In the Environment Court of New Zealand
Auckland Registry

I Mua I Te Kōti Taiao O Aotearoa
Ki Tāmaki Makaurau

ENV-2023-AKL-160

Under	the Resource Management Act 1991
In the matter of	An application for a direct referral to the Environment Court under section 87G of the Act for an order granting the applicant's resource consent applications to construct and operate a new asphalt plant at 54 Aerodrome Road, Mt Maunganui, together with an application for consent to authorise the continued operation of the existing asphalt plant on the site pending construction of the new plant
Between	**Allied Asphalt Limited**
	Applicant
And	**Bay of Plenty Regional Council and Tauranga City Council**
	Consent Authorities

Statement of Evidence of Dr Lynette Denison

29 February 2024

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Qualifications and experience

1 My full name is Lynette Susan Denison.

2 I hold a Ph.D. and Bachelor of Science (Honours) in Chemistry from the University of Melbourne. I have over 30 years' experience in the environment area including 17 years at EPA Victoria as Principal Scientist. My area of expertise is the assessment of risk to human health and the environment from air pollution, contaminated land, noise and industrial chemicals.

3 I am currently employed as Technical Director Health Risk Assessment at Tonkin & Taylor Pty Ltd and have held that position since February 2022.

4 Prior to joining Tonkin and Taylor I was employed by Environmental Resources Management (ERM) as a Technical Director. In this role I conducted a large number of human health risk assessments and was involved in Regulatory Approvals for a variety of projects. I was the lead for the ERM Product Stewardship area for Australia and New Zealand which involved the registration of industrial chemicals in these countries. This involves the preparation of dossiers to support the registration applications and include risk assessments on the impact of industrial chemicals on occupational and public health as well as impacts on the environment.

5 Prior to joining ERM I was a Principal Consultant for Pacific Environment and DLA Environmental Services. These companies were acquired by ERM in July 2017. As part of this role, I was the National Practice Lead for Risk Assessment and Toxicology.

6 Prior to my role at Pacific Environment and DLA I was employed by the Environment Protection Authority Victoria (EPA) as a Principal Scientist. I was employed by the EPA for 17 years. During my time at EPA, I was involved in the development of several State and National policies for air quality including the review of the State Environment Protection Policy (Air Quality Management) in 2001. I represented Victoria in a number of national working groups through the National Environment Protection Council (NEPC) including the development of the National Environment Protection Measure [NEPM] (Ambient Air Quality), the variation to the NEPM to include standards for PM2.5 and the review of that NEPM, the development of the NEPM for Air Toxics, the Risk Assessment Taskforce and Risk Assessment Working Group (which I Chaired) and several other projects relating to air pollution and health. I also chaired the NEPC working group to develop a methodology to prioritise air toxics in Australia and was a member of the Environment Protection and Heritage Council

(EPHC) working group developing a methodology for the setting of air quality standards in Australia. I also conducted a number of health and environmental risk assessments for a range of issues.

7 I have also been involved in a number of international projects on environmental issues primarily relating to risk assessment, air quality and health and the development of air quality policy and standards in these countries. I presented a course on Environmental Health Risk Assessment on behalf of the World Health Organisation (**WHO**) to the Ministry of Health in Mozambique. I was also involved in a study that investigated the associations between environmental factors in Mozambique and their impact on health. This work identified key issues to be addressed as part of a National Environmental Health Strategy and prioritised areas for action. I have been involved in a number of epidemiological studies investigating the impact of air pollution on health in both Victoria and nationally. I was also involved in the preparation of soil contamination guidelines for the Environment Agency in Abu Dhabi.

8 I was a Sessional Member of Planning Panels Victoria from 2012 to June 2023 and was a member of the Ministerial Advisory Committee for the Long Term Hazelwood Health Study which is being undertaken in response to the 2014 coal mine fire at the Hazelwood Power Station in Morwell and the potential impacts on the local community from exposure to smoke from that fire.

9 My CV can be found in Attachment 1.

10 My role in relation to Allied Asphalt Limited's (**Allied**) application for resource consents for a new asphalt plant and the continued operation of an existing plant pending construction of the new plant at 54 Aerodrome Road, Mt Maunganui (**Application**) has been to provide advice in relation to the risk to human health from air emissions.

11 My assessment is based upon the project description provided in the planning evidence of Mr Craig Batchelar.

12 In preparing this statement of evidence I have considered the following documents:

(a) The s87F report of BPORC and included submissions relevant to my area of expertise;

(b) the statement of evidence on air quality prepared by Ms Jennifer Simpson;

(c) The ESR (2023) Air Pollution Health Risk Assessment for Mount Maunganui and Air Quality Report: 4 year review.

Code of Conduct for Expert Witnesses

13 I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

14 I have prepared evidence in relation to:

(a) the existing environment of the Application Site as it is relevant to my area of expertise;

(b) the key findings of my assessment of effects;

(c) matters raised by submitters on the Application.

Executive Summary

15 I have undertaken a health risk assessment (HRA) for the existing and proposed Allied Asphalt Plants being considered in this Consent Application.

16 The HRA has assessed the incremental risk associated with emissions to air including PM_{10}, $PM_{2.5}$, NO_2, SO_2, volatile organic substances (including benzene), polyaromatic hydrocarbons (PAHs) and trace metals.

17 For PM_{10}, $PM_{2.5}$ and NO_2 both long and short term mortality as well as hospital admissions for children with asthma have been assessed. For SO_2, based on the assessment conducted by WHO (2021), only short term effects have been identified and therefore short term mortality and hospital admissions for asthma in children have been assessed.

18 For PM_{10}, $PM_{2.5}$, NO_2 and SO_2, all predicted incremental risks are below acceptable risk criteria established by international agencies. In many cases the predicted risks are below negligible risk criteria.

19 For Volatile Organic Compounds (VOCs), benzo[a]pyrene (BaP) and metals, both non-carcinogenic and carcinogenic risks have been

assessed. All predicted risks are below acceptable risk levels and many below negligible risk levels.

20 The results of the HRA show that the existing Plant, operating on Used Lubricating Oil (ULO), is not posing an unacceptable risk to the health of the surrounding community including Whareroa Marae, residential areas, primary schools, Mount Maunganui College and childcare centres.

21 The assessment of the proposed Allied Asphalt Plant also shows that the Plant as designed can operate without posing an unacceptable risk to the surrounding community.

The existing air environment

22 Since 2019, BOPRC has undertaken air quality monitoring, predominantly for PM_{10} and SO_2, at a number of sites in the Mount Maunganui area. The monitoring is largely focussed on measuring air quality in locations influenced by industrial emissions.

23 The Mt Maunganui airshed is a polluted airshed for PM_{10} under the National Environmental Standards for Air Quality NESAQ. This means that air quality exceeds the Ambient Air Quality Standard (AAQS) for PM_{10} of 50 $\mu g/m^3$ (24-hour average) on more than one occasion in a 12-month period. The airshed will remain polluted for PM_{10} until there has been a 5-year period with no more than one exceedance.

24 The most recent report by BOPRC summarising the available data and trends covers the period up to the end of 2022.[1] The data shows that air concentrations of PM_{10} at the different monitoring sites are variable, reflecting the influence of localised sources at some locations.

25 The closest BOPRC monitor (for PM_{10}) to the Allied site is located at De Havilland Way. The De Havilland Way (also sometimes referred to as Aerodrome Road) monitoring site is approximately 500 m southeast of the Site.

26 The De Havilland Way monitoring data reflects existing levels of PM_{10} air pollution and will therefore include any effects of the existing Allied asphalt plant. Therefore, the measurements do not reflect "background" air quality, which is air quality in the absence of effects from the Site. Measurements at De Havilland Way also do not reflect background air quality at locations further from the influence of localised industrial sources.

[1] Bay of Plenty Regional Council. (2023). Ambient air quality update 2023

27 Although PM_{10}, $PM_{2.5}$ and SO_2 are monitored at a number of locations in the industrial area as well as the Whareroa Marae and De Havilland Way, I am unaware of monitoring being undertaken for NO_2, VOCs or metals in the Mount Maunganui area.

28 I have read the Air Pollution Health Risk Assessment for Mount Maunganui (ESR Report) which was prepared for Toi Te Ora Public Health and released in July 2023. The ESR Report adopted the methodology used in the HAPINZ 3.0 study to estimate the health effects of air pollution in Mount Maunganui.

29 The ESR Report has used data monitored at the Rata St monitoring site, located within the industrial area, for PM_{10} and $PM_{2.5}$ to estimate the number of deaths due to air pollution in the local community. The data used is a measure of particulate matter (PM) in the Mount Maunganui area including emissions from traffic, industrial emissions (in total), operations of the Port of Tauranga as well as marine aerosol, windblown dust and during cooler months smoke from domestic heating.

30 For NO_2 I understand that there is no monitoring data available and modelling data was used to estimate pollution levels in the potentially affected community. It should be noted that the ESR estimates are intended to include all current industrial emissions including the existing Allied Plant.

31 The approach used in the ESR Report was to compare the estimated deaths attributable to air pollution in the potentially affected community with a control population, Otūmoetai. The ESR Report concluded that there were about 5 additional deaths per year in Mount Maunganui compared with Otūmoetai attributable to $PM_{2.5}$ and NO_2. For PM_{10} the ESR report estimated that there were 13 additional deaths in Mount Maunganui attributable to air pollution compared to Otūmoetai.

32 It should be noted that the air pollution data used in the ESR Report was from 2019. Analysis of monitoring data since that time has shown that the PM_{10} levels are decreasing due to actions being taken to improve air quality (ESR Air Quality Report, 2023).

Assessment of effects

33 As part of the Application, I have undertaken a human health risk assessment (HRA) to assess the potential impacts on the health of the surrounding community from the air discharges at the site. I have assessed the existing operation using ULO as well as the proposed plant operating on natural gas or diesel.

34 The HRA has considered the health effects of the criteria pollutants PM_{10}, $PM_{2.5}$, nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) as well as metals and VOCs.

35 The HRA has used the data generated in the air quality assessment (Tonkin & Taylor, 2024a) prepared as part of this Application. The air quality assessment is discussed in the evidence of Ms Jennifer Simpson.

36 I have conducted a quantitative risk assessment to assess the potential risk to the residents of Omanu Beach as well as the Whareroa Marae from emissions from the existing Allied Asphalt Plant as well as the proposed Allied Asphalt Plant. The detailed risk assessment is presented in the Health Risk Assessment Existing and Proposed Asphalt Plants, Mount Maunganui (Tonkin & Taylor, 2024b).

37 The HRA has assessed the incremental risks from the existing and proposed Plants. I consider this to be the most appropriate way to assess the potential risk from the emissions from the facilities being considered in this Consent Application as it is consistent with international guidance. It does not mean that there is no risk associated with existing exposure from all sources to some of the pollutants assessed in the HRA, for example PM_{10} and $PM_{2.5}$, but assesses the change to the baseline risk from the proposal in the Consent Application. The baseline risk is due to cumulative sources of air pollution in the airshed including natural sources as well as emissions from traffic and industry.

38 The baseline risk to the population from other sources in the Mount Maunganui airshed includes any contribution from the existing Allied Asphalt Plant. The incremental risk approach used in the HRA is specific to emissions from Allied and is not dependent on changes in air quality due to other sources.

39 The approach used in the HRA to assess incremental risk for approvals for industrial facilities, contaminated land etc is consistent with international guidance including for assessing incremental lifetime cancer risks.

40 The HRA has considered the operation of the existing Plant using ULO and the proposed Plant operating on natural gas or diesel or biodiesel.

41 For PM_{10}, $PM_{2.5,}$ NO_2 and SO_2 it has been assumed that there is no threshold for effect consistent with the assessment of the World Health Organization (**WHO**) in the development of the Global Air Quality Guidelines (2021).

42 In undertaking the HRA, I have reviewed the systematic reviews conducted for the WHO Global Air Quality Guidelines (2021)[2]. These reviews looked at hundreds of epidemiological studies conducted worldwide that met certain criteria that are used internationally for these types of reviews. The reviews studies that had adequately controlled for confounding factors and identified health outcomes for which the evidence of an adverse effect was strong. They then conducted a meta-analysis that combined the individual studies and developed an overall Concentration Response Function (**CRF**) for each health outcome identified.

43 For the HRA for the Allied Asphalt Plants I have used the Concentration Response Functions (**CRFs**) that were determined by the WHO systematic reviews for the health outcomes assessed[3]. These health outcomes include both long-term (annual) and short term (daily) mortality as well as hospital admissions and emergency department attendances for children with asthma. The CRFs used are shown in Table 4.3 (PM_{10} and $PM_{2.5}$), Table 4.8 (NO_2) and Table 4.12 (SO_2) of the HRA.

44 As I will discuss later (paragraph 65), I have undertaken health risk calculations using CRFs developed from New Zealand data to evaluate the sensitivity of the HRA to the CRFs adopted.

45 The CRFs are also discussed later in my evidence (Paragraphs 92 and 93) in relation to uncertainty analysis.

Baseline Health and Population Data

46 Baseline health data was available from the Bay of Plenty Public Health District database. This data[4] was supplied to the Environmental Health Indicators programme, Centre for Public Health Research, Massey University by Statistics New Zealand and the Ministry of Health.

47 Baseline health data was not available for all health outcomes identified in the systematic reviews. This limited the range of health outcomes that could be assessed. The health outcomes that were assessed are long-term all-cause (non-accidental), cardiovascular and lung cancer mortality,

[2] Chen and Hoek, 2020; Huangfu and Atkinson, 2020; Orellano et al., 2020

[3] Concentration Response Functions describe the increased risk of a particular health outcome associated with an incremental increase in exposure to a pollutant

[4] Data available at EHINZ.

short term all-cause (non-accidental) and cardiovascular mortality, and hospital admissions for children (1-14 years) for asthma.

48 Baseline health data was available for the total population as well as the Māori population. The data for the Māori population was used in the HRA for the Whareroa Marae. For the population of Omanu Beach the health data for the total population for the Bay of Plenty was used. The data for the total population includes the Māori population who live in that area.

49 In general, the baseline health data was higher for the Māori population than the total population. This means that the number of cases per 100,000 population is higher in the Māori population. This was consistent across the whole of New Zealand and was not specific to the Bay of Plenty Health District. This is shown in Table 3.2 of the HRA.

50 The population data was obtained from NZ Stats. The most recent published census data (NZ Stats, 2018) for the study area is summarized in Table 3.1 of the HRA. The data is also included for New Zealand for comparison with the country wide averages.

51 The data shown in Table 3.1 of the HRA shows that the age of the Māori population is younger than the total population with a lower percentage of people in the 65+ years age group. There is a higher percentage of children aged 0-14 years in the Māori population. Both children and older adults (> 65 years of age) are groups within the population that are vulnerable to the effects of air pollution.

HRA Results for PM_{10}, $PM_{2.5}$, NO_2 and SO_2

The CRFs and baseline health data were combined with the modelled air pollution data to assess the incremental risk at sensitive receptors in Omanu Beach (including schools and childcare centres), De Havilland Way and the Whareroa Marae. Both annual averages and 24 hour average pollutant concentrations were used in the health risk assessment. The outcomes of the risk calculations for the most affected sensitive receptors for PM_{10} are shown in Table 1 below.

Table 1: Predicted increase in risk due to PM_{10} from the existing and proposed Allied Asphalt Plants

Receptor	Health Outcome	Increase in risk due to PM_{10}	
		Existing Plant	Proposed Plant
Whareroa Marae	Long-term mortality 30 + years (all cause non-accidental)	$0.1x10^{-5}$	$0.03x10^{-5}$
	Daily all-cause mortality all ages	$0.01x10^{-5}$	$0.003x10^{-5}$

Receptor	Health Outcome	Increase in risk due to PM_{10}	
		Existing Plant	Proposed Plant
	Daily cardiovascular mortality all ages	$0.004x10^{-5}$	$0.001x10^{-5}$
Most affected residential receptor	Long-term mortality 30 + years (all cause non-accidental)	$0.7x10^{-5}$	$0.1x10^{-5}$
	Daily all-cause mortality all ages	$0.1x10^{-5}$	$0.02x10^{-5}$
	Daily cardiovascular mortality all ages	$0.04x10^{-5}$	$0.008x10^{-5}$
Most affected receptor- De Havilland Way	Long-term mortality 30 + years (all cause non-accidental)	$0.6x10^{-5}$	$0.1x10^{-5}$
	Daily all-cause mortality all ages	$0.08x10^{-5}$	$0.02x10^{-5}$
	Daily cardiovascular mortality all ages	$0.03x10^{-5}$	$0.007x10^{-5}$

52 There is general agreement by international agencies including the WHO and US Environmental Protection Agency (**USEPA**) that acceptable incremental risk levels fall between 1 in a million and 1 in 100,000. Risk levels below 1 in a million are considered negligible. These criteria are also used in New Zealand[5] in the assessment of risk from contaminated land (MfE, 2011) and in Australia (enHealth, 2012;[6] NEPC, 2013[7]).

53 These acceptable risk levels apply to incremental risks not total risk. For example, the baseline rate of cancer in New Zealand was 341 per 100,000 in 2020, which exceeds the acceptable risk levels. The addition of an incremental increase in risk of 1 in 100,000 cancer cases is considered by the international agencies as an acceptable increase compared to the baseline incidence.

54 The results for $PM_{2.5}$ are shown in Table 2 below.

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[5] Ministry for the Environment. 2011. Toxicological Intake Values for Priority Contaminants in Soil. Wellington: Ministry for the Environment

[6] enHealth (2012) *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards*. Department of Health and Ageing and enHealth Council, Commonwealth of Australia.

[7] National Environment Protection Council (NEPC) (2013), National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013, Canberra (abbreviated to ASC NEPM).

Table 2: Predicted increase in risk due to $PM_{2.5}$ from the existing and proposed Allied Asphalt Plants

Receptor	Health Outcome	Increase in risk due to $PM_{2.5}$	
		Existing Plant	Proposed Plant
Whareroa Marae	Long-term mortality 30 + years (all cause non-accidental)	$0.7x10^{-5}$	$0.03x10^{-5}$
	Long-term mortality 30 + years (cardiopulmonary disease)	$0.7x10^{-5}$	$0.02x10^{-5}$
	Long-term mortality 30 + years (ischaemic heart disease)	$0.1x10^{-5}$	$0.03x10^{-5}$
	Long-term mortality 30 + years (lung cancer)	$0.5x10^{-5}$	$0.01x10^{-5}$
	Daily all-cause mortality all ages	$0.08x10^{-5}$	$0.002x10^{-5}$
	Daily cardiovascular mortality all ages	$0.03x10^{-5}$	$0.0009x10^{-5}$
Most affected residential receptor	Long-term mortality 30 + years (all cause non-accidental)	$0.7x10^{-5}$	$0.2x10^{-5}$
	Long-term mortality 30 + years (cardiopulmonary disease)	$0.7x10^{-5}$	$0.1x10^{-5}$
	Long-term mortality 30 + years (ischaemic heart disease)	$1x10^{-5}$	$0.2x10^{-5}$
	Long-term mortality 30 + years (lung cancer)	$0.5x10^{-5}$	$0.1x10^{-5}$
	Daily all-cause mortality all ages	$0.08x10^{-5}$	$0.02x10^{-5}$
	Daily cardiovascular mortality all ages	$0.04x10^{-5}$	$0.006x10^{-5}$
	Long-term mortality 30 +	$0.8x10^{-5}$	$0.2x10^{-5}$

Receptor	Health Outcome	Increase in risk due to $PM_{2.5}$	
		Existing Plant	Proposed Plant
Most affected receptor - De Havilland Way	years (all cause non-accidental)		
	Long-term mortality 30 + years (cardiopulmonary disease)	$0.6x10^{-5}$	$0.1x10^{-5}$
	Long-term mortality 30 + years (ischaemic heart disease)	$0.8x10^{-5}$	$0.2x10^{-5}$
	Long-term mortality 30 + years (lung cancer)	$0.4x10^{-5}$	$0.1x10^{-5}$
	Daily all-cause mortality all ages	$0.07x10^{-5}$	$0.01x10^{-5}$
	Daily cardiovascular mortality all ages	$0.03x10^{-5}$	$0.006x10^{-5}$

55 All the incremental risks shown in Tables 1 and 2 are within acceptable risk levels – below 1 in 100,000 ($1x10^{-5}$). Many are below 1 in a million ($1x10^{-6}$) and would be considered negligible risk. This applies to both the existing and proposed Plants. The risk predicted for the Whareroa Marae is lower than for the closest residential receptors in Omanu Beach.

56 The results shown in Tables 1 and 2 show that the risks predicted for all health outcomes are lower for the proposed Plant than the existing Plant although all are within acceptable risk levels.

57 The results for NO_2 are shown in Table 3. These results show that the effects of emissions from existing and proposed Plants on NO_2 pollutant levels, whether operating on ULO for the existing plant and either natural gas or diesel/biodiesel for the proposed plant, are also within acceptable risk levels and would not pose an unacceptable risk to the health of the population of Omanu Beach and at the Whareroa Marae. This includes children and the elderly.

Table 3: Predicted increase in risk due to NO_2 from the existing and proposed Allied Asphalt Plants

Receptor	Health Outcome	Increased risk due to $N0_2$		
		Existing Plant	Proposed Plant	
		ULO	Diesel	Natural Gas
Whareroa Marae	Long-term mortality 30 + years (all cause non-accidental)	$0.02x10^{-5}$	$0.04x10^{-5}$	$0.02x10^{-5}$
	Long-term mortality 30 + years (COPD)	$0.008x10^{-5}$	$0.02x10^{-5}$	$0.01x10^{-5}$
	Daily all-cause mortality all ages	$0.06x10^{-5}$	$0.01x10^{-5}$	$0.008x10^{-5}$
	Hospital Admissions Asthma children <14 years	$0.02x10^{-5}$	$0.05x10^{-5}$	$0.03x10^{-5}$
Most affected residential receptor	Long-term mortality 30 + years (all cause non-accidental)	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.1x10^{-5}$
	Long-term mortality 30 + years (COPD)	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.1x10^{-5}$
	Daily all-cause mortality all ages	$0.6x10^{-5}$	$0.1x10^{-5}$	$0.06x10^{-5}$
	Hospital Admissions Asthma children <14 years	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.1x10^{-5}$
Most affected receptor - De Havilland Way	Long-term mortality 30 + years (all cause non-accidental)	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.1x10^{-5}$
	Long-term mortality 30 + years (COPD)	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.1x10^{-5}$
	Daily all-cause mortality all ages	$0.5x10^{-5}$	$0.08x10^{-5}$	$0.05x10^{-5}$
	Hospital Admissions Asthma children <14 years	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.1x10^{-5}$
Most Affected Childcare Centre	Hospital Admissions Asthma children <14 years	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.3x10^{-5}$
Mount Maunganui College	Hospital Admissions Asthma children <14 years	$0.1x10^{-5}$	$0.2x10^{-5}$	$0.02x10^{-5}$

58 The risk estimates for the childcare centres, primary schools, and Mt Maunganui College for hospital admissions for asthma are predicted to pose a negligible risk to the health of children attending these facilities. The risk estimates are conservative and likely to overestimate the risk as they include the assumption that the children would be at these facilities continuously over the entire day (24 hours), 365 days per year.

59 The predicted risks from NO_2 for the proposed Allied Asphalt Plant are similar or lower than those predicted for the existing Plant.

60 For SO_2 the results are shown in Table 4. The predicted incremental risks are all below acceptable risk levels and many are below negligible risk levels. This includes the predicted risks for the childcare centres, primary schools and Mount Maunganui College using the same conservative assumptions as those described in paragraph 58 for NO_2.

Table 4: Predicted increase in risk due to SO_2 from the existing and proposed Allied Asphalt Plants

Receptor	Health outcome	Increased risk due to SO_2		
		Existing Plant	**Proposed Plant**	
		ULO	**Diesel**	**Natural Gas**
Whareroa Marae	Daily all-cause mortality all ages	$0.01x10^{-5}$	$0.00005x10^{-5}$	$0.0002x10^{-5}$
	Hospital Admissions Asthma children <14 years	$0.01x10^{-5}$	$0.0002x10^{-5}$	$0.0009x10^{-5}$
Most affected residential receptor	Daily all-cause mortality all ages	$0.1x10^{-5}$	$0.0003x10^{-5}$	$0.2x10^{-5}$
	Hospital Admissions Asthma children <14 years	$0.3x10^{-5}$	$0.0005x10^{-5}$	$0.3x10^{-5}$
Most affected receptor – De Havilland Way	Daily all-cause mortality all ages	$0.1x10^{-5}$	$0.0003x10^{-5}$	$0.002x10^{-5}$
	Hospital Admissions Asthma children <14 years	$0.2x10^{-5}$	$0.0006x10^{-5}$	$0.003x10^{-5}$
Most Affected Childcare Centre	Hospital Admissions Asthma children <14 years	$0.3x10^{-5}$	$0.0009x10^{-5}$	$0.005x10^{-5}$
Mount Maunganui College	Hospital Admissions Asthma children <14 years	$0.2x10^{-5}$	$0.0006x10^{-5}$	$0.003x10^{-5}$

61 The results presented in Tables 1 to 4 and in the HRA show that the existing and proposed Allied Asphalt Plants would not pose an unacceptable risk to the health of the population of Omanu Beach or the Whareroa Marae. This includes children and the elderly.

Sensitivity Analysis

62 To provide an estimate of the upper and lower bounds of the predicted risk estimates, the 95% Confidence Intervals (95% CI) for the CRFs have been used. The 95% CI is the statistical probability that the risk to 95% of the population will fall within these limits. The 95% CIs are generated in the epidemiological modelling to derive the CRFs and are used internationally to provide the upper and lower estimates of risk. The 95%

CIs for the pollutants assessed in the HRA have been taken from the WHO meta-analyses undertaken to derive the 2021 Guidelines (WHO, 2021).

63 The CRFs used in the HRA for a 1 µg/m^3 increase in pollutant level together with the corresponding 95% CIs are shown in Appendix 1 of the HRA.

HAPINZ 3.0 CRF Sensitivity analysis

64 In July 2023 ESR released a report that was prepared for Toi Te Ora Public Health which presented a HRA for the Mount Maunganui airshed (ESR Report). The quantitative HRA focussed on the health effects of PM_{10}, $PM_{2.5}$ and NO_2 and used a similar approach to that used in the HAPINZ 3.0 study. The primary health endpoint was increases in annual mortality.

65 The ESR Report used CRFs that had been derived for the Health and Air Pollution in New Zealand (HAPINZ) 3.0 study[8] and are specific to New Zealand. The CRFs are higher than those determined through the global meta-analysis conducted by WHO in establishing their 2021 Air Quality Guidelines. To assess the impact of using alternative CRFs in the Allied Asphalt HRA a sensitivity analysis has been undertaken using the CRFs used in the ESR Report. The CRFs used in this sensitivity analysis are shown in Table 4.14 of the HRA.

66 To assess the impact of the use of the HAPINZ 3.0 CRFs on the risk estimates presented in the HRA using the WHO CRFs, increases in long-term mortality have been calculated for the Marae and residential receptors in Omanu Beach using the HAPINZ values. The incremental risk is shown in Table 5 below.

67 The results in Table 5 for NO_2 and $PM_{2.5}$ show that all incremental risks for all fuel types using the HAPINZ 3.0 CRFs, for both the existing and proposed plants, are below acceptable risk levels established by international agencies. Most would be considered to pose a negligible risk.

68 For PM_{10} for the existing plant, there are some minor exceedances of the acceptable risk levels. These levels would not be considered to pose an unacceptable risk but sit within a range where the risks need to be

[8] Documents describing the HAPINZ 3.0 study can be found at: https://www.ehinz.ac.nz/projects/hapinz3/

managed. This means that air emissions should be managed so that they are as low as reasonably possible so that risks are minimised.

Table 5: ***Predicted Increase in Risk of Long-term Mortality due to PM_{10}, $PM_{2.5}$ and NO_2 from the Existing and Proposed Allied Asphalt Plants using HAPINZ 3.0 CRFs***

Receptor	Health Outcome	Increase in risk due to PM_{10}, $PM_{2.5}$ and NO_2		
		Existing Plant	**Proposed Plant**	
PM_{10}				
Whareroa Marae	Long-term mortality 30 + years (all cause non-accidental)	$0.3x10^{-5}$ (95%CI: $0.2x10^{-5}$, $0.3x10^{-5}$)	$0.08x10^{-5}$ (95%CI: $0.06x10^{-5}$, $0.09x10^{-5}$)	
Most affected residential receptor	Long-term mortality 30 + years (all cause non-accidental)	$2x10^{-5}$ (95% CI: $1x10^{-5}$, $2x10^{-5}$)	$0.4x10^{-5}$ (95% CI: $0.3x10^{-5}$, $0.5x10^{-5}$)	
Most affected receptor - De Havilland Way	Long-term mortality 30 + years (all cause non-accidental)	$2x10^{-5}$ (95% CI: $1.4x10^{-5}$, $2x10^{-5}$)	$0.3x10^{-5}$ (95% CI: $0.3x10^{-5}$, $0.4x10^{-5}$)	
$PM_{2.5}$				
Whareroa Marae	Long-term mortality 30 + years (all cause non-accidental)	$0.1x10^{-5}$ (95%CI: $0.09x10^{-5}$, $0.2x10^{-5}$)	$0.03x10^{-5}$ (95%CI: $0.02x10^{-5}$, $0.05x10^{-5}$)	
Most affected residential receptor	Long-term mortality 30 + years (all cause non-accidental)	$0.9x10^{-5}$ (95% CI: $0.7x10^{-5}$, $1.4x10^{-5}$)	$0.2x10^{-5}$ (95% CI: $0.1x10^{-5}$, $0.3x10^{-5}$)	
Most affected receptor - De Havilland Way	Long-term mortality 30 + years (all cause non-accidental)	$0.8x10^{-5}$ (95% CI: $0.5x10^{-5}$, $1.2x10^{-5}$)	$0.2x10^{-5}$ (95% CI: $0.1x10^{-5}$, $0.3x10^{-5}$)	
NO_2		ULO	Diesel	Natural Gas
Whareroa Marae	Long-term mortality 30 + years (all cause non-accidental)	$0.09x10^{-5}$ (95%CI: $0.07x10^{-5}$, $0.1x10^{-5}$)	$0.2x10^{-5}$ (95%CI: $0.1x10^{-5}$, $0.2x10^{-5}$)	$0.1x10^{-5}$ (95%CI: $0.09x10^{-5}$, $0.1x10^{-5}$)
Most affected residential receptor	Long-term mortality 30 + years (all cause non-accidental)	$0.6x10^{-5}$ (95% CI: $0.5x10^{-5}$, $0.8x10^{-5}$)	$1x10^{-5}$ (95% CI: $0.8x10^{-5}$, $1x10^{-5}$)	$0.6x10^{-5}$ (95% CI: $0.5x10^{-5}$, $0.7x10^{-5}$)
Most affected receptor - De Havilland Way	Long-term mortality 30 + years (all cause non-accidental)	$0.5x10^{-5}$ (95% CI: $0.4x10^{-5}$, $0.6x10^{-5}$)	$0.9x10^{-5}$ (95% CI: $0.7x10^{-5}$, $1x10^{-5}$)	$0.5x10^{-5}$ (95% CI: $0.4x10^{-5}$, $0.7x10^{-5}$)

69 All risks for the proposed plant are within acceptable and negligible risk levels.

71 It should be noted that the CRF for PM_{10} used in the ESR study, and this sensitivity analysis, is derived from a one pollutant model. This means that the effects of other pollutants from similar sources, e.g. NO_2 and $PM_{2.5}$ from combustion sources, have not been controlled for in the derivation of the CRF. Therefore, the CRF is likely to reflect the mixture of pollution rather than PM_{10} alone.

72 The consent application is requesting an extension of the operation of the existing plant for up to 2 years after which it will be replaced by the proposed new plant. Given the conservatism built into the air dispersion modelling undertaken to inform this HRA and the consent application (Tonkin & Taylor, 2024a), the risks predicted for all scenarios are likely to overestimate the predicted incremental risks. Given the short duration of the operation of the existing plant and the level of conservatism in the model the minor exceedances of the acceptable risk levels for PM_{10} are not likely to pose an adverse risk to the health of the surrounding community.

HRA for Metals and Volatile Organic Compounds

73 The emissions from both the existing and proposed plants include a range of VOCs and trace metals. The VOCs and trace metals have been modelled as part of the air quality assessment conducted as part of the consenting process (Tonkin & Taylor, 2024a).

74 The VOCs included in the HRA are benzene and formaldehyde. Although other VOCs are emitted at trace amounts benzene and formaldehyde are the ones for which reliable emissions estimates were available. This is discussed further in the air quality assessment (Tonkin & Taylor, 2024a). In addition, PAHs were modelled and assessed as benzo-[a]-pyrene (BaP) which is the most toxic PAH.

75 The trace metals for which reliable emission estimates were available and which have been assessed in the HRA are arsenic, cadmium, chromium III and chromium VI, copper, and lead. The estimates of annual average exposure to these metals are highly conservative as they assume the asphalt plants operate continuously over the entire year at maximum production and that these metals are present in the ULO used as a fuel in the existing plant at the highest concentration allowed by the proposed consent conditions.

76 Benzene, formaldehyde, BaP, arsenic, cadmium, and chromium VI have been classified by the International Agency for Research into Cancer (**IARC**) as known human carcinogens. Lead has been classified as a probable human carcinogen. A carcinogenic risk assessment has been undertaken to assess the potential carcinogenic risks associated with emissions from the existing and proposed Allied Asphalt plants on sensitive receptors in Omanu Beach (including schools and childcare centres), De Havilland Way and the Whareroa Marae.

77 In addition to the carcinogenic risks many of the VOCs and metals have acute and chronic non-cancer health risks associated with exposure to the pollutant. These include benzene, formaldehyde, cadmium, chromium III and chromium VI, copper, and lead. These health effects associated with emissions from the existing and proposed plants have also been assessed.

Carcinogenic risk

78 For the carcinogenic pollutants – arsenic, BaP, benzene, cadmium, chromium VI, formaldehyde, and lead – the Californian Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) unit risk factors (**URF**) have been used to calculate the incremental lifetime cancer risk from the existing and proposed Plants. The URF is the increase in risk of cancer due to a 1 $\mu g/m^3$ increase in pollutant concentration in air. The unit risk factors used are shown in Table 4.16 of the HRA.

79 An acceptable risk level of $1x10^{-5}$ and negligible risk level of 1 in a million have been used to assess the carcinogenic risk from the existing and proposed Allied Asphalt Plants. This is consistent with national and international guidance.

80 The unit risk factors shown in Table 4.16 of the HRA were combined with the predicted annual average concentrations of the pollutants to calculate the incremental lifetime cancer risk.

81 For all residential receptors, including the Whareroa Marae, it was assumed that people are exposed 24 hours/day, 7 days/week, 365 days/year over a 70 year lifetime. For the daycare centre it has been assumed that children are there during opening hours – 7 hours/day, 5 days/week, 240 days/year over a 6 year period. For Mount Maunganui College and the primary schools, it was assumed that students would be present for 8 hours/day with all other assumptions the same as the day care centre. Adjusting for exposure was done in accordance with the enHealth Guidelines (2012).

82 For benzene and BaP OEHHA Cancer Risk Guidance (2015) recommends the application of a safety factor of 10 when assessing the cancer risk in children. This is to account for the increased vulnerability in the early life stages in children. This has been applied to assess the cancer risk to children at all receptors included in the HRA.

83 The results of the carcinogenic risk assessment for the existing and proposed Allied Asphalt Plant are shown in Table 6. The risk estimates for children are shown in italics.

84 The results in Table 6 show that at all locations the predicted cancer risks for adults and children are below the negligible risk criterion of $1x10^{-6}$.

Table 6: Predicted incremental lifetime cancer risk attributable to emissions from the existing and proposed Allied Asphalt Plants

Receptor	Pollutant	Incremental lifetime cancer risk		
		Existing Plant	Proposed Plant	
		ULO	Diesel	**Natural Gas**
Whareroa Marae	Arsenic	$2x10^{-7}$	$3x10^{-7}$	$3x10^{-9}$
	Cadmium	$9x10^{-7}$	$2x10^{-7}$	$5x10^{-9}$
	Chromium VI	$2x10^{-7}$	$1x10^{-8}$	$1x10^{-8}$
	Benzene	$9x10^{-9}$ *$9x10^{-8}$*	$1x10^{-8}$ *$1x10^{-7}$*	$1x10^{-8}$ *$1x10^{-7}$*
	Formaldehyde	$2x10^{-8}$	$8x10^{-9}$	$8x10^{-9}$
	BaP	$2x10^{-10}$ *$2x10^{-9}$*	$6x10^{-12}$ *$6x10^{-11}$*	$6x10^{-12}$ *$6x10^{-11}$*
	Lead	$2x10^{-11}$	$1x10^{-11}$	$2x10^{-8}$
Most affected residential receptor	Arsenic	$2x10^{-6}$	$2x10^{-6}$	$2x10^{-8}$
	Cadmium	$7x10^{-7}$	$1x10^{-6}$	$5x10^{-8}$
	Chromium VI	$2x10^{-7}$	$9x10^{-8}$	$9x10^{-8}$
	Benzene	$8x10^{-8}$ *$8x10^{-7}$*	$1x10^{-7}$ *$1x10^{-6}$*	$1x10^{-7}$ *$1x10^{-6}$*
	Formaldehyde	$1x10^{-7}$	$6x10^{-8}$	$6x10^{-8}$
	BaP	$2x10^{-9}$ *$2x10^{-8}$*	$4x10^{-11}$ *$4x10^{-10}$*	$4x10^{-11}$ *$4x10^{-10}$*
	Lead	$2x10^{-10}$	$8x10^{-8}$	$1x10^{-10}$
Most affected receptor -De Havilland Way	Arsenic	$2x10^{-6}$	$2x10^{-6}$	$2x10^{-8}$
	Cadmium	$9x10^{-7}$	$1x10^{-6}$	$3x10^{-8}$
	Chromium VI	$2x10^{-6}$	$8x10^{-8}$	$8x10^{-8}$
	Benzene	$7x10^{-8}$ *$7x10^{-7}$*	$9x10^{-7}$ *$9x10^{-6}$*	$9x10^{-7}$ *$9x10^{-6}$*
	Formaldehyde	$1x10^{-7}$	$5x10^{-8}$	$5x10^{-8}$

Receptor	Pollutant	Incremental lifetime cancer risk		
		Existing Plant	Proposed Plant	
		ULO	Diesel	**Natural Gas**
	BaP	$1x10^{-9}$ *$1x10^{-8}$*	$4x10^{-11}$ *$4x10^{-10}$*	$4x10^{-11}$ *$4x10^{-10}$*
	Lead	$2x10^{-10}$	$7x10^{-8}$	$1x10^{-10}$
Most affected receptor childcare	Arsenic	$3x10^{-8}$	$4x10^{-8}$	$4x10^{-10}$
	Cadmium	$2x10^{-8}$	$2x10^{-8}$	$7x10^{-10}$
	Chromium VI	$4x10^{-8}$	$2x10^{-9}$	$2x10^{-9}$
	Benzene	$2x10^{-9}$ *$2x10^{-8}$*	$2x10^{-9}$ *$2x10^{-8}$*	$2x10^{-9}$ *$2x10^{-8}$*
	Formaldehyde	$3x10^{-9}$	$1x10^{-9}$	$1x10^{-9}$
	BaP	$3x10^{-11}$ *$3x10^{-10}$*	$9x10^{-13}$ *$9x10^{-12}$*	$9x10^{-13}$ *$9x10^{-12}$*
	Lead	$1x10^{-9}$	$2x10^{-9}$	$3x10^{-12}$
Mount Maunganui College	Arsenic	$2x10^{-8}$	$3x10^{-8}$	$2x10^{-10}$
	Cadmium	$1x10^{-8}$	$1x10^{-8}$	$4x10^{-10}$
	Chromium VI	$3x10^{-8}$	$1x10^{-9}$	$1x10^{-9}$
	Benzene	$1x10^{-9}$ *$1x10^{-8}$*	$1x10^{-9}$ *$1x10^{-8}$*	$1x10^{-9}$ *$1x10^{-8}$*
	Formaldehyde	$2x10^{-9}$	$7x10^{-10}$	$7x10^{-10}$
	BaP	$2x10^{-11}$ *$2x10^{-10}$*	$6x10^{-13}$ *$6x10^{-12}$*	$6x10^{-13}$ *$6x10^{-12}$*
	Lead	$9x10^{-10}$	$1x10^{-9}$	$2x10^{-12}$

Non-carcinogenic HRA

85 For the assessment of health effects where there is a known threshold for effect, the predicted concentration for each contaminant is compared to the health-based guideline values for both acute and chronic health effects. The ratio of the predicted level to the guideline is termed the hazard quotient (HQ) (enHealth, 2012)

HQ = predicted pollutant concentration / health-based guideline

86 The health-based guidelines used to calculate the HQs have been adopted from the OEHHA except for lead. For lead the New Zealand Ambient Air Quality Guideline has been used. The health-based guidelines that have been used are shown in Table 4.18 of the HRA.

87 The acute and chronic hazard quotients are shown in Table 7 below. The data in Table 7 shows that all HQs are below the acceptable risk level of 1 and the negligible risk level of 0.1, in many cases by several orders of

magnitude. Although the risks are all within acceptable risk levels, the HQs associated with exposure to metals in the diesel and natural gas scenarios for the proposed Plant are lower than those using ULO in the existing Plant.

Table 7: Acute and Chronic Hazard Quotients for Metals and VOCs

Receptor	Pollutant	Chronic Hazard Quotients			Acute Hazard Quotients		
		Existing Used Oil	Proposed Diesel	Natural Gas	Existing Used Oil	Proposed Diesel	Natural Gas
Whareroa Marae	Arsenic	0.004	0.006	0.00005	na	na	na
	Cadmium	0.001	0.002	0.0001	na	na	na
	Chromium VI	0.000007	0.0000004	0.0000004	na	na	na
	Benzene	0.0001	0.0002	0.0002	0.0007	0.0008	0.0008
	Formaldehyde	0.0003	0.0001	0.0001	0.003	0.001	0.001
	Chromium III	0.0009	0.002	0.00002	0.007	0.0001	0.0001
	Copper	na	na	na	0.0004	0.0004	0.000002
	Lead	na	na	na	0.006	0.00002	0.00002
Most affected residential receptor	Arsenic	0.03	0.04	0.0004	na	na	na
	Cadmium	0.01	0.01	0.0004	na	na	na
	Chromium VI	0.00007	0.000003	0.000003	na	na	na
	Benzene	0.001	0.001	0.001	0.002	0.003	0.003
	Formaldehyde	0.003	0.001	0.001	0.007	0.003	0.003
	Chromium III	0.009	0.01	0.0001	0.02	0.0003	0.0003
	Copper	na	na	na	0.0009	0.001	0.000007
	Lead	na	na	na	0.03	0.00007	0.00007

Receptor	Pollutant	Chronic Hazard Quotients			Acute Hazard Quotients		
		Existing Used Oil	Proposed Diesel	Natural Gas	Existing Used Oil	Proposed Diesel	Natural Gas
Most affected receptor – De Havilland Way	Arsenic	0.03	0.04	0.0003	na	na	na
	Cadmium	0.009	0.01	0.0003	na	na	na
	Chromium VI	0.00005	0.000003	0.000003	na	na	na
	Benzene	0.0008	0.001	0.001	0.002	0.003	0.003
	Formaldehyde	0.002	0.0009	0.0009	0.009	0.003	0.003
	Chromium III	0.007	0.01	0.0001	0.02	0.0003	0.0003
	Copper	na	na	na	0.001	0.001	0.000007
	Lead	na	na	na	0.05	0.00005	0.00005
Little Einstein's Childcare Centre	Arsenic	0.04	0.06	0.0005	na	na	na
	Cadmium	0.01	0.02	0.0005	na	na	na
	Chromium VI	0.00008	0.000004	0.000004	na	na	na
	Benzene	0.001	0.001	0.001	0.002	0.003	0.003
	Formaldehyde	0.003	0.001	0.001	0.008	0.003	0.003
	Chromium III	0.01	0.01	0.0002	0.02	0.0003	0.0003
	Copper	na	na	na	0.001	0.001	0.000007
	Lead	na	na	na	0.02	0.00005	0.00005
Mount Maunganui College	Arsenic	0.03	0.04	0.0003	na	na	na
	Cadmium	0.009	0.01	0.0003	na	na	na
	Chromium VI	0.00006	0.000002	0.000002	na	na	na

Receptor	Pollutant	Chronic Hazard Quotients			Acute Hazard Quotients		
		Existing Used Oil	Proposed Diesel	Natural Gas	Existing Used Oil	Proposed Diesel	Natural Gas
	Benzene	0.0009	0.001	0.001	0.002	0.003	0.003
	Formaldehyde	0.002	0.0009	0.0009	0.008	0.003	0.003
	Chromium III	0.008	0.009	0.0001	0.02	0.0003	0.0003
	Copper	na	na	na	0.001	0.000007	0.000007
	Lead	na	na	na	0.02	0.00005	0.00005

Uncertainty Analysis

88 There are three key areas that introduce some uncertainty in the risk assessment:

(a) Air Quality Data

(b) Concentration Response Functions

(c) Baseline Health Data

89 **Air Quality Data:** The air quality data used in the HRA has been obtained from the air dispersion modelling undertaken by Tonkin & Taylor (Tonkin + Taylor, 2024).

90 As discussed in the evidence of Ms Simpson, there are several conservative assumptions included in the modelling and worst-case scenarios have been modelled. These include the assumption that the plant will operate at maximum capacity 24 hours a day 7 days per week. For PM_{10} it is assumed that the Plant is emitting continuously at the existing and proposed consent limits. In reality the Plant will only be operational for a fraction of that time and Allied has proposed limiting annual production as a condition of consent. The assumption that the Plant will operate continuously will produce highly conservative prediction of long term (annual average) air pollution levels experienced at the Whareroa Marae and within the Omanu Beach population. The highly conservative nature of the air dispersion modelling will lead to an overestimate of the associated risk. Therefore, the risk estimates, based on these assumptions, will be highly conservative.

91 Even with this high level of conservatism the predicted risk levels are within acceptable risk levels.

92 **Concentration Response Functions:** The CRFs used in the HRA are those that were derived by WHO in the development of the 2021 WHO Global Air Quality Guidelines. These were derived from a meta-analysis of many studies conducted in various part of the world with a range of sensitive population groups. I consider that these are the most robust CRFs available to assess the potential health effects of air pollution as they have drawn on evidence from many parts of the world with differing air pollution levels and sensitivity of populations.

93 Although the use of the WHO CRFs introduces some uncertainty into the HRA I consider this to be low. The HRA has used the upper and lower confidence limits to provide upper and lower estimates of risk which will

address variability in the sensitivity of the population to the effects of air pollution. The use of meta-analysis to derive the WHO CRFs produces an overall value that is reflective of the range of sensitivities within the population to the effects of air pollution. The use of the WHO CRFs will not introduce significant uncertainty into the predicted risk levels. I acknowledge that there are CRFs from New Zealand specific studies which have been used in the sensitivity analysis conducted as part of the HRA. It is important to note that the New Zealand studies were considered by the WHO as part of the development of the 2021 air quality guidelines. The use of the CRFs used in the HAPINZ 3.0 study in the sensitivity analysis shows that using New Zealand specific CRFs does not change the conclusions of the HRA.

94 **Baseline Health Data**: The baseline health data reflects the vulnerability of the population to environmental pollution due to the baseline prevalence of disease in the community.

95 Baseline health data is not available for small populations, such as the Whareroa Marae. The health data at a CAU level is also not publicly available. The data used in the HRA has been obtained from the NZ Ministry of Health for the Bay of Plenty District Health Board area. The data used is for both the total and the Māori population within the Bay of Plenty. Although there may be slight variability in baseline health conditions within populations, the use of the health data for the Bay of Plenty as a whole is unlikely to introduce any significant uncertainty in the risk estimates.

Matters raised by submitters

96 I am aware that as part of the consenting process the Bay of Plenty Regional Council (**BOPRC**) and Tauranga City Council (**TCC**) publicly notified the consent application. BOPRC and TCC notified the application jointly on 12 May 2023. The proposal was notified via the Bay of Plenty Times, and on the BOPRC website. Social media was also used to spread awareness of the public notification.

97 According to a summary of submissions provided by BOPRC, which is included as Attachment B to the s87F report, a total of 103 submissions were received of which 20 were identical pro-forma submissions. Four late submissions were received within a week of the closing date.

98 Based on the information in Attachment B of the s87F report, the submissions relating to air quality raised the following key concerns:

- Levels of air pollution generated by the proposal close to sensitive land use areas, including daycares, schools, businesses, sports fields, residential areas, and local marae.
- The renewal of the proposed discharge consent continuing to adversely impact on human health, particularly of vulnerable populations, by exacerbating emissions of dust and particulate matter, respiratory issues, and foul smells.
- Discharge to air of particulate matter and other contaminants that can have serious health impacts on the lungs of residents, particularly children, the elderly, and those with pre-existing respiratory conditions.
- The health effects of exposure to PM_{10} and $PM_{2.5}$ including increased risks of lung cancer, heart disease, and respiratory illnesses such as asthma and bronchitis as well as irritation of the respiratory system and exacerbation of respiratory conditions.
- The odour resulting in negative impact on the mental health of the local community.

99 The issues raised by the community with respect to the health effects of air discharges from the existing and proposed plants were addressed in the HRA with the exception of odour.

100 The HRA has assessed the potential impacts on the childcare centres, schools and Mount Maunganui College for all pollutants included in the HRA. The incremental risks for all pollutants and all health outcomes assessed are below acceptable risk levels, and in many cases below negligible risk levels. This indicates that the emissions from the existing and proposed Plants will not adversely affect the health of the children attending these facilities.

101 The HRA has also assessed the potential impacts on the Whareroa Marae. Given the distance between the Allied Plant and the Marae (approximately 1.45km) the predicted incremental risks for all pollutants assessed are lower than at all other locations considered in the HRA. All incremental risks predicted for the Marae are within acceptable risk levels with most below negligible risk criteria.

102 The most affected residential receptors identified in the air dispersion modelling report (Tonkin & Taylor, 2024a) have been assessed in the HRA. These include residences along Maunganui Road and workers accommodation in De Havilland Way. The results presented in the HRA

show that the predicted incremental risks at these locations for all pollutants and health outcomes assessed are below acceptable risk levels with many below the negligible risk level.

103 The HRA has assessed the impacts on sensitive groups identified by the submitters including the elderly and children and people with existing disease.

104 The health effects of exposure to PM_{10} and $PM_{2.5}$ identified by the submitters have been assessed where CRFs and baseline health data are available. This includes increased risks of lung cancer, heart disease, and asthma in children as well as mortality estimates. The WHO in their Global Air Quality Guidelines (2021) conclude that protecting against the impact on mortality will also protect other identified health outcomes. The HRA shows that the incremental increase in risk is below acceptable risk levels for all mortality outcomes assessed.

105 With respect to odour, it is acknowledged that the odour from the existing Plant at times can impact on the surrounding community. The proposed Plant will be designed to minimise odour impacts from the site. This means that the operation of the new Plant will lead to an improvement in regard to odour issues currently experienced by the community.

106 The evidence of Ms Simpson notes that for the existing plant, there is the potential for localised odour effects close to the plant and also in the residential area northeast of the Site. The proposed Plant will result in a significant reduction in odour concentrations compared to the existing plant.

107 According to Ms Simpson's evidence, the modelled concentrations of odour from the proposed Plant are an order of magnitude below the odour modelling criteria at all locations and therefore it is very unlikely that the proposed plant would cause odours that might be considered offensive or objectionable either in the neighbouring industrial area or the more distant residential area.

108 It is important to note that the odours emitted from the Asphalt Plant are related to the individual pollutants in the emissions. For some of these pollutants the odour threshold, the level at which you can smell it, is lower than the level at which health effects would be observed. This means that for some pollutants the community would be able to smell the emissions before the pollutant levels reached concentrations where they may impact on health.

109 There are a number of studies in the scientific literature that have found associations between odour and depression, anxiety and stress within communities close to odorous industries. Most of these studies have been conducted near landfills and intensive animal industries such as chicken or pig farms. For many of these studies the associations were weak and the results weren't consistent between studies.

110 I undertook a literature search through PubMed and was unable to find any similar studies conducted near asphalt plants.

111 Given that the proposed Plant will be designed to reduce odour impacts from the site by an order of magnitude below the odour modelling criteria, the impact on the community associated with odour from the Plant will be minimised.

Matters raised by s87F report

112 Apart from the issues raised by submitters there were no issues raised in the s87F report in relation to health.

Conclusion

113 I have undertaken a HRA to assess the potential short- and long-term health effects associated with the emissions from the existing operations and proposed new Allied Asphalt Plant at Mount Maunganui. The HRA draws on the results of the air dispersion modelling undertaken by T+T as part of the consenting process (Tonkin & Taylor, 2024a).

114 The results of the HRA showed that for PM_{10}, $PM_{2.5}$, NO_2 and SO_2 the predicted increase in risk of premature mortality and hospitalisation for asthma for children were all within acceptable risk levels established by international agencies such as WHO and US EPA. All incremental lifetime cancer risks were below negligible risk levels established by these agencies.

115 For acute and chronic health risks from metals and VOCs, a hazard quotient approach was taken. All predicted risks were below negligible risk criteria of HQ less than 0.1.

116 It is my opinion that the results of the HRA show that the existing Plant, operating on ULO, is not posing an unacceptable risk to the health of the surrounding community including Whareroa Marae, residential areas, primary schools, Mount Maunganui College and childcare centres.

117 It is also my opinion that the proposed Plant as designed can operate without posing an unacceptable risk to the surrounding community. The

predicted risk estimates for most pollutants assessed are lower for the proposed Plant than the existing Plant. The exceptions are NO_2 and benzene where very small increases in risk are observed.

118 For benzene the increase in risk is associated with the potential for increased production of asphalt. The increase in risk for the new Plant is 0.2×10^{-7}, well below the negligible risk criteria. All risks predicted for both the new and proposed Plants for benzene are below the acceptable risk levels. For benzene the predicted levels are not related to the type of fuel used.

119 For NO_2 the highest increase in risk is 0.1×10^{-5} for the most impacted receptor for the use of diesel fuel. This increase is very small and is below the acceptable risk criteria. For all other locations the risk is lower and in most cases does not differ from the existing Plant irrespective of the type of fuel used.

Dr Lynette Denison
Dated 29 February 2024

Tonkin+Taylor

Dr Lyn Denison

Technical Director Human Health Risk Assessment

Victoria

Lyn is a Technical Director for Human Health Risk Assessment within Tonkin & Taylor. She has more than 30 years' experience in air quality and human health risk assessment in both Government and consulting. Her work has focused on the assessment of environmental pollutants and their impact on human health.

Expertise

- Human health risk assessments
- Health Impact Assessment
- Toxicology
- Air quality impacts assessments
- Noise health risk assessments
- Environmental Policy and Regulation Development
- Litigation support - Expert evidence
- Regulatory submissions for chemical and/or product registrations
- Legal registers for products for importation and sale
- Regulatory Product Compliance
- Hazardous Substances and Dangerous Goods
- Product Stewardship

Experience

Lyn has extensive experience in human health risk assessment including the application to environmental standard setting, health impacts from transport and industrial emissions, noise, accidental chemical releases and fires and contaminated land. Her work has focussed on the assessment of environmental pollutants and their impact on human health. She has been involved in the development of National and State Policy including the development of air quality standards aimed at the protection of human health. She has also led the development of the Regulations for the assessment of the impacts of mining and extractive industries on the environment in Victoria. Lyn was awarded the Werner Strauss Clean Air Award, Clean Air Society Australia and New Zealand, 2005 for her contribution to the development of State and National Policy for Air Quality.

Prior to becoming a consultant Lyn was Principal Scientist at the Environment Protection Authority Victoria (EPAV). During her time at EPAV Lyn was involved in the development of Statutory Policy and Regulation at both a State and National level. She also spent 2 years as Manager of the Atmospheric and Energy Policy Unit which was responsible for the development of State Environment Protection Policies for Air Quality and Greenhouse Gases. She represented Victoria in the development of the National Environment Protection Measures for Ambient Air Quality and Air Toxics and their subsequent reviews. She Chaired the National Environment Protection Council (NEPC) Risk Assessment Working Group and was a member of the Environment Protection and Heritage Council (EPHC) Working Group for the development of a methodology for setting air quality standards in Australia.

From 2012 to 2023 Lyn was a Sessional member of Planning Panels Victoria which is responsible for the assessment of major infrastructure projects in Victoria and providing advice to the Minister for Planning on the acceptability of environmental, planning and social impacts of the project. Lyn was also a member of the Long Term Hazelwood Health Study Ministerial Advisory Committee which reported to the Minister of Health. This Committee was established to oversee the epidemiological study that has been funded by the Victorian Government to assess the potential long-term impacts of a fire at the Hazelwood Coal Mine at Morwell on the health of the local community.

Lyn has presented courses at the University of Melbourne in the Development of Policy and Regulation as part of the Environmental Engineering Course. She has presented training courses at the National Short Course in Environmental Health (Adelaide) on the Development of Air Quality Standards in Australia. Lyn also conducted a course on Environmental Health Risk Assessment on behalf of the World Health Organisation for the Ministry of Health in Mozambique. She also led a review of environmental health issues in Mozambique and provided recommendations to the Ministry of Health and AusAid on the development of a National Environmental Health Strategy for Mozambique.

Lyn was part of the project team that was involved in the development of Guidelines and associated User's guide for Contaminated Soil in Abu Dhabi. This work was undertaken for the Environment Agency Abu Dhabi. She was also involved in the preparation of CRC CARE Guidance document on Determining Site Specific Remediation Objectives as part of the National Remediation Framework for contaminated sites in Australia. She was the lead author on the CRC CARE Guidance document on Assessment, Remediation and Management of MTBE in Groundwater in Australia as part of the Emerging Contaminants Program.

Project Examples

WIM Resources Avonbank Mineral Sands Environmental Effects Statement

Lyn was engaged to conduct health risk assessment for WIM Resources Avonbank Mineral Sands Mine in Western Victoria. The HRA covered air quality, noise, impacts on crops, home grown produce and rainwater tanks from metals in deposited

dust, surface water and groundwater. This work was conducted as part of an Environmental Effects Statement. This work has involved community consultation on the results of the HRA as well as preparation of an expert witness statement and presentation at the Panels Hearing as part of the approvals process.

Ballarat Gold Mine Planning Permit Application Tailings Storage Facility, Victoria

To address community concerns raised during the Planning Permit process I conducted a health risk assessment to assess potential risks to the local community from emissions from the construction and operation of a new tailings storage facility at the mine site. The HRA looked at health impacts from PM_{10} and $PM_{2.5}$, respirable crystalline silica and metals from the current operation of the mine as well as the construction and operation of the new tailings facility.

Health Impact Assessment for Intermodal Transport Facility, Western Sydney, NSW

As part of an Environmental Impact Statement (EIS) in NSW Lyn conducted a Health Impact Assessment (HIA) for Intermodal Transport Facility in Western Sydney including health risk assessments for air quality and noise. The HIA addressed the vulnerability of the potentially affected community as well as social impacts such employment opportunities and anxiety and stress that may be experienced by the affected community. The health effects of PM_{10}, $PM_{2.5}$, NO_2 and diesel was assessed. The noise HRA assessed the potential increases in sleep disturbance, increases in heart disease and cognitive development in children.

Allied Asphalt, Mount Mauganui, New Zealand, Health Risk Assessment

As part of the reconsenting process for the Allied Asphalt Plant I have conducted a health risk assessment for emissions from the proposed plant and the impact on the health of the surrounding community. As part of this work expert evidence will be prepared and evidence presented at an Environment Court Hearing in 2024**.**

Confidential Client – Expert Witness Illegal Chemical Dumping

As part of an investigation to the illegal dumping of industrial chemicals in Victoria Lyn prepared 13 expert witness reports assessing the potential risk to human health and the environment due to the storage of a large range of industrial chemicals close to residential areas. This case is being heard in the Supreme Court in 2024 and Lyn will provide expert evidence at the trial.

Regulatory Compliance Personal Care Products – confidential client

Lyn has undertaken regulatory compliance checks against AICIS and TGA requirements in Australia as well Hazardous Substances and New Organisms Act (HSNO) in New Zealand for a range of personal care products. The compliance assessment included ensuring that the chemicals were listed or exempt form listing on the relevant chemical inventories in both Australia and New Zealand and that any restrictions on the use of chemicals were being met. Where chemicals weren't listed on inventories Lyn led a team that prepared registration dossiers for assessment by the relevant regulatory agencies.

Compliance Assessments Automotive Products – Confidential Client

Lyn led the ANZ team to assess the compliance of a range of automotive products with regulations in both Australia and New Zealand, in particular compliance with the Australian Industrial Chemical Introduction Scheme (AICIS), the Poisons Standard (Therapeutics Goods Administration) and the Hazardous Substances and New Organisms Act (NZ). This work was to provide the client with advice on whether the products could be legally imported into these countries.

Legal Registers for Volkswagen products for Australia and New Zealand

Lyn was part of a team that prepared a legal register of requirements for the importation and sale of automotive products in the UK, Japan, Germany, Korea, Australia and New Zealand. This involved reviewing and documenting the applicable legislation in each country for the importation, use and end-of-life requirements for these products. The focus of the work Lyn was involved in was the development of legal registers for Australia and New Zealand including requirements under AICIS, Poisons Standard, the Australian Competition and Consumer Commission (ACCC) and the HSNO. It also included assessment under the Safework Australia and Worksafe New Zealand requirements for the storage and handling of these products based on the chemical composition and physical properties of these substances. These substances were updated annually to ensure that they were up to date with any changes to the applicable regulations.

Legal Register for Medical Devices UK

Lyn was part of a team that prepared a legal register of requirements for the importation and sale of medical devices in the UK, Japan, Germany, Korea, Australia and New Zealand. This involved reviewing and documenting the applicable legislation in each country for the importation, use and end-of-life requirements for these products. The assessment included assessment against the requirements of the Therapeutics Goods Administration (TGA Australia) and MedSafe New Zealand as well as AICIS and the HSNO. Electrical safety and radiation safety requirements were also included in the registers.

Legal Registers for Personal Care and Cleaning Products – confidential client

Lyn was part of a team that prepared a legal register of requirements for the importation and sale prepared a legal register of requirements for the importation and sale of personal care and cleaning products in Australia and New Zealand. This involved reviewing and documenting the applicable legislation in each country for the importation, use

and labelling for these products. The legal registers included requirements under AICIS, Poisons Standard, the Australian Competition and Consumer Commission (ACCC) and the HSNO. Review of labelling and packaging requirements were included in the development of the registers.

EPA Works Approval Waste to Energy Facility, Victoria

As part of an EPA Works Approval application Lyn conducted a HRA for a waste to energy facility in Melbourne. This included the assessment of risk from air emissions including metals and dioxins as well as deposition on soil and uptake through home grown produce or produce grown in commercial facilities such as market gardens. The HRA assessed potential impacts on the surrounding community including sensitive uses such as childcare facilities, schools and aged care facilities as well as recreational areas and market gardens.

Public Health Risk Assessment for Reconsenting of Fertilizer Plant NZ

Lyn has been engaged to conduct a Public Health Assessment for the Reconsenting of a Fertilizer works in Dunedin NZ. This work will assess the potential risk to the health of the local community through emissions to air, deposition to home grown produce and discharge to water. This work has involved consultation with local iwi and broader community engagement.

Health Risk Assessment for the Stella Passage Consent, Port of Tauranga NZ

To address concerns raised through the hearing for the Stella Passage project Lyn conducted a human health risk assessment for the for Port of Tauranga to assess potential impacts on the health of the residents of the Marae from the proposed Port expansion. As part of this work Lyn has prepared expert evidence and presented expert evidence at the Environment Court hearing.

Noise Health Risk Assessment for Melbourne Airport Expansion

Lyn was engaged by Brimbank City Council to undertake a human health risk assessment for aircraft noise from the proposed expansion of Melbourne Airport. This work included conducting stakeholder focus groups to gain an understanding of the current impacts of the airport on the Brimbank community. The HRA looked at the potential health impacts from the proposed third airport runway and increased flights across the Brimbank local Government area. The HRA looked at sleep disturbances, increases in cardiovascular disease and exacerbation of symptoms and decreased cognitive development in children caused by increased noise levels from operating aircraft.

EPA Works Approval Cattle Saleyard, Victoria

As part of an EPA Victoria Works Approval application for a Cattle Saleyard, Lyn conducted a health risk assessment to assess the potential risk from a range of air pollutants – in particular PM_{10} and $PM_{2.5}$, pathogens such as EColi, salmonella and C Burnetti (cause of Q fever) as well as noise from the proposed facility. Impacts through direct inhalation as well as the potential for impacts on rainwater tanks and quality of drinking water and deposition and uptake through home grown produce were assessed. The HRA was approved by EPA and both the Works Approval and Planning Permit issued.

Health Risk Assessment for Kvanefeld Mineral Sands Project, Greenland.

As part of the Environmental Approvals process for the Kvanefeld Minerals Sands project in Greenland, Lyn conducted a health risk assessment for air pollutants from the mine and potential impacts on the nearby communities. This assessment was focussed on air pollutants including the criteria pollutants (PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2), diesel and metals.

Human Health Risk Assessments for Bifenthrin for use as Pesticide in NZ

As part of a regulatory review in NZ, Lyn undertook human health risk assessments for a range of pesticides containing bifenthrin. Both risk to residents as well as workers in the application of the pesticides was assessed. The report was submitted to the NZ EPA as part of their assessment for the reclassification for the use of bifenthrin in pesticides in NZ.

Independent Advice Department of Environment, Land, Water and Planning Fingerboards Mineral Sands EES

As part of the assessment of the draft EES Lyn was engaged by Department of Environment, Land, Water and Planning (DELWP) to provide independent advice to the Department on the air quality assessment. This involved review of draft documents, meetings with the Department, the proponent and other Government agencies and written advice on the draft reports and compliance with the regulatory framework for air quality in Victoria.

Assessment of Risk to Workers from Spray Drift from Pesticide Spraying

A risk assessment was conducted to determine the risk to workers from spray drift arising from the spraying of pesticides on farms in Victoria. 160 products were assessed using the APVMA risk assessment and management tool and buffers determined for each product for separation from the spray cloud and workers on adjacent properties. These results led to risk management practices being put in place to reduce the risk to workers from these applications.

Health Risk Assessment for Port Hedland Western Australia

Port Hedland in Western Australia is the main Port for the export of iron ore in Australia. In 2013-2015 Lyn conducted a health risk assessment commissioned by the WA Department to help inform future planning decisions for the development of Port Hedland including the development of new residential areas. The HRA examined the impact of fine particles, metals, diesel exhaust and nitrogen dioxide arising from the transport of iron ore from the mine sites to the Port, the processing at the Port, storage of ore and metals prior to shipping and the

loading of ships on the health of the local community including fly-in-fly-out workers. An assessment of the public health benefits of meeting alternative air quality standards in the residential areas was also undertaken. The results HRA was part of the information considered by the WA Government in formulating a government response to the issues in Port Hedland and the future development of the town.

Health Effects from Proposed Chicken Farm

As part of an approvals process for an expanded chicken farm in southeast Queensland Lyn prepared expert evidence on the potential health effects arising from emissions to air from the facility. This included assessment of the risk from inhalation of PM_{10} and $PM_{2.5}$ as well as health risks from EColi and Salmonella from the facility impacting on local rainwater tanks used for drinking water. As part of this work Lyn presented expert evidence at the Land and Environment Court in Brisbane.

Health Risk Assessment for Western Sydney Airport EIS

As part of the EIS process for the proposed airport at Badgerys Creek in Western Sydney, Lyn conducted the health risk assessment for air quality, noise, groundwater and surface water. This included an assessment of the potential impact of both overflight and ground-based operations on the health of the exposed communities.

Health Risk Assessment for Mercury as part of the Minamata Protocol Implementation

Lyn conducted a health risk assessment for mercury in Australia as part of a cost benefit analysis for the phase out of mercury under the Minamata Protocol. Assessment was undertaken for the Commonwealth Department of Environment. This included the assessment of the health impacts of mercury exposure based on mercury levels in blood arising predominantly from the consumption of fish in the Australian population.

Health Risk Assessment for POPs as part of the Stockholm Convention Ratification

As part of the cost benefit analysis conducted for the Commonwealth Department of Environment for the phase out of PFOS, HBCD octa-BDE and penta-BDE under Australia's obligations for the Stockholm Convention, Lyn conducted a human health risk assessment for the Australian population for these pollutants. This included a review of the current knowledge on the health effects of these pollutants and the known levels in blood of the Australian population.

Development of Short Term Air Quality Guidelines

EPA Victoria engaged Lyn to develop short-term air quality guidelines that are protective of human health. The guidelines were required to be applicable in emergency situations, such as (chemical fires or industrial releases) as well as assessment of the impacts of pollution events on the health of potentially exposed communities. The guidelines were developed to be protective of human health under the particular exposure scenario eg., short exposure to elevated levels of pollutants. Each of these guidelines has three tiers of exposure values. The first tier is a temporary, non-disabling effects threshold; the second tier is a disabling (escape impairment) threshold, and the third tier is a life-threatening effects threshold. The intention was to provide an agreed set of guidelines to be used by Government Agencies in emergency or pollution events to be able to assess the impacts on the health of the exposed community and to inform decisions as to when shelter in place or evacuation actions may be required.

Regulatory Advice Mineral Sands Development Victoria

Iluka Resources engaged Lyn to provide advice on regulatory requirements for air quality as part of their EES approvals process. Lyn was involved in providing advice in regard to meeting the requirements of the Protocol for Environmental Management (Mining and Extractive Industries) and ensuring compliance with relevant environmental regulations relating to air quality in Victoria.

Education

Ph. D. (Physical Chemistry) University of Melbourne

B.Sc., (Honours) University of Melbourne

Memberships/Affiliations

Clean Air Society Australia and New Zealand (CASANZ)

International Society for Environmental Epidemiology

International Society for Exposure Science

Awards

Werner Strauss Clean Air Award, CASANZ, 2005 (for contribution to the development of State and national Air Policy)

Recipient of 3 EPA Chairman awards for excellence including contribution to the City Link project and extensive knowledge of air quality and health issues

International Society for Radiation Research, Young Investigators Award 1987

Work History

February 2022 - present - Technical Director Human Health Risk Assessment Tonkin and Taylor

May 2019 – January 2022 – Technical Director Environmental Resources Management (ERM)

June 2017 – January 2022 – ERM Product Stewardship Lead for Australia and New Zealand

November 2012 – May 2019 – Principal Consultant Pacific Environment/DLA Environmental

January 2013 – December 2015 – National Practice Lead Risk Assessment and Toxicology, Pacific Environment/Toxikos

June 2014 - September 2015 – Acting General Manager Victorian Office Pacific Environment

June 2017 – June 2020 – Member of Ministerial Advisory Committee for Long Term Hazelwood Health Study (Appointment by the Minister for Health)

May - September 2017 – Technical Adviser Air Quality and Health, Inquiry and Advisory Committee for Westgate Tunnel Project Environmental Effects Statement

October 2013 – June 2014 – Member of the Assessment Committee for the East West Link Project (Appointment by the Minister for Planning)

May 2014 – November 2014 – Member of Inquiry Panel for Environmental Effects Statement Stawell Gold Mines

December 2012 – June 2023 – Sessional Member Planning Panels Victoria

Feb – Aug 2012 – Principal Scientist/Strategic Advisor EPA Victoria

2008-2010 Chair Clean Air Society Australia and New Zealand Risk Special Interest Group

2002-2012 – Principal Scientist (Air Quality) EPA Victoria

1999-2002 – Manager Atmosphere and Energy Unit EPA Victoria

1995-1999 – Senior Policy Officer EPA Victoria

1987-1994 - Research Fellow Peter MacCallum Cancer Institute

1984-1987 – Research Fellow Department of Chemistry University of Melbourne

1983 –1984 – Post Doctoral Research Fellow School of Chemistry University of Texas, USA

1982 -1983 – Post Doctoral Research Fellow Department of Radiation Biophysics, University of Kansas, USA

1981 – Visiting Research Scientist Argonne National Laboratory, Chicago, Illinios, USA

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