BEFORE THE GREATER WELLINGTON REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of an application by **NCI Packaging (NZ) Limited** for a resource consent in relation to the manufacture of metal cans and associated processes at 62-66 Montgomery Crescent, Upper Hutt.

STATEMENT OF EVIDENCE OF RHYS KEVERN

Dated: 26 July 2021

INTRODUCTION

Qualifications and experience

1. My name is Rhys Kevern, I am the Plant Chemist/Compliance Manager at NCI Packaging (NZ) Limited (NCI) based in Auckland but provide compliance assistance to the Upper Hutt Site. I have degrees in Chemistry (BSc) and Chemical Engineering (BE Chemical and Process) from the University of Canterbury, New Zealand. I have nearly 30 years compliance experience, 22 years specifically involving air quality (Regional Council and Consulting).

2. I first became involved with NCI Packaging (NZ) limited (NCI) in 2011 as a consultant working on the first air consent application. I prepared this current application.

Scope of evidence

3. My evidence will address the following matters:

   - The potential emissions associated with NCI and the basis for determining those emissions.

- Relevant statutory and policy documentation and assessment criteria.
- The results of my assessment of effects.
- The proposed mitigation.
- The Officer's report
- Assessment Conclusions.

DESCRIPTION OF PROPOSAL

4. The site processes are described in the Assessment of Effects on the Environment which accompanied the application, and by Mr Flitcroft in his evidence. I adopt those descriptions for the purposes of my evidence.

NCI AIR DISCHARGES

5. There are two main air emissions from the processes at NCI, combustion gases and Volatile Organic Compounds (VOCs) and their associated odour. The following describes how I determined the various emissions.

Combustion Emissions

6. Natural gas is used for space heating, the sidestripe ovens in assembly and the aluminium aerosol wash plant water heater. The main combustion emissions from natural gas burning are carbon monoxide and nitrogen oxides. The mass discharge of these two gases was measured by a combustion analyser as part of the assessment of the previous air discharge permit application and they are considered to be a minor discharge from the site, with no discernible odour beyond the site.

Volatile Organic Compounds and Odour

7. VOCs are discharged from both the Tinplate Assembly and Aluminium Aerosol Lines. In the tinplate assembly process the VOCs come from the sidestripe oven and bailear repair application process.

8. The Aluminium Aerosol Can process generates the majority of the VOC emission from the site. The majority of the emissions from the Aluminium Aerosol process are directed to the L2 main stack, the internal lacquer application process of the Aluminum Aerosol line is directed to the Internal Lacquer/Assembly stack, as shown in Figures 1 and 2.

Figure 1 **L2 Main Stack Configuration**

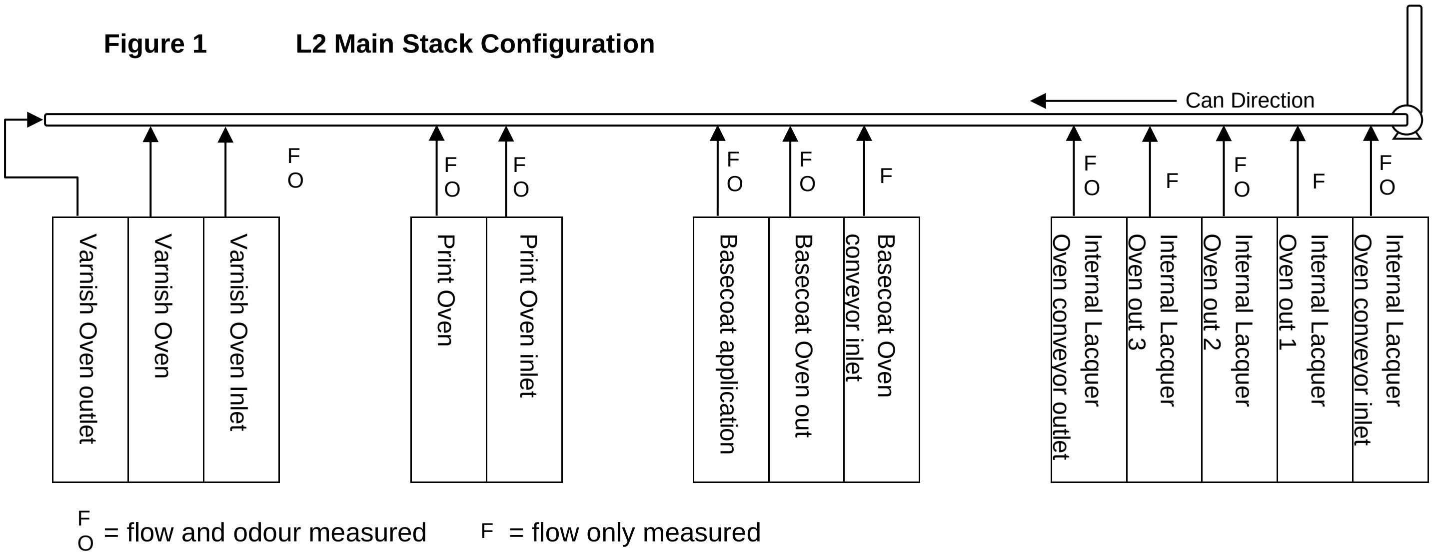
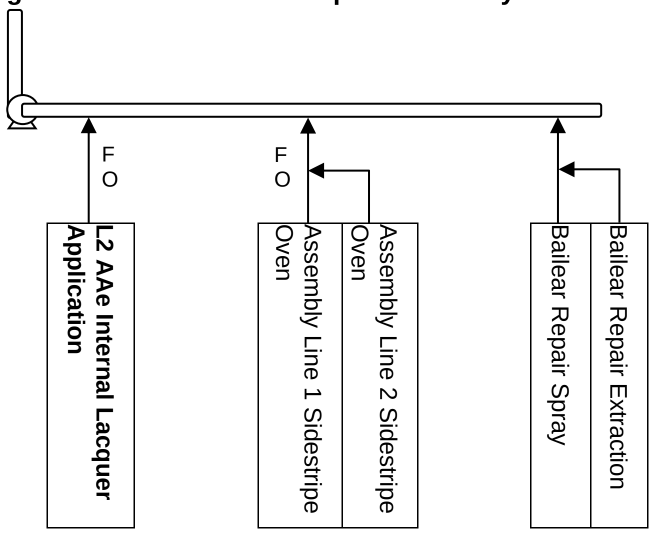


Figure 0 **Internal Lacquer/Assembly Stack Configuration**



9. VOCs have the potential to generate two types of effects. The first relates to the chemical nature of the compounds and whether they can have direct health effects. The second is odour, which is typically detectable at significantly lower concentrations than those that give rise to health effects.

10. Therefore, in order to assess the potential off-site effects associated with the various VOCs the actual concentrations of a range of different VOCs and their associated odour were measured from each stack.

11. Monitoring of VOCs and Odour was undertaken by Source Testing New Zealand (STNZ) in November and December 2018 from the L2 Main Stack and the Internal Lacquer/Assembly Stack as part of the original application. In August 2020 further odour and flow monitoring was undertaken on several of the processes connected to both stacks to determine the proportion of each input to the relative stack to aid in the review of odour control options.

12. Two methods were used to determine the VOC concentration, absorbent tubes analysed by GC-MS and whole air samples analysed by Selective Ion Flow Tube technology (SIFT). Whole air samples were assessed for odour concentration by dynamic dilution olfactometry. This is where a panel of people sniff various levels of dilution of the original odour until they cannot smell it anymore. The number of dilutions is the number of odour units.

13. The total mass emission of detected specific VOC emissions from the L2 Main Stack was about 445 g/hr and about 700 g/hr from the Internal Lacquer/Assembly Stack (which includes the internal lacquer application emissions from the aluminium aerosol line). The total petroleum hydrocarbons mass emission was 1,364 g/hr from the Line 2 main stack and 464 g/hr from the Internal Lacquer/Assembly Stack. The compounds detected were typical of solvents e.g., benzene derivatives, xylene, esters and alcohols.

14. The odour monitoring results in the sampling undertaken for the initial application were higher than the individual measurements taken in the 2020 round. Table 1 presents the initial odour monitoring results and Tables 2 & 3 the August 2020 results.

Table 1 Average Odour Emissions

Stack / Parameter	L2 Main Stack	L2 Lacquer/Assembly Stack	L2 Main Stack	L2 Lacquer/Assembly Stack
	Concentration, OU/m³		Mass Discharge, OU/s	
Odour	4,625	5,325	4,152	5,524

Table 2 Line 2 AAe Odour Emissions (estimated concentrations in itallics and (E))

Location	L2 Main Stack Concentration, OU/m³ at 20ºC, 1 Atm.	Flow, m3/s at 20ºC, 1 Atm.	L2 Main Stack emissions rate, OU/s
Internal Lacquer Oven conveyor inlet	276	0.152	41.9
Internal Lacquer Oven out 1 (E)	*977*	0.091	88.4
Internal Lacquer Oven out 2	977	0.095	93.2
Internal Lacquer Oven out 3 (E)	*977*	0.095	92.6
Internal Lacquer Oven conveyor outlet	63	0.109	6.8
Total internal Lacquer		**0.541**	**323**
Basecoat Oven conveyor inlet (E)	*6,970*	0.096	670
Basecoat Oven out	15,916	0.088	1,394
Basecoat application	8,622	0.066	566
Total Basecoat		**0.250**	**2,630**
Print Oven inlet	1,660	0.106	176
Print Oven	4,272	0.083	356
Total Print		**0.189**	**532**
Total Varnish	1,068	**0.139**	**149**
Grand Total		**1.12**	**3,634**

[The assembly stack monitoring results were not consistent with previous monitoring runs as it is possible not all of the processes were operating at the time].

Table 3 Assembly/Internal Lacquer Odour Emissions

Location	L2 Main Stack Concentration, OU/m³ at 20ºC, 1 Atm.	Flow, m3/s at 20ºC, 1 Atm.	L2 Main Stack emissions rate, OU/s
Tinplate assembly only	81	0.567	45.9
Tinplate assembly and Internal Lacquer Oven out 1	46	1.911	87.9
Internal Lacquer application individual flow		0.415	

ASSESSMENT CRITERIA

15. Having determined what the potential emissions are, it is necessary to determine what criteria need to be used to assess the effects of those emissions. Both the National Environmental Standard and the Greater Wellington Proposed Plan criteria are set for locations where people may be exposed for the averaging period. The maximum off-site concentration predictions from modelling have been assessed at industrial and residential locations.

16. Where there was no relevant New Zealand standard or guideline, the California Office of Environmental Hazard Assessment acute and chronic reference exposure limits (OEHHA) were used. If the OEHHA did not have a reference exposure limit, then Texas Commission on Environmental Quality (TCEQ) Effects Screening Levels[1] (ESL) were used. The Greater Wellington Regional Council (GWRC) has set a number of Regional Ambient Air Quality Guidelines which are primarily based on the NZAAQG.

17. For odour the MfE has produced guidance[2] which considers that for less sensitive areas such as industrial areas, the ambient odour levels should be less than 10 OU/m^3 for 99.5% of the time. For high sensitivity areas such as residential zones, 2 OU/m^3 for 99.5% of the time has been adopted.

ASSESSMENT PROCESS

18. NCI commissioned Jacobs New Zealand Limited to undertake air dispersion modelling of the VOC and odour emissions from the two discharge stacks. The dispersion modelling was undertaken using the CALPUFF multi-layer, multi-species non-steady-state puff dispersion model, which is capable of simulating the effects of time and space-varying meteorological conditions on pollutant transport. The meteorological data was generated by the TAPM "the air dispersion model" meteorological model using several levels of meteorological data from region wide data to the site anemometer data.

19. The benefits of using the Calpuff model over gaussian dispersion models such as Ausplume are that the plume is tracked along the terrain and wind direction changes along the plume are considered in the dispersion calculations. Building downwash effects were assessed using the PRIME algorithm.

[1] Available from http://www.tceq.state.tx.us/implementation/tox/
[2] Good Practice Guide for Assessing and Managing Odour in New Zealand, Ministry for the Environment, 2003

20. The modelling for the application was undertaken using the current stack height and flow. As part of the investigation into odour reduction options the model was re-run with the stack height increased by 2 m and 5 m to assess the effect on predicted ambient odour concentrations.

ASSESSMENT OF EFFECTS

VOC Emissions

21. The predicted ambient concentrations of specific VOCs were all less than 6% of the ambient guidelines. The maximum predicted ground-level concentrations of all the VOCs are well below their respective assessment criteria. Therefore, the effects on the environment of VOCs are considered to be no more than minor.

Odour

22. The predicted 99.5%ile ground level 1 hour average off-site odour concentration in the industrial area was 3.8 OU/m³ compared to the MfE guideline of 10 OU/m³. The predicted concentration for the Mountbatten Grove residential location was marginally over the MfE guideline <u>at 2.6 OU/m³ compared to a guideline of 2 OU/m³</u>.

FURTHER INVESTIGATIONS

Review of Odour Mitigation Options

23. As discussed above, a review of air pollution control technologies was undertaken to see whether there were any other feasible controls that could be put in place. Table 4 summarises the options reviewed. Although Biofilters had been discounted previously as they are typically used for more natural emissions such as rendering plant or sewage type odours there was potential they may work in NCI's application. This is especially so as the solvents are not chlorinated which would make them more difficult to treat by bacteria, as noted in the text "Biotechnology for Odor and Air Pollution Control, Shareefdeen & Singh, 2005".

24. The German standard VDI 3477 on biological waste gas purification biofilters, 2004, highlights that aromatic compounds are conditionally suited to biofiltration and alcohols, ketones and esters are well suited to biofiltration. NCI is aware of one company utilising a biofilter for VOC control for wallpaper adhesive application at Pacific Wall Coverings, Porirua which is consented by Greater Wellington Regional Council.

25. The other option considered to have potential is increased dispersion from the stacks. Carbon filtration and afterburners have both a high capital and running cost so were not considered further.

Table 4 Odour Control Option Summary

Odour Control	Comment
Dilution/dispersion	This is the current solution, increasing stack height is unlikely to markedly change the ambient odour concentrations but a modelling exercise could be undertaken to assess the benefits or otherwise of this.
Masking compounds and neutralising agents	These are more commonly used for open air situations like landfills. Masking just tries to hide the smell and can actually produce more odour.
Biological treatment	Biofilters are suitable for low temperature flows of reasonably natural odours. The area required to treat a reasonable amount of air is quite large. They can either use solid material or a biofilm in a wet scrubber configuration
Incineration/afterburning	These units are very expensive (a second hand one was $810,000). The ongoing natural gas usage is significant as well.
Adsorption	Carbon filter units have a high efficiency until the carbon is saturated with VOC and then there is the cost of replacement and disposal of the used carbon (estimated to be M$1.5/yr). A unit to treat all of the emissions would be in the order of $20,000 capital cost.
Dry Scrubbing	This is more suited to acid gases such as sulphur dioxide or fluorides.
Dry Chemical Scrubbing	This is more suited to reduced gases such as ammonia and hydrogen sulphide.
Absorption wet scrubbing	As this is a wet process it works best on soluble species, the solvent VOC at NCI are not very soluble so this method isn't considered an effective option.
Condensation	Condensation works best on high concentrations of volatile material in low air flows. The concentration of NCI's VOC would mean a large condenser would be required to cool the air flow and it would probably need to be refrigerated to work effectively.
UV Oxidation	The reaction time is too long for this method to treat the solvents. This method was tested in 2013.
Non-Thermal Plasma	This is a developmental technology mainly for coal fired boiler emissions so is not applicable to NCI.

Biofilter Trial

26. Due to the uncertainty of the treatment of solvents by biofiltration, a trial biofilter was made in an IBC container ~1 m^3 with a bark compost mix to treat a portion of the emissions from the internal lacquer application emissions. This source was chosen as it was at ambient temperature, had easy access to the ducting and had a significant level of odour.

27. The biofilter design was based on the Auckland Council TP152 guideline of less than 50 m^3/hr per m^2 surface area and a mid to higher residence time of 90 s.

Table 5 Trial Biofilter Design

Parameter	Units	Value
Diameter of Stack	Dstk (m)	0.03
Velocity in stack	Ustk (m/s)	10.50
Stack flow	Q(m^3/s)	0.0074
	Q(L/min)	445.3
	Q(m^3/hr)	26.7
Bed Vol required based on TP 152 (at 50 m^3/hr per m^2 (1 m deep))	m^3	0.53
Residence Time	s	90
Bed Depth	m	0.65
Area Required	m^2	1.03
length one side	m	0.95
length other side	m	1.15
Area Chosen	m^2	1.09
Actual Biofilter Volume	m^3	0.71
Actual Residence Time	s	95.7
Actual Residence Time	min	1.59
Actual biofilter loading rate	m^3/hr per m^2	24.5

28. Site staff made regular observations of the odour before and after the biofilter from 30 June 2020 to 2 September 2020 and did not detect any internal lacquer odour from the top of the biofilter for that whole period.

29. As discussed above, odour monitoring of the individual sources connected to the Line 2 main stack identified that the Basecoat application and oven emissions were 72% of the odour but only 25% of the flow. Therefore, this source was selected for treatment by a biofilter. However, in order to treat this source a cooling unit will be needed to get the temperature down to around 35°C due to bacteria in the biofilter not being able to survive high temperatures. The Proposed design for the full scale biofilter is summarised in Table 6.

Table 6 Full Scale Biofilter Design

Parameter	Units	Value
Diameter of Stack	Dstk (m)	0.25
Velocity in stack	Ustk (m/s)	5.34
Stack flow	Q(m^3/s)	0.2620
	Q(L/min)	15,720
	Q(m^3/hr)	943.2
Bed Vol required based on TP 152 (at 50 m^3/hr per m^2 (1m deep))	m^3	18.9
Residence Time	s	90
Bed Depth	m	1.2
Area Required	m^2	19.65

Parameter	Units	Value
length one side	m	3.65
length other side	m	6.05
Area Chosen	m^2	22.1
Actual Biofilter Volume	m^3	26.5
Actual Residence Time	s	101.1
Actual Residence Time	min	1.49
Actual biofilter loading rate	m^3/hr per m^2	42.7

Biofilter Operational Parameters

30. The proposed conditions of consent require the operational parameters of the biofilter to be included in the AMOP. The typical parameters for consistent operation of a biofilter relate to maintaining a consistent airflow across the bed material and maintaining suitable conditions for bacteria to survive. Moisture content of the biofilter bed is important to keep the bacteria alive but too much moisture causes the biofilter bed to become saturated and it is difficult for the air to move through the media. If the bed material becomes too wet or packed down the airflow will not be consistent over the bed and the pressure drop increases. As discussed above, the temperature needs to be maintained below 40°C and preferably below 35°C, so the bacteria are not killed off.

31. The two texts referred to above recommend the biofilter should be operated under the following conditions:

Table 6 Biofilter Operating Conditions

Parameter	Biotechnology for Odor and Air Pollution Control	German standard VDI 3477
Temperature	40°C max short peaks to 45°C	40°C max
Pressure	80-150 mm wg	No specific values
Moisture content	40-60% wet weight basis	40-60% wet weight basis
pH	6-8	No specific values

32. pH control is more important if the odour source contains sulphur compounds such as hydrogen sulphide.

33. Increased Stack Height

34. One of the additional odour controls investigated was increasing the height of the stacks to increase the level of dispersion of the odour. Two scenarios were run on the

same Calpuff model, increasing the stacks by 2 m to 27 m total, or increasing the height by 5 m to 30 m total. The results are presented in Table 7.

Table 7 Prediction of Odour Reduction from Stack Height Increases

	OU/m^3 25 m (Current)	**OU/m^3 27 m stack height**	**Reduction**	**OU/m^3 30 m stack height**	**Reduction**
Residential	2.6	1.5	-42%	1.3	-50%
Industrial	3.8	2.1	-45%	2.4	-37%

35. If the height of only one stack was increased, the improvement would be approximately halved. Ms Simpson's review of the options considers increasing the stack height to be a back-up option to the installation of a biofilter in the form discussed above.

SUBMISSIONS

36. There were six submissions relating to this application, one in support, two neutral and three opposing. The issues that were raised with respect to air quality fall into the following categories:

- Odour emissions from the plant.
- Property contamination
- Possible health effects

37. The effects highlighted in the opposing submissions mainly relate to on-going odour experiences and the effect it has on the ability to have the windows open and sit outside, etc. One submission raised a concern about health effects of the emissions including cancer of a family member. Another submission mentioned deposits on their property, especially on paintwork.

38. NCI has undertaken several investigations into the odour issue, including review of complaints, an ambient odour survey and review of possible odour mitigation options.

39. The Aluminium Aerosol process is fairly consistent. It is turned on in the morning and operates steadily through the day, even operating through breaks as it takes around 20 minutes to empty out the line.

40. The frequency of complaints seems to be quite variable where there can be several complaints close together and then nothing for months. NCI has not received a notification of odour since 5 February 2021.

41. Following the last prehearing meeting NCI and GWRC visited the neighbour's property at 35 Mountbatten Grove where the spots on the house were observed. There are several houses on Mountbatten Grove that have solid fuel burners and it is possible that soot from those could be the cause. NCI's emissions are gaseous and therefore unlikely to cause deposits.

42. As discussed above, the level of emissions is relatively low and consequently the predicted ground level concentrations are less than 6% of the health-based guidelines so health effects are not reasonably expected.

PROPOSED CONDITIONS

43. I have read the Officer's report and consider that it is a fair assessment of the application and concerns raised by the submitters. I have also reviewed the proposed consent conditions and will address some general concerns and some of the wider issues will be dealt with in Ms Simpson's evidence.

44. NCI requests Condition 7 be adjusted by removing the last part of the condition as this is already covered in the beginning of Condition 5.

"Cnd 7. Any amendments to the AMOP shall be submitted to the Manager for approval. Once approved, the amended AMOP shall become the operative AMOP. ~~and the plant shall be operated in accordance with the approved AMOP at all times.~~"

45. Similarly, in Condition 10 the requirement for operating under the OMM is a repeat of Condition 9's requirement.

"Cnd 10. The consent holder shall review and update the OMM:

a. Following the review of the effectiveness of the biofilter in accordance with Condition 20 and 21 and the review of the other mitigation, if required, in accordance with Condition 22; and
b. As necessary based on day-to-day experience.

Any amendments to the OMM shall be submitted to the Manager for approval. Once approved, the amended OMM shall become the operative OMM. ~~and the plant shall be operated in accordance with the approved OMM at all times.~~"

46. Condition 14 requires the biofilter to be installed within 4 months, I think a longer period may be required to install the biofilter. I have contacted the cooling system contractor to determine the timeframe for design, supply and installation of the equipment and he is looking at minimum period of 4 months so to allow for adjustments to be made following a site visit and for potential project over runs 6 months might be more realistic.

47. In Condition 33(e) I think the annual report needs to be limited to the observations in Condition 17, not including Conditions 18 and 19 as the later conditions relate to a discrete ambient odour survey which is reported separately.

48. Through the review of the conditions, I noted a number of minor changes for the Committee's consideration.

   a. In Condition 6 I think it reads better to include the frequency of review with the requirement for review. It could read "The Consent Holder shall review the AMOP at least once in a 12-month period or within another timeframe to the satisfaction of the Manager." Subparts (iii) and (iv) can then be deleted.

   b. In Condition 21(b) in the draft conditions supplied to GWRC I inadvertently changed the name of the Internal Lacquer/Assembly Stack which should be consistent with the AEE and elsewhere in the conditions.

   c. In Condition 21(c) I think the sentence needs the word "be" inserted i.e. "Implement an alternative method that ~~this~~ would *be* at least as effective…."

   d. In Condition 26 the word "shall" is misspelt. In Condition 14 parameters is misspelt.

   e. In Condition 31 the term permit holder is used instead of consent holder which is used throughout the consent. Even though the terms are interchangeable it could be changed.

   f. In Condition 33(d) I think the word "issues" needs to be inserted into the later part of the sentence i.e. "… a description of any actions taken to rectify any *issues* associated with its operation."

CONCLUSION

49. Given the nature of the process there will always be some potential for odour from the site, however I consider that all practical and appropriate mitigation measures have been implemented, and that the residual odours are at, or capable of, being at acceptable levels.

Dated: 26 July 2021

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Rhys Kevern