BEFORE THE HEARING COMMITTEE

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Bio Plant Manawatu NZ Limited to the Manawatū-Whanganui Regional Council for application **APP-2020203133.00** for the discharge of contaminants and odour to air from a pyrolysis plant at 247 Kawakawa Road, Feilding

REPORT TO THE COMMISSIONERS

MR MARK ST CLAIR (CHAIR) AND MS JENNY SIMPSON

SUPPLEMENTARY SECTION 42A REPORT OF ANDREW FERGUSON CURTIS AIR QUALITY

16 January 2023

A. INTRODUCTION

Qualification and Experience

1. My name is Andrew Ferguson Curtis.

2. My experience and qualifications are set in my 10 June 2022 S42A report

3. I have been retained by the Manawatū-Whanganui Regional Council to provide specialist air quality advice in relation to this matter.

4. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. My evidence has been prepared in compliance with that code. In particular, unless I state otherwise, the evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

B. SCOPE OF REPORT

5. The Commissioners Minute 10 dated 27 October 2022, set out a timeline for further responses from various parties to the further information provided by the Applicant. This included a requirement that:

   "*Council Officers (Section 42A technical officer's effects on air, water and land) provide a written response to the new technical information and any matter raised by the submitters*"

6. The evidence sets out my response as requested by the Commissioners, and is divided into two main sections:

   a. Comment on the new technical information provided by the Applicant.

   b. Comment on matters raised by Submitters.

7. Further, I then provide some overall comments including a conclusion and consequential recommendation.

C. REVIEW OF NEW TECHNICAL INFORMATION

DR IBRAHIM

8. Dr Ibrahim has provided a more detailed process description and a set of process flow diagrams in Appendix A of his evidence which are generally consistent with his description. Both of these are also consistent with my understanding of what was proposed by the Applicant at the hearing.

9. The detailed process and flow diagrams provide significantly more detail on the pyrolysis process, which enables better understanding of that process. However there are no process diagrams that encompass the entire process that is proposed on site. For example there is no detail on the onsite wastewater treatment plant or the electricity generation process.

10. While I accept that these may not be areas that Dr Ibrahim is familiar with, it remains information that, as far as I can determine, has not been provided by anyone else within the Applicant's team.

11. Using the sections in Dr Ibrahim's statement I have commented on the air discharges from the various processes he has described.

12. In terms of initial processing and drying of waste, Dr Ibrahim confirms (paragraph 2.4) that moisture and odour laden air, extracted from the drying trommel, is mixed with air from the pre-treatment area and then treated in the odour management system. This then discharges to air via a 700 millimetre diameter stack 15 metres above ground level. There is no additional detail on what this treatment device consists of and therefore I presume it is remains as described in the initial application.

13. In term of the flue gas from the pyrolysis process (paragraph 2.7), this is treated in a three stage Air Pollution Control Device (APCD) consisting of:

    a. a semi dry ion exchange scrubber which neutralises any acidic or basic gases and some of the hazardous compounds;

    b. dosing of activated carbon and lime which will remove organic compounds and remove any or acidic compounds that may remain in the gas stream with these material then removed in a baghouse together with any other particulate that may be present; and

    c. an activated carbon filter which will remove remaining organic compounds.

14. While Dr Ibrahim's evidence does not confirm it, Dr Koh's evidence states (paragraph 3.1 (a)), that the discharge from the APCD occurs via a 360 millimetre diameter stack, 20 metres above ground level.

15. There is no detail provided on how material collected in the baghouse will be handled to minimise the potential for dust effects.

16. Dr Ibrahim's process information provides further detail on the handling of solid material from the pyrolysis process, but:

    a. There is no detail on how nonferrous materials that have been separated from the char will be handled in order to minimise the potential for dust or other discharges to air.

    b. Figures EPC-002 and EPC-009 also identify a baghouse that will collect dust from the char separation process. There is no detail on the baghouse or where it is located.

    c. There is no information on how dust collected in the baghouse will be handled to minimise the potential for dust effects, which is particularly important if the baghouse is located outside.

17. The "clean" air from the baghouse is shown as discharging to air via the APCD. This is considered to be appropriate.

18. Overall, I consider that the APCD as discussed should provide a high level of treatment to the combustion emissions if it has been appropriately sized and is appropriately maintained.

19. In paragraph 2.8 of his evidence, Dr Ibrahim discusses the processing of the syngas/pyrolysis oil. This helpfully explains in section (a) that the syngas is quickly cooled to 300° to reduce the potential for "de novo" generation of dioxins. This is reasonable practice, but in other literature[1] it is recommended that temperatures are dropped to less than 200°C as this further reduces the potential for dioxin formation.

20. In section (c) Dr Ibrahim, in talking about the purified syngas, mentions that it could also be used in the Combined Heat and Power Engine. This unit is mentioned again in paragraph 3.17, where it is further stated that combustion of syngas in this unit could be used *"to generate the heat energy to support all the thermal and power processes of the plant"*. I am not aware that any

[1] Addink R. Olie K. Mechanisms of formation and destruction of polychlorinated dibenzo-p- dioxins and dibenzofurans in heterogeneous systems. *Environ. Sci. Technol.* **29**, 1425–1435 (1995)

information has been provided for this unit, but note that it appears, based on information in paragraph 3.23, than any combustion emissions associated with its use are treated in the APCD prior to discharge to air.

21. In paragraph 2.8 (d) Dr Ibrahim mentions the on-site wastewater treatment plant. In the hearing it was stated that any odours associated with this unit would be treated, however there is no information in any of the supplementary evidence to demonstrate how this will occur.

22. In paragraph 2.13 Dr Ibrahim mentions that there are a range of gaseous by products from the hydrocracking process that can be easily removed. Despite the information that is presented in paragraph 2.15 on the gas treatment process, I am unclear whether there is any potential for a release of odorous compounds from the processing of the waste streams from the process, and if so, how these will be treated.

23. In section 3 of his evidence Dr Ibrahim responds to specific questions from the Panel. The following paragraphs address those matters that are relevant to my area of expertise.

24. In paragraphs 3.11 to 3.12 the evidence of Dr Ibrahim provides information and references associated with destruction of polycyclic aromatic hydrocarbon compounds (PAHs) in the hydrocracking process. I have reviewed the references attached to his evidence and consider that the information supports to some extent the destruction of PAHs in the hydrocracking process.

25. In paragraph 3.13 Dr Ibrahim's evidence discusses PFAS destruction in the pyrolysis process. I have reviewed the two references that Dr Ibrahim attached and consider that the Appendix 5 reference and the actual paper supporting it[2] do indicate that pyrolysis is at a minimum, volatilising the PFAS from the waste, and that some of the PFAS was captured by the relatively simple air quality control device associated with that experiment. That paper specifically states that it was not able to determine the fate of the remaining PFAS compounds and recommended further studies. Consequently, and in my opinion, it is not possible to state conclusively that the PFAS compounds were broken down.

[2] Thoma, Eben D et al, Pyrolysis Processing of PFAS-Impacted Biosolids, a Pilot Study. (2021). Journal of the Air & Waste Management Association just accepted.

26. While the second reference (Appendix 6) describes a technology that can breakdown PFAS, I am not aware that the technology discussed in that document is being proposed by Bio Plant, and am therefore not sure of its relevance.

27. In paragraphs 3.14 to 3.17 Dr Ibrahim discusses the syngas cleaning process. I consider that maintaining the gas temperature at 850°C for two (2) seconds will destroy a lot of potentially toxic compounds such as dioxins, and due to the low oxygen environment, there is less potential for the formation of dioxin precursor compounds. As I have already discussed in paragraph 19 I consider that rapid reduction in temperature to 300°C will reduce the potential for de novo formation of dioxins.

28. I do not consider that paragraphs 3.18 to 3.19 of Dr Ibrahim's evidence answer the question from the panel as to the temperature that the pyrolysis chamber is heated to prior to waste entering it. He states that waste needs to be 500°C prior to entering the pyrolysis chamber. Presumably this means that the chamber will be at 500°C before waste enters it, however this is not explicit.

29. Paragraphs 3.20 to 3.22, of Dr Ibrahim evidence discusses the process that is followed to minimise the potential for hazardous material to enter the process. Essentially this is a four step process as follows:

    a. Waste is screened by the Feilding waste transfer station.

    b. Bio Plant staff will then undertake screening as they load waste into the plant feed hopper.

    c. Bio Plant staff will screen the material post the crusher.

    d. Ferrous material will be removed by a magnet prior to entering the shredder

30. I agree with Dr Ibrahims' comment in paragraph 3.22 that the process described should ensure that "*most of the hazardous materials have been removed from the waste stream prior to getting pyrolyzed*". I would also note that while the process cannot guarantee that lithium batteries are not shredded, as lithium batteries have steel casings the magnet should remove any that are present prior to it entering the pyrolysis chamber.

31. I consider that it would be better if the metals were screened out prior to crushing to reduce the potential for contamination and fires that could occur if batteries were shredded.

32. In paragraph 3.23 to 3.25 Dr Ibrahim reiterates material that is presented in paragraph 2.7 in relation to the APCD. As I stated in paragraph 18, I consider that the APCD represents appropriate treatment technology which should remove the majorities of contaminants if appropriately sized, operated and maintained.

33. In paragraph 3.26 Dr Ibrahim discusses the water cooling tower. Based on Dr Ibrahim's description the cooling tower appears to be operating as a closed loop, with no contact between the fluids in the plant and the cooling water. Consequently I agree with Dr Ibrahim that there "*there is no issue about odor control in the evaporation cooling tower due to the waste feedstock or the pyrolysis process".* However in the absence of information on the wastewater treatment plant and the level of treatment it will provide, it is not possible to confirm that there will be no odour if treated wastewater is used in the cooling tower.

34. Dr Ibrahim indicates, in paragraph 3.27 of his evidence, that Dr Koh addresses management procedures for air quality control. However as I discussed in paragraph 61, I do not consider that Dr Koh has done so and this remains an area where additional information is required in my opinion.

35. In section 4 Dr Ibrahim presents a reassessment of the syngas requirements for the plant. This has resulted in a greater quantity of syngas being burnt (1,287 Nm^3/h) and a subsequent increase in the volume of flue gas (6,615 Nm^3/hr). I am not able to comment on the appropriateness of the changes other than to state that Dr Koh has used the updated flue gas volume in his assessment.

DR KOH

36. Dr Koh has provided an updated air quality assessment based on the changes to the plant discussed by Dr Ibrahim and confirmed by Dr Koh in paragraph 2.1 of his supplementary statement.

37. In paragraph 3.1 Dr Koh sets out in more detail what his reassessment has considered. Unfortunately there appears to be an inconsistency between the air flow in section (a) (odour control) of 12,500 m^3/hour (3.5 m^3/s) and that in the image of the ADMS setup page 7.06 m^3/s or 25,000 m^3/hour. I understand from Mr Tani's evidence that the additional flow is associated with maintaining the building under negative pressure. As noted in paragraph 67 below, I am not sure that the numbers are correct.

38. There also appears to be an inconsistency between odour emission rate in (a) (1,115 OU_e/sec) and that shown in both the image titled "the model "strength" for the odour exhaust for Twin chamber BPMNZ" and in Appendix 5[3] of 2,230 OU_e/sec.

39. I require further clarification from Dr Koh as to what the correct figures are before I am able to confirm whether the predicted off-site odour concentrations are acceptable or not.

40. In section (b) Dr Koh states that the combustion flowrate is 6,615 m^3/hour. While the numerals are the same as those presented by Dr Ibrahim, the flow is not identified as normalised[4] (N) as Dr Ibrahim has done or standardised (S) which Dr Koh has done elsewhere in his evidence for flows. I presume this is an error as he has indicated that it is at standard conditions elsewhere in his evidence. I note that if there is an error it does not affect the mass emissions as Dr Koh has used normalised concentrations and flows to calculate those.

41. Dr Koh appears to have calculated discharge velocities in his model on the basis of normalised or standardised flows. If this is the approach he has taken then it is incorrect. Velocities must be calculated on the basis of actual flows. While this error has potentially underestimated the dispersion, as increased velocities will generally improve dispersion, the actual discharge velocity should have been modelled.

42. With respect to section (c) I note that the ADMS output page titled "Flue Gas Exhaust Stack Location and parameters" provided on page 19 appears to be for the initial modelling undertaken by Dr Koh, and consequently I am unable to confirm whether the correct parameters have been used in the remodelling.

43. I also note that Dr Koh has presented 99.7 and 99.9%ile values for his 24 hour average modelling results. This is not considered good practice, with 24 hour average values normally presented as the 100%ile values. Consequently the values presented by Dr Koh potentially do not present the maximum off-site concentrations.

44. I consider that the process described in section (d) of Dr Koh's evidence is a reasonable way of estimating emissions rates for contaminants for which no measured emission data was available.

[3] This value is calculated by dividing the stated emission rate of 8,028,00 OU_e/hr by 3600, the number of seconds in an hour.
[4] A normalised flow is generally one which has been adjusted to 273 K at 1 atmosphere. A standardised flow can also be adjusted to 273 K although is some jurisdictions a different value is used.

45. Finally, I consider that the sensitivity analysis assessment under taken by Dr Koh is an appropriate way of dealing with the uncertainties that exist because of the potential differences in the waste composition between Korea and New Zealand.

46. In section 4 Dr Koh discusses the calculation of the emission rates for contaminants and the rerunning of the ADMS model with the two stack configuration. I have discussed some of the key points in the following paragraphs.

47. The modelling has been carried out in a similar way to that previously with emission concentration data presented in Table 1 from the Korean plant used with the flowrates and plant configuration for the Feilding plant. The predicted concentrations have then been compared against appropriate New Zealand and international standards with the values presented in various table in appendices to his evidence.

48. In light of comments made by submitters in relation to the Mungyeong plant, (which I discuss later) I have reviewed the Application and evidence to better understand the emission data that forms the basis of the assessment. In all cases the basis for the emissions data used by D Koh appears to be a table of consolidated emission test results identified as being sourced from GGII for the Mungyeong plant.

49. Given the importance of the emission test results to the assessment I consider it would be useful to have copies of the stack testing reports which inform this table.

50. In terms of understanding the updated assessment, the key appendices in Dr Koh's evidence are 4 and 5, with the sensitivity analysis discussed in paragraph 45 presented in Appendix 4 and a summation of the modelling results and proposed stack emission limits (both concentration and mass emissions) presented in Appendix 5.

51. I have identified a number of issues with the modelling (odour concentration in paragraph 38, discharge velocities in paragraph 41 and in paragraph 43 in relation to the presentation of 99.9%ile values rather than 100%ile 24 hour concentrations). Consequently while I consider that the values in Appendix 5 appear reasonable and should result in off-site concentrations that are less than all relevant guidelines and standards, it would be helpful if the Applicant were to provide updated modelling that does not contain these or any other errors.

52. In paragraph 4.9 Dr Koh talks about his first rerun of the model with the results presented in Appendix 3. This appendix is confusing. It shows two sets of modelling results with two different

flowrates, neither of which are mentioned in the report. Therefore I do not consider that the results in this Appendix are helpful.

53. In Section 5 Dr Koh has discussed the continuous monitoring that is proposed. I consider that the list of compounds (PM_{10}, $PM_{2.5}$, O_2, CO, CO_2, NOx, SO_2 H_2S and HCl) set out in the first sentence of paragraph 5.1 is reasonable and appropriate for continuous monitoring, and are consistent with good practice for this type of plant. I do not consider the reduced list of compounds in the second sentence (PM_{10}, $PM_{2.5}$, NOx, and formaldehyde) is sufficient to be able to characterise the emissions, particularly for a new plant of the type proposed.

54. With respect to dioxins I am aware that in Europe it is common practice for waste to energy plants to sample for dioxins on a continuous basis onto a sampling media and then send that sample to an external laboratory to be analysed on a regular basis. While this is not the same as continuous analysis, for a compound like dioxins, this is an appropriate way of determining what the annual mass emission is. I have attached an example of the equipment as Appendix A.

55. Given that there were considerable concerns raised in submission about dioxins I consider that sampling as discussed above is reasonable and should be required for this plant if consent is granted.

56. In Section 6 Dr Koh discusses the updated energy balance and consequential updated exhaust flow rates that is discussed by Dr Ibrahim and in paragraph 6.8 includes a table which presents the results. The values at the flowrate of 6,615 Sm^3/hr are consistent with the values in Appendix 5, and reinforces the concern I expressed in paragraph 40 that Dr Koh has not modelled the actual exit velocities from the plant.

57. Consequently, while I consider that it is probably that the emissions from the APCD will meet all relevant guidelines I cannot confirm that Dr Koh's statement in paragraph 6.12 is correct.

58. Similarly for the reasons expressed in paragraph 37, I cannot confirm that Dr Koh's conclusions in paragraph 6.13 is correct.

59. In section 7 of his evidence Dr Koh presents responses to some question asked by the Panel.

60. I found the material set out paragraphs 7.2 to 7.4 to be helpful, although as I discussed in relation to Dr Ibrahim's evidence, BPMNZ needs to provide additional information on how dust from the dust collector will be handled to minimise any off-site effects.

61. I do not consider that Dr Koh's response in paragraph 7.5(aRMWD) provides any information on how the SCADA system will monitor the "health" of the various emission control devices particularly the activated carbon in the APCD.

DR KELLY

62. Dr Kelly has prepared a report which is appended to her evidence. I have reviewed Dr Kelly's report and consider that the methodology that has been used is appropriate and reasonable. I also consider that the conclusions that have been reached are reasonable on the basis of the modelling data provided to Dr Kelly.

63. However until Dr Kelly is provided with updated modelling that resolves the concerns that I have expressed above and considered how that might affect her conclusions, I am not able to endorse the conclusions summarised in paragraph 2.4 of her evidence.

MR TANI

64. Mr Tani has attached updated site layout drawings to his evidence which appear to be consistent with the information presented at the hearing. However Figure CD.02, which presents a plant layout, does not appear to be totally consistent with the process description and flow diagrams provided by Dr Ibrahim. For example Mr Tani's diagram only shows a single magnetic separator on the waste feed, and does not provide any information on where the char processing is occurring, or where the syngas storage tank will be.

65. I consider that the Applicant needs to provide a plant layout which identifies the location of all of the activities and process equipment which will occur on the site.

66. In section 4 of his evidence Mr Tani has provided more information on how the process building will be maintained under negative pressure. It also provides the explanation for the air flowrate through the odour treatment system that Dr Koh has modelled, although the numbers are not exactly the same.

67. Unfortunately I am unable, based on the information provided, to determine whether the extraction rate quoted in in paragraph 4.1 (a) (ii) is appropriate to meet number of air changes quoted in subsection (iii). This is because the value would only be correct if BPMNZ was only extracting air from first floor (height shown as 3.3 m on Figure CD.03) and the first floor went the

entire length of the building. However as the only area shown as being divided into two floors is the office area at the northern end of the site, as shown on Section A-A' (Figure CD.04), the volume of air required to achieve three air changes would be greater than that stated. Consequently I am not able to confirm whether the building will be maintained under negative pressure.

68. Therefore I consider that the Applicant needs to confirm the details of the design of the building negative pressure system.

MR FRENZ

69. In Attachment 3, Mr Frenz has set out an indictive table of contents for the air quality management plan. While it is very high level it appears to cover the broad topics that I would expect for a document of this type.

70. Notwithstanding the comments and concerns I have identified above in respect of the further technical information provided by the Applicant, I have the following comments on the proposed consent conditions.

    a. The operating temperature (25°C) stated in Condition 5 is not consistent with the 500°C temperature stated by Dr Ibrahim.

    b. There is an inconsistency in condition 37 between the words and the units for odour. Either the condition should talk about "odour discharge rate" to be consistent with emission rate provided (1,115 OU per second) or a discharge odour concentration xxx OU/m^3 should be provided. In any case given the concerns that I have made in relation to Dr Koh's modelling and Mr Tani's calculations, whatever limit goes into this condition needs to be consistent with the actual odour emissions from the plant.

    c. The table associated with condition 39 sets out the proposed emission limits for the plant. I am comfortable that the values provided in the Emission concentration column are consistent with information provided. But consider that the values will need to be revisited after confirmation of the veracity of the data is provided and Dr Koh has remodelled the emissions using the correct parameters.

d. However, it is not appropriate in the "Pollutant column", to attach averaging periods (e.g. 24-hr average) as that implies that the emission concentration is averaged over that period, which should not be the case.

e. I consider that condition 46 should refer to the APCD stack rather than the pyrolysis combustion exhaust as based on the process information from Dr Ibrahim there are other sources that will also discharge via the APCD.

f. In order to avoid any potential concerns about the pyrolysis emissions not being treated via to discharge to atmosphere condition 49 could be rewritten to make it explicit that the discharge from the pyrolysis process is via the APCD.

g. Similar to above I consider that condition 47 should be rewritten to refer to the APCD.

h. Condition 49 is somewhat confusing as it refers to a "process plant" and a baghouse. It is unclear which baghouse this is referring to as there are baghouses associated with the APCD, the odour control system and char processing. In context, I presume that it that associated with APCD and therefore propose that the condition should be rewritten as follows:

   All discharges to air from the pyrolysis process shall be via the APCD which is capable of achieving the emission concentration limits specified in **Condition 39**. No part of the process shall be operated without the associated emission control equipment being fully operational and functioning correctly.

i. As there is more than one baghouse on site I consider that condition 50 should be rewritten as follows:

   All baghouse onsite shall be fitted with suitable broken bag detector that are alarmed if particulate concentrations in the discharge reach levels such as those produced by bag filter failure.

j. Condition 54 should refer to the APCD stack.

k. Condition 59 refers to "bagfilters for each of the dryer plants". This wording is confusing as there is only one drying plant. Consequently the wording of this condition needs to be clarified to either refer specifically to the "dryer plant" or more generally to all bagfilters on site which I consider to be more appropriate.

D. SUBMITTER EVIDENCE

I have read all of the supplementary evidence. In many cases the evidence adopts the conclusions reached by Dr Rollinson or Dr Wiles, or raises issues outside my area of expertise. Consequently while I acknowledge all of the submissions and their content, I have only set out in this section, comments on unique issues raised by submitters that are not covered by Dr Rollinson or Dr Wiles that are relevant to my area of expertise.

Ellen Thompson

71. Ms Thompson expresses a number of concerns in relation to the process description and proposed resource consent conditions which I have identified in the previous section of my evidence.

72. In paragraph 1.1 Ms Thompson talks about the requirement to undertake a greenhouse gas assessment. While I do not disagree that preparing such an assessment might be helpful, I do not think there is a legal requirement to do so as the Bio Plant application was made prior to the change to the Resource Management Act and therefore must be considered on the basis of the legislation that existed at that time. I also do not think that the clarification on the site process has materially changed the scale or intensity of the potential effects from the process.

73. In paragraph 1.2 Ms Thompson talks about a need to undertake sampling of soils and water particularly for persistent pollutants. I consider that there is merit in this suggestion. Based on other consents that I am aware of, a condition(s) could be included which would require some baseline sampling to occur before the plant became operation and sampling to occur at intervals of perhaps five years, to enable meaningful data to be collected, which is then compared back to the base line data. The condition should also require some investigation or action if the monitoring in subsequent years identified meaningful increases over the baseline values.

74. In paragraph 1.3 Ms Thompson states that the operating license for the Mungyeong plant was revoked in 2016. From my review of the references that were attached it appears to be related to the storage of waste as opposed to the processing. However I agree that it would be helpful to have more information from the Applicant on this, to better understand whether it was a process issue.

75. In paragraph 4.2 states that the use of the emission data from the Mungyeong plant is “irrelevant as the licence for this plant … was revoked”. I do not agree with this statement as if the data was

collected from the plant when it was operating them it is an appropriate source of data. However as noted in the previous paragraph, if the Mungyeong plant was closed down because it was not able to meet appropriate discharge standards that information is relevant.

76. Therefore as I have stated in paragraph 49 I consider that it would be helpful to have copies of verified emissions tack testing results to support the emission rates used.

77. In paragraph 4.8 Ms Thompson, in referring to proposed condition, raises a concern about monitoring persistent organic pollutants (POPs). I agree that there is merit in doing this and have suggested in paragraph 54 that a continuous dioxin sampling mechanism. This sample may also be able to be provide information on other POPs.

Lou Wickham

78. Mx Wickham has identified a number of the issues with the assessment undertaken by Dr Koh that I have already addressed above. These issues particularly in relation to the calculation of stack velocities mean that the predicted off-site concentrations are not correct, but possibly conservative if the Mungyeong emission concentrations are correct. They have also identified a number of the short comings with the process description and the mass and energy balance presented by Dr Ibrahim. These short comings make it difficult to understand the process, and determine whether the data that feeds into the mass emissions is correct.

79. I agree with Mx Wickham (paragraph 10) that it would be useful to have a comparison with the technology on the Mungyeong plant and the feed (paragraph 11) to better understand the relevance of the emissions data that has been used.

80. While I expressed some concerns about the use of the Meteoblue meteorological data in my initial S42A report, I do not agree with Mx Wickham (paragraph 15) that the use of the data is inappropriate. Air quality professionals are quite often required to use synthetic meteorological data to undertake assessments when actual data is not available. Meteoblue, which is a well-established Swiss company, is one of number of companies that provide a range of meteorological services, including atmospheric dispersion modelling datasets.

81. In terms of Mx Wickham's comment about which years of meteorological data were used, Dr Koh states in the Air dispersion study that formed part of the S92 response, that modelling was undertaken using five years of data (2016 to 2020), this information was also provided in Dr Koh's primary statement. This is considerably more data than is often used in New Zealand and I

consider that it would have included all of the worst case meteorological conditions, and consequently in that respect the modelling was sufficiently conservative.

82. In paragraphs 16 to 20 Mx Wickham raises concerns about the validity of some of the assessment criteria used by Dr Koh. I agree with Mx Wickham that some of the assessment criteria (such as the no longer used Victorian Environment Protection Authority 3 minute averages) are probably no longer appropriate. However as Dr Kelly has not commented on them or raised concerns then they may still have some validity. I would recommend that if the Applicant were to undertake further dispersion modelling that it should seek advice from Dr Kelly as to the appropriate assessment criteria to use for the various pollutants.

83. In paragraph 19 Mx Wickham states that for known carcinogens (such as benzene) good practice is to undertake a quantitative health risk assessment. While it may be good practice it is relatively unusual to undertake this type of assessment in New Zealand, with assessment criteria being used which take the risk into account, for example the New Zealand Ambient Air Quality Guideline value for benzene of 3.6 $\mu g/m^3$ is based on an acceptable level of risk of 1×10^{-6}.

84. Nevertheless, Dr Kelly was engaged by the Applicant so that the risk associated with the carcinogens would be assessed and dealt with.

85. In paragraphs 25 to 29 Mx Wickham talks about the risk of air discharges from a process failure. It would not be normal practice to include emissions from this type of event in an air discharge consent application, particularly when the potential emissions from such an event are unknown, and would be difficult to determine.

86. However I agree with Mx Wickham that some form of process risk assessment is appropriate, but note that process risk is normally dealt with in relation to hazardous substances which is a district council matter as they have the responsibility for hazardous substances rather than a regional council matter.

87. In paragraph 36 Mx Wickham identifies three additional compounds that they consider need to be monitored for. I understand the relevance of the benzo[a]pyrene as one of the more toxic PAHs, but am not sure of the relevance of the other two compounds, and Mx Wickham has not provide a reason for their inclusion.

88. In paragraph 37 Mx Wickham provides a list of material that should be excluded from the process. I presume they mean as primary feed rather than incidental material in MSW. If that is not the

case, then I think it would be difficult to enforce. Notwithstanding this, proposed Condition 3 already excludes hazardous waste and tyres. In terms of the other materials mentioned by Mx Wickham, I can see no reason why BioPlant would want to deliberately introduce large quantities of glass, metals or masonry into the process as those materials would produce no useful energy or by-products.

Sue Godbaz

89. In paragraphs 3.1 to 3.5 Ms Godbaz raises a concern that not all hazardous materials will be removed from the feed material. With the exception of larger lithium batteries I do not consider that the small quantities of hazardous materials that are often present in the MSW will give rise to off-site effects as long as the pyrolysis process and emission control equipment is able to meet the emission limits that the Applicant has proposed.

90. In paragraph 3.7 Ms Godbaz states that the activity is prohibited by the NES-AQ. On the basis of the material I have seen and also the primary evidence of Mx Wickham, I confirm that this activity is not considered to be a high temperature incinerator and is therefore not prohibited by the NES AQ.

Dr Peter Wiles

91. Dr Wiles has presented a detailed mass and energy balance which casts doubt on that presented by Dr Ibrahim. While the overall process mass balance is important and potentially raises concerns about the viability of the project if that presented by the Applicant is incorrect, it is not particularly relevant to the discharge to air consent, as that authorises only what discharges to air occur from the process.

92. However there are aspects of the mass and energy balance that are relevant to the assessment undertaken by Dr Koh, for example how much syngas is burnt, as that influences the stack discharge parameters, particularly if additional support fuel such as diesel is required, as well as the mass emissions and concentrations of compounds in the discharge.

93. Consequently I consider that it would be helpful for the Applicant to provide a comprehensive and independently verified mass and energy balance for the process, so that reliance can be put on the parameters that relate to the discharges to air.

94. In paragraphs 14.1 to 14.5 Dr Wiles raises concerns about the Mungyeong plant that is identified as providing the emission data for the Applicant. I have already discussed this in paragraphs 48 and 49 and 76 and repeat that I consider that additional information is required to verify the emission data used in the Application.

Angela Baker

95. In Section 6 Ms Baker raises concerns about Dr Kelly's assessment. I note that in health risk assessments of this type, the health risk expert is reliant on the information provided by the proponent. In this respect, Dr Kelly has followed standard practice.

96. As I stated earlier in my evidence, I consider that the conclusions reached by Dr Kelly are reasonable given the report she was provided with which predicted identified low levels of off-site concentrations. Should the Applicant update its assessment to address matters that I have raised, Dr Kelly's work will need to be revised and updated to reflect this.

97. I do concur with Ms Baker, that a more detailed report might have been appropriate given the potential significance of this application.

98. Finally, I note that it would not be normal for a health risk assessment of this type to include information on onsite effects as those do not fall under the purview of the RMA. If the plant is constructed, WorkSafe New Zealand, who are responsible for worker safety, will be tasked with following up on any concerns that may occur in relation to worker health.

Dr Andrew Rollinson

99. Dr Rollinson has identified a number of matters that I have already expressed above, including the confusing nature of the process description.

100. In particular in section 3.1 Dr Rollinson discusses the issue identified by Dr Wiles in his evidence as to whether steam gasification is occurring as part of this process. I agree with Dr Rollinson that it is important to know if stream gasification is occurring as it will have an impact on the gas flows through the system, and the modelling that has been undertaken of the off-site concentrations.

101. This reinforces the point that expressed above in relation to the need for a clear process description for all activities on site.

102. In Section 3.2 Dr Rollinson discusses the CHP Engine, which I discussed in paragraph 20. I agree with Dr Rollinson that further information is required to explain this unit. I note that I understood from Dr Ibrahim's evidence that any discharges from the CHP were via the APCD, and therefore it would be helpful to understand whether the APCD is appropriately sized to accommodate this.

103. In section 9, Dr Rollinson raises concerns about POPs (such as dioxins and PAHs). I have already addressed this issue to some extent, but note that while there is debate about whether the Applicants process will or will not appropriately destroy these compounds, BPMNZ has offered a strict emission concentration limit for the plant. If the plant is not able to meet this, and therefore is in breach of its resource consent, then there is potential that the site could be required to stop operating. In addition I have recommended additional monitoring for these types of compounds that should be undertaken if consent is granted, that will provide better data on compliance.

104. In Section12 Dr Rollinson discusses the cooling tower emissions. As I have discussed in paragraph 33, I understand from Dr Ibrahim's evidence that the process cooling is closed loop and therefore there is no potential for contaminants to enter the cooling tower water from the pyrolysis plant. Consequently, I do not share Dr Rollinson's concern in that regard.

105. However, I agree with Dr Rollinson, that in the absence of information on the wastewater treatment plant it is not possible to know what level of contaminants may be introduced into the cooling tower plume from any treated process water that is required as makeup from this source.

E. SUMMARY AND RECOMMENDATION

106. I have reviewed the additional evidence provided by the Applicant. In summary I consider that:

a. While Dr Ibrahim has provided significantly more information on the process, which has provided greater clarification about aspects of the process, there are areas such as the wastewater treatment plant which are remain unknown. In addition, there are aspects of Dr Ibrahim's evidence that have confused things even more, such as the introduction of steam gasification as a step in the process.

b. While Dr Koh has provided updated dispersion modelling for the activity using a model which now resembles what is proposed, and predicts off-site concentration which are well less than generally acceptable guidelines, the fundamental errors in his work,(e.g. calculating velocities

using normalised flows) have reduced the creditability of his work and mean that it is not possible to rely on his predictions.

c. Mr Tani has provided information on the rational for the building odour extraction rates which do not appear to make sense, give the size of the building. This in conjunction with Dr Koh's modelling makes it impossible to confirm whether or not there will be off-site odour effects.

107. I have reviewed the additional evidence provided by the various submitters. In summary while much of the information is not strictly relevant to resource consent for discharges to air, there appear to be valid concerns about:

a. Whether the mass and energy balance which provides important input data for the stack emission calculations is valid.

b. The source of the data that has been used to calculate the mass emissions of the various compounds that will discharge from the stacks.

108. Taking all of these matters into consideration, I do not consider that there is sufficient information to allow me to be confident that there will be no air quality effects from the proposal and therefore I can no longer support the granting of an air discharge consent on the basis of the information that has been presented to date.

109. If the Commissioners were minded to grant consent, then I consider that they could only do so once they have received:

a. information on all of the processes that will be undertaken on site, any potential discharges to air and information on all of the air pollution control devices proposed to minimise the discharges;

b. comprehensive site layout and process flow diagrams;

c. an independently verified mass and energy balance;

d. updated air quality modelling undertaken by, or verified by, a suitable qualified air quality professional which demonstrated that any air quality effects on the environment were at an acceptable level; and

e. an updated human risk assessment which demonstrated that there was no potential for human health effects from the activity.

DATED this 16 day of January 2023

Andrew Curtis
Air Quality Consultant