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**EXPERT PEER REVIEW** of the  
*Pinjarra Alumina Refinery Revised Proposal: Health Risk Screening Assessment*  
(Ramboll, August 2021)

## SCOPE

This report provides independent expert peer-review of the *Pinjarra Alumina Refinery Revised Proposal: Health Risk Screening Assessment (Ramboll, August 2021)*, so as to update the 2014 HRA to account for any potential change in health risk associated with a planned expansion in alumina production from 5.0 to 5.25 Mtpa.

The intent of the review is to provide information to the regulator to assist it in assessing the application to expand production, by checking the HRA against the relevant policies and guidelines of both Australian and international organisations. The review is in the form of a desktop review, reporting on the appropriateness and completeness of the assessment itself as well as the conclusions and recommendations based upon it.

For simplicity, the *Pinjarra Alumina Refinery Revised Proposal: Health Risk Screening Assessment (Ramboll, August 2021)*, will be referred to herein as the “HRA”, and any reference to the earlier health risk screening assessment will be referred to as “HRA 2014”.

## LIMITATIONS

In providing a high-order desktop review, the air quality modelling *per se* that informs the HRA is not reviewed, and is assumed to have been correct as provided to Ramboll to undertake the HRA. The reviewer has not checked the original data sources and calculations, taking these as accurate for the purpose of assessing the public health risk posed by the proposed increase in production at the refinery.

## ASSESSMENT

This review examines the HRA of the potential health risks that could be posed by the additional emissions that would result from increasing production at the Pinjarra Alumina Refinery from 5.0 Mtpa to 5.25 Mtpa. That HRA builds on a similar HRA undertaken in 2014, but now incorporates:

- new types and levels of emissions resulting from alterations in on-the-ground operations (sources);
- new meteorological data based on more recent records, to inform an update of the dispersion modelling, and
- new health protective guidelines as updated by Australian and international organisations resulting from advances in epidemiological and toxicological research

This additional information has been used in updating the health risk assessment as it now applies to the proposed increase in production.

The HRA covers three main areas of potential inhalational exposure: acute noncarcinogenic, chronic noncarcinogenic, and carcinogenic substances. Inclusion criteria for compounds examined are appropriate and include those compounds that remain relevant from the HRA 2014. Changes consist of deletions (eg. dioxins, furans) as a result of those compounds no longer being present due to alterations in on-ground operations (refinery point sources, fugitive sources, and stockpiles); and additions (hydrogen sulphide from a new source now producing this pollutant, and PM<sub>10</sub> for which new guidelines are available). Modelling of ground level inhalational exposures informed the risk assessment as the only likely route of exposure of concern, for the scenario of increased alumina production of 5.25 Mtpa. Updated emissions estimates were used, based on receptor locations closest to potential human habitation and therefore maximum exposure. New meteorological data (2018/19) were also included in the modelling. These changes improve accuracy and currency over the HRA 2014 modelling, and are appropriate and conservative.

The same approach was used as in the HRA 2014 to identify any potential increase in health risk for an exposed population. Modelled pollutant concentrations at ground level were compared to the health protective guidelines for ambient air provided by both Australian and international organisations (NEPC, OEHHA, ATSDR, and IRIS). These guidelines have been updated for some compounds since 2014 as a result of improved epidemiological and toxicological evidence. Current guideline values are generally lower than those previously recommended, and these lower guideline values have been used in the HRA, providing both currency and conservatism. Inhalation represents the most significant exposure route, and because the health risk assessment produces no cause for concern by that pathway, the risk of other exposure pathways or combination of exposure pathways producing an exposure of concern can be considered negligible. The very conservative (health protective) approach used in assessing potential inhalational exposure means that even if alternative pathways were contributing to the total exposure, it is extremely unlikely that they would alter the conclusions of the HRA.

The methodological approach consists of summing risk quotients to provide hazard indices for noncarcinogenic exposures, and using NOAEL to assess probabilities of additional cancer cases per million people for carcinogens. These approaches are best practice, and inherently conservative (protective of health) in nature. Different scenarios (0, 1A, 1B, 2, and 3) are presented to help interpret exposures. Scenario 2 demonstrates that the HRA 2014 was also conservative, in that based on updated meteorological data and health guidelines, the exposure estimates it produced are likely to have been greater than were the actual exposures that could have been experienced on the ground. It would have been interesting for this reason to examine a scenario consisting of (1B + increased throughput of 5.2 5MTP), to compare to Scenario 3 and ascertain if the increased output would have produced any exposures of concern using the

older meteorological data and health guidelines. The results of such an examination would however be unlikely to influence the conclusions of the HRA. Conservatism is inherent in the methodology, and reinforced by use of the lowest available guideline values; it is therefore reasonable to assume that the actual risk to exposed populations would in fact be likely to be even lower than that presented in the health risk assessment.

**Acute noncarcinogenic exposures** (1h or 24h GLC inhalational exposures) of potential concern were mainly to NO<sub>2</sub>, PM<sub>10</sub>, Ni and Hg. However, the HI was <1 using the most conservative national and international guidelines, so acute exposures posed no cause for concern from a health perspective. This holds true for all scenarios (see Acute HI maximum column, Table 5-1).

**Chronic noncarcinogenic exposures** (annual average GLC inhalational exposures) of potential concern were mainly to NO<sub>2</sub>, PM<sub>10</sub> and Hg, and to lesser extent Cd and VOC. However, the HI was <1 using the most conservative national and international guidelines, so chronic exposures posed no cause for concern from a health perspective. This holds true for all scenarios (see Chronic HI 'Highest' column, Table 5-3).

**Carcinogenic exposures** of potential concern were mainly to VOCs, As and Cr. However, all ICRs were in the order of 1 additional case per million people with a lifetime of exposure, so posed no cause for concern from a health perspective. No ICR breached the EnHealth suggestion that "in the case of an assessment for multiple chemical exposures, a combined risk of one in 100,000 may be considered acceptable by Australian environmental regulatory authorities" (p.19), with all ICRs being closer to the more conservative USEPA criterion of one in 1 million.

Compared to the HRA 2014, there is some variation in the sites of predicted minimum and maximum exposure, due to changes in on-the-ground operations (location of residue storage areas, new bioreactor, condensate tanks) as well as because of the proposed increase in production. However, all exposures still remain below guideline values, so these variations have not led to any change in the conclusions of the HRA 2014. The assumptions made and way that uncertainty has been dealt with in the HRA are appropriate, the best available data have been used to inform to HRA, and the methodology is consistent with best practice and the adoption of the most conservative (health protective) options. This review therefore supports the HRA's conclusion that exposure to emissions from the refinery at the increased level of production would present no cause for health concerns.

## DISCLAIMER

This review is based on the assumption that the information provided to the reviewer in the HRA is accurate and complete.

The following minor points were noted in the review process, and could be kept in mind for the purposes of further work. They do not detract from or alter the review statements made above.

- The Summary (p. 37) states that "The approach used to conduct the health risk screening assessment is broadly consistent with the approach used for the previous screening assessment (ENVIRON, 2014), *although the method used for the acute exposure assessment has been modified to reduce overly conservative estimates of potential acute non-carcinogenic health risk*" [Reviewer's italics]. It is unclear to the reviewer what specific modifications are being referred to here.
- Selenium appears in Table 5-4, but is not listed with (or without) a guideline value in Table 4-3.

- In Section 5.5, note that “mild, transient adverse health effects” in the form of anxiety can result from malodorous substances, even if the concentrations of these are below the threshold for irritancy.

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