

**Pinjarra Refinery Efficiency Upgrade
Review of Draft Health Risk and Toxicological
Assessment Report**

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Scope

As part of a proposed efficiency upgrade of the refinery at Pinjarra, Alcoa is to install new atmospheric emission controls. Toxicos Pty Ltd has performed a toxicological and human risk assessment of the potential emissions from the upgraded refinery, and it is the draft report of this assessment that I have been asked to review. As an environmental health physician, my review will focus on those aspects of the report relevant to the protection of the public health. I understand that other reviewers will comment on the engineering and atmospheric modeling aspects of the assessment.

My review is based on the information presented in the report and is in four sections:

1. Completeness
2. Appropriateness of Measures
3. Appropriateness of Analysis
4. Validity of Conclusions

1. Completeness

The report provides a comprehensive toxicological assessment of emissions from the refinery operating in both pre-upgrade and post-upgrade modes. Emission components have been covered exhaustively, and are clearly tabulated in the appendices. Guideline values and references have been sought and reported in detail. The overall impression is one of scientific rigour and completeness.

The report does not constitute a Health Risk Assessment in the traditional sense, in so far as the exposure assessment does not include an analysis of the number and type of people at risk or routes of exposure, and the risk characterisation does not estimate morbidities and mortalities. Rather, the report can be seen as a screening exercise to determine if a formal health risk assessment is required for any of the emission components. There is in fact no indication of a health risk posed by any emission component, but the approach could have been made more explicit so as not to overstate the scope of the report.

2. Appropriateness of Measures

The measures used include daily peak, annual average, highest one hour concentration and 95th percentile 1 hour modeled concentrations. These measures are standard in air quality work, and have been used intelligently and conservatively: At all times possible exposures have been overestimated, for example by assuming that the daily peak activity occurred throughout the day. This conservative approach to using the measures adds great rigour to the analysis and conclusions based upon them.

Four locations were chosen (1, 3, 4 and 7) for detailed analysis based both on maximum possible exposures and on representativeness of likely population exposures. These sites have been selected to provide maximum conservatism in the results, again adding rigour to extrapolations of exposure at other sites.

There are minor slips in attention to detail (eg. upgrade productivity increase variously quoted as 17% and 18%, inconsistent spellings of Pinjarra) that do not detract from the validity of what has been undertaken.

3. Appropriateness of Analysis

The emission measures have been used to compare predicted concentrations with air quality guideline values, where such are available. Hazard Quotients and Hazard Indices are calculated for the 4 sites, and total cancer risk assessed. All results are professionally tabulated, and analyses clearly explained so as to be replicatable.

The issue of concentrations of non toxicological concern has been dealt with sensibly, but a consideration of non-respiratory routes of exposure might have strengthened this analysis. For example, airborne chemicals of no toxicological concern may still accumulate on surfaces or in water bodies. It is also not clear from the report to what extent teratogenicity has been considered, although this does not appear to be a concern on the basis of the results that are presented.

There is a flaw in section 4.2 where the use of health guidelines based on irritancy is justified by suggesting that more serious effects of emissions would require exposure to higher doses. The example of lead would readily counter this argument, where children's IQ levels are affected by lead concentrations much lower than those required to cause irritancy. The report would therefore be strengthened by considering the derivation of guideline values on an individual component basis, thus avoiding this overgeneralisation.

4. Validity of Conclusions

With the exception of Site 1, the results are uniformly negative and strongly suggestive of no acute or chronic health risk from exposure to emissions from the Pinjarra Refinery. Let us therefore focus on Site 1. It is inappropriate here to attribute the calculation of a significant hazard index or cancer risk to inaccuracies in the model, because the model has been accepted as appropriate *a priori* before undertaking the analysis. It is more informative to examine the percentage

contributions to the apparent risk, for example as presented in Table 7.1.2. Some 25% of the hazard index is accounted for by the NO_x hazard quotient, which is largely based on respiratory health outcomes. Some 50% of the hazard index is accounted for by the As and Hg HQ's, which are based on reproductive and developmental health outcomes. Under these circumstances the HI can justifiably be regarded as overestimating the combined health risk from entirely different biological pathways. The HI has nevertheless served its purpose as a screening tool to draw attention to a scenario in need of further examination, rather than indicating a definitive risk to the public health. A similar approach maybe informative in examining the combined cancer risk.

The report concludes that there is "little likelihood of health effects being caused by either acute or chronic exposure of the general public to refinery emissions from the Alcoa Pinjarra refinery". Given that the proposed upgrade is set to lower emissions further, an even wider safety margin can be anticipated for future emission at Pinjarra. The conclusion is further strengthened by considering the extreme conservatism built into the analysis and the very marginal exceedances of levels of human health risk with the possible reasons for same discussed above. It would nevertheless be prudent to maintain a rigorous hazard surveillance system, particularly for NO_x, As and Hg. Assuming that such precautionary surveillance takes place, and assuming that the upgrade performs to expectation, I strongly support the report's conclusion that emissions from the Pinjarra Refinery pose no threat to public health.