to as "the model CALPUFF which has been validated for the refinery (SKM, 2004) along with…". While CALPUFF, and TAPM, were judged in SKM (2004) to have performed reasonably well against the odour measurements, I believe that there was so much uncertainty in both the odour emissions and the observations of odour concentration that it is incorrect to say that either model has been validated for odour modelling from the Kwinana refinery. The uncertainties in the odour data and the implications for model evaluation have been recognised and discussed in SKM (2004) on p36 and 39, with a recommendation on p56 for another round of odour sampling and data collection to be undertaken. I support this recommendation.

Correctness of the analysis performed on the data with respect to health impact assessments
It is my opinion that the data analysis and dispersion modelling have been done correctly, with a suitable model CALPUFF, and that the resulting concentrations in the vicinity of the receptors are suitable for input to the health risk assessment.

Suitability of modelling methodology used to make predictions relating to the health impact assessment
My assessment is that the models have been configured (Section 2 and SKM (2004)) and run properly, the various experiments designed well and the interpretation of the results carried out correctly and in a logical manner. While TAPM may be the best model to use for close-in modelling (within 1 km), the Report showed that CALPUFF

is quite suitable for modelling in the sensitive receptor areas, where the health impact assessments need to be carried out.

In summary, I believe that this Report has shown that CALPUFF (and TAPM) are suitable for modelling odour emissions from the Kwinana refinery, and also that odours from the new liquor burner are likely to result in quite low concentrations offsite from the refinery. The actual magnitude of the concentrations from the refinery itself must be considered uncertain, due to the uncertainties in the emissions and observations used to 'validate' CALPUFF and TAPM. As far as these uncertainties are concerned, it is extremely unlikely that the resulting model concentrations are underpredicted by any more than a factor of three. Even an upper limit of three is considered conservative, given some of the assumptions (also conservative) made in the modelling. My opinion is that uncertainties in the odour emissions are not a concern if the acute and chronic Hazard Index values are well below 1.