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Dear Bryony

APP-2020203133.00 TECHNICAL ASSESSMENT OF AIR QUALITY EFFECTS

1.0 Introduction

Bio Plant Manawatū NZ Ltd (BPMNZ) is proposing to establish and run a renewable energy facility in Manawatū, and is seeking appropriate resource consents from Horizons Regional Council (Horizons) to operate a site on Kawakawa Road, Feilding, adjacent to the Manawatu Resource Recovery Centre.

Pattle Delamore Partners Limited (PDP) has been engaged by Horizons to assess the potential for air discharges from the proposal. This letter report sets out our assessment.

2.0 Documents Reviewed

BPMNZ has provide a significant quantity of documents with its Application, and PDP has reviewed all of the relevant documents provided by the Applicant, and in particular the following:

- Resource Consent Discharge to Air, April 2021, prepared by Taupo Tani (Application);
- Application, Appendix 1 -Air Quality Impact Assessment Bioplant Ltd – Waste to Energy Plant;
- Application, Appendix 2 -Discharge Control Process and Management;
- Application, Appendix 4 - Bioplant Pyrolysis Waste to Energy Plant, Dandenong South, Work Approval; and
- Application, Appendix 5 – Environmental Impact Statement GGE 4 MW Waste to Energy Plan for Anguillia.

Having reviewed the initial information contained in these documents, PDP identified areas where additional information was required in order to assess the application. These questions were put to BPMNZ by Horizons in a section 92 request and the following documents were received:

- Response to the Additional Queries from Horizon Regional Council;
- Schematical Diagram of a single line; and
- Site setup.

Having reviewed these documents, PDP considered that there were still areas where additional information was required, and this was discussed the Applicant. In response to this discussion the following additional documents were provided:

- Air Dispersion Study for Bioplant Manawatu NZ Limited, (ADS) prepared by Dr Peng Hong Koh;
- Appendix A BPMNZ Air Dispersion Modelling R1.5;
- ANNEX B - Emission Standards - GGI Hydbrid MSW Plant (Korea); and
- Preventive Emissions Management System.

Having reviewed all of these documents, PDP is satisfied that there is sufficient information upon which to assess the potential air quality related aspects of the Application.

3.0 Process Description

The process is described in detail in the Application, but in brief it will involve the processing of Municipal Solid Waste (MSW) that has had all of the recyclable materials removed, through two pyrolysis plants, with the end products (synthetic diesel and biochar) being sold commercially, and waste heat converted into electricity using an Organic Rankine Cycle.

As proposed the site will have the capability to process up to 40 tonnes of waste per day, and produce up to 14,000 litres per day of diesel, 1.9 MWh of electricity and 2.5 tonnes of bio char per day.

The plant being proposed has been developed by Global Green International Investments Ltd (GGII) and is already in operation at a number of locations around the world.

4.0 Consent Requirement

All discharges to air from industrial and trade practices are controlled by Section 15 of the Resource Management Act, which only permits discharges which are "*expressly allowed by a national environmental standard or other regulations, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent*". In the Manawatu-Whanganui region Chapter 15 of the Horizon's OnePlan regulates air discharges and sets out the consent requirements.

In this case PDP considers that the most appropriate rule is Rule 15-17 which is a Discretionary Activity rule which covers activities that either do not meet the permitted activity standards of other rules or are not addressed by any other rule in the plan.

In particular PDP considers that the activities proposed by Bio Plant are identified in clause xiv of the Rule guide being:

"**carbonisation, gasification**, refining, purification, or reforming of natural gas, petroleum oil, shale, coal, wood, **or other carbonaceous materials**:" (emphasis added)

5.0 National Environmental Standard

There are National Environmental Standards[1] for Air Quality (NESAQ) that set mandatory limits on the concentrations of five key air pollutants (PM_{10}, nitrogen dioxide, carbon monoxide, sulphur dioxide and ozone), primarily related to combustion, which must be met within the region controlled by Horizons, and also prohibit the granting of consent in some circumstances. The combustion related emissions associated with the proposal are governed by the NESAQ and therefore the potential impacts of the emissions are considered against this standard.

[1] Resource Management (National Environmental Standards for Air Quality) Regulations 2004

6.0 Regional Standards

As well as the NESAQ there are also Regional Standards for Ambient Air Quality set out in Chapter 7 of the One Plan, which discharges from the proposal must meet. For this Application the relevant standard is for odour and requires that "*a discharge must not cause any offensive or objectionable odour beyond the property boundary*".

7.0 Potential Discharges to Air

There are two main types of discharges to air from the proposal which are odour and combustion products, and are discussed in the following sections.

7.1 Combustion Products

The pyrolysis process involves heating organic material to high temperatures (in the order of 1,000 ^{o}C) in the absence of oxygen which leads to the breakdown of the waste, and the generation of pyrolysis gas and bio char. The pyrolysis units will initially start up on LPG and then once the process is stable switch to the raw pyrolysis gas. In total the process could burn up to 20% of the raw pyrolysis gas.

Combustion gases from the process will pass through a treatment train incorporating a semidry scrubber, and baghouse (which includes carbon injection) before being discharged to air.

The Applicant has set out in Table 7 of the ADS the emissions that have been quantified in the assessment. These are based on emission testing results from an identical plant operating in Korea. PDP has reviewed these values and considers that they are not unreasonable, but will presumably be driven (particularly for the metals) by the composition of the waste. These same emission values were also used in an application in Australia. PDP requested additional emission information from the Australian site but understands that it is not yet operational.

Therefore, the information provided appears to represent the best available information and on that basis is considered suitable for assessing the potential effects. However as discussed later, PDP has recommended conditions requiring stack testing to confirm the emission rates if a decision is made to grant consent.

The applicant has not considered any emissions associated with the combustion of LPG on the basis that emissions associated with pyrolysis gases will represent worst case emissions. PDP consider that this appropriate.

7.2 Odour Emissions

Based on the information in the ADS, BPMNZ is proposing to operate the process building under negative pressure to control the potential for fugitive odours, with specific point source extraction from the trommels (which dry the shredded waste). The extracted air will be treated by filters to remove particulate and then carbon filters to remove odours prior to discharge to atmosphere.

PDP considers that this approach represents best practice for odour control and should minimise the potential for fugitive odours from the process.

The ADS has estimated the concentrations of odours from the waste material based on monitoring undertaken at an Australian site handling MSW. Dr Koh has then made some conservative assumptions on the likely increase in odour in the trommel and reduced the potential removal efficiency of the carbon filters. Given the level of uncertainty in the applicability of the odour concentrations information, PDP consider that the level of conservatism is appropriate.

The emission data used in the assessment is set out in Table 5 of the ADS. Based on PDP's experience at other sites, an odour discharge concentration of 321 OU/m^3 (derived from the data provided) is considered reasonable for this type of process.

8.0 Assessment Methodology

In the Application the potential effects associated with the proposed plant were presented based on a report prepared for the Australian plant. PDP expressed concerns about the validity of this approach for a number of reasons set out in the S 92 requests. In response to these requests the Applicant has provided an updated assessment undertaken specifically for this proposal using site specific information. Consequently, in this section and subsequent sections of this review any references to results is based on the updated assessment provided in the ADS.

8.1 Sensitive Receptors

Table 1 and Figure 3 in the ADS present the sensitive receptors used on the assessment. PDP consider that these are appropriate and have identified all of the nearby sensitive receptors. PDP notes that there are residences to the southeast along Boness Road. However, given the distance to these (greater than 1,500 metres) any effects at those locations will be less than predicted at the locations assessed, and therefore PDP is confident that the ADS has considered all of the potentially affected parties.

8.2 Meteorological Data

One of the key inputs into dispersion models is meteorological data. In this case the Applicant has used five years of data for Feilding obtained from Meteoblue. Data from this site appears to be synthetic data. While it is not unusual to use synthetic data in dispersion modelling, it is normal practice to provide an assessment which demonstrates the representativeness of the data. This was not included in the ADS, however PDP has considered other publicly meteorological data for Feilding and there appears to be a reasonable degree of agreement, therefore PDP considers that the data is suitable for use in the assessment.

8.3 Background Data

ADS has considered background data collected at various locations with the Horizons region. PDP is generally comfortable with the values that have been used but consider that the values that have been used for PM_{10} and NO_2 in the report are too low based on our experience. PDP has reviewed background data prepared by Waka Kotahi and has used it in Section 9.2 when considering the cumulative effects of the proposal.

8.4 Dispersion Model

This assessment has been carried out using the Atmospheric Dispersion Modelling System (ADMS), which is the primary dispersion model used in the United Kingdom. ADMS is a Gaussian model similar to AERMOD, which is commonly used in New Zealand. Consequently, while ADMS is not commonly used in New Zealand, PDP consider that the model is appropriate for use.

8.4.1 Building Downwash

The ADS has considered the potential effects of building downwash and included the majority of nearby buildings which could impact on the emissions from this site. This is considered best practice.

8.4.2 Model Setup

The applicant has not provided copies of the model set up files and therefore PDP has not been able to verify that the model outputs are correct. However, the modelling results presented are consistent with

the modelling results presented for the Australian plant, and therefore PDP considers that the modelling has been undertaken appropriately.

8.5 Assessment Criteria

The ADS sets out the assessment criteria that have been used in this assessment. PDP considers that the criteria selected are appropriate, but that no criteria have been presented for some of the pollutants assessed. Therefore, in order to assess the potential effects of these pollutants, PDP has compared the predicted concentrations against conservative screening criteria developed by the Texas Commission on Environmental Quality (TCEQ).

9.0 Predicted Emissions

9.1 Odour Emissions

The modelling undertaken by the Applicant predicts a worst-case 1 hour 99.9 percentile off-site odour concentrations of 0.37 OU/m^3. This is well less than the 2 OU/m^3 odour modelling guidelines developed by the Ministry for the Environment[2] for high sensitivity locations, and consequently odour emission at these levels would meet the regional odour standard and should not result in an off-site odour nuisance.

PDP notes that this conclusion is predicated on the fact that there will be no fugitive odour emissions from the operation, which should be the case if the building operates under negative pressure and as set out in the S92 response that emissions from the leachate holding tank will be incorporated into the odour treatment system discussed above.

It is noted that there are a number of potential odour sources in the area, including the adjacent Manawatu Resource Recovery Centre, and the Manawatu Wastewater Treatment Plant. This means that there is potential for cumulative odour effects in the area. However, based on the modelling results, PDP considers that it is extremely unlikely odour emissions from BPMNZ would result in any measurable increase in the local odour environment.

9.2 Combustion Emissions

Section 17.2 of the ADS presents the modelling results for BPMNZ. PDP notes that all of the results are presented as either 99.7 or 99.9 percentiles. While this is normal practice for modelled 1 hour average concentrations, it is not normal practice in New Zealand to do this for 8 hour or 24 hour average concentrations, with results normally presented as the 100 percentile. This means that the results presented may not represent the worst case. However, given how low the predicted concentrations are PDP does not consider that this would have any material change on the conclusions reached in this assessment.

As mentioned earlier PDP has concerns that the background values used in the ADS for PM_{10} and NO_2 may be too low for this area, and has reviewed data developed by Waka Kotahi[3] and considers that it is more appropriate. Therefore, PDP has reproduced the values predicted in the ADS in Table 1, with the Waka Kotahi background values for PM_{10} and NO_2.

[2] Ministry for the Environment, Good Practice Guide for Assessing and Managing Odour, November 2016
[3] https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/air-quality-climate/planning-and-assessment/background-air-quality/

Table 1: Assessment of NESAQ Compounds

Parameter	Units	GLC	Background	Cumulative GLC	Percentage of Standard
PM_{10}	µg/Sm^3	0.121	33.22	33.35	66%
$PM_{2.5}$	µg/Sm^3	0.121	10.96[1]	11.08	44%
NO_x	µg/Sm^3	2.7	58	60.7	30%
SO_2	µg/Sm^3	0.216	3.72	3.94	1.1%
CO	µg/Sm^3	0.324	135.3	135.6	1.3

Notes:

1. *Based on Guidance from Auckland Council which indicates that in rural areas $PM_{2.5}$ is 37% of PM_{10}*

Overall PDP is comfortable that the combustion related emissions will not result in any exceedance of the NESAQ.

There are other pollutants that the Applicant has modelled which are not compared to any standards or guidelines. Therefore, for completeness PDP has set these values out in Table 2, together with an appropriate standard to compare the predicted value against.

Based on the data set out in Table 2, it is unlikely that there will be any effects associated with these emissions.

Table 2: Assessment of non NESAQ Compounds

Parameter	Units	GLC	Averaging Period	Guideline	Source
HCl	µg/Sm^3	0.113	1 hour	190	TCEQ
HCN	µg/Sm^3	0.061	1 hour	20	TCEQ
Dioxins	fg/Sm^3	0.0067[1]	Annual	0.03	TCEQ

Notes:

1. *Annual value derived by comparison with the PM_{10} annual modelling results*

There are also some pollutants which were identified in Table 7 of the ADS as potentially being present in the discharge which have not been assessed by ADS. In order to determine the potential effect of these compounds PDP has therefore reviewed the modelling presented in the Australian report, and on that basis has concluded that the emissions of these compounds will not result in any off-site effects.

9.3 Assessment Conclusion

Based on our review of the assessment set out in the ADS, PDP considers that it is likely that discharges to air associated with the proposal will not result in any adverse off-site effects as long as the concentration of any discharges are no greater than those that have been assessed.

10.0 Recommendation

Based on the assessment conclusion PDP consider that there are no air quality related reasons why a resource consent for discharges to air could not be granted for this activity. PDP has proposed some consent conditions in Appendix A which it considers should be incorporated into a consent if it is granted to ensure that any effects are commensurate with those that have been assessed.

11.0 Limitations

This report has been prepared by PDP on the specific instructions of Horizons Regional Council for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Yours faithfully

PATTLE DELAMORE PARTNERS LIMITED

Prepared by

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Reviewed and Approved by

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Appendix A Proposed Consent Conditions

Proposed Consent Conditions	
Number	**Condition**
	Limit Conditions
	The consent holder shall ensure that discharges to air from the site must not result in any offensive or objectionable odour, dust, smoke or water vapour beyond the boundary of the property.
	The consent holder shall ensure that discharges to air from the site must not result in any noxious or dangerous levels of gases or particulates beyond the boundary of the property.
	The maximum acceptance rate of waste material on the site shall be 40 tonnes per day.
x	The mass emission rates of respirable particulate matter (PM_{10}), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) from each combustion discharge stack shall not exceed: a. 0.0006 grams per second of PM_{10}; b. 0.0003 grams per second of SO_2; and c. 0.0041 grams per second of NO_2.
y	The odour discharge concentration from the odour treatment stack shall not exceed 1,115 OU/second.
	Process Conditions
	The consent holder shall ensure that all waste material received on site is stored inside the processing building.
	The consent holder shall ensure that all doors into the processing build are kept shut, except when waste material is being received or biochar is being removed.
	All biochar shall be handled and processed and dispatched in a manner that minimises the potential for dust generation.
	The consent holder shall ensure that no part of the process is operated unless the odour control system is fully operational.
	The consent holder shall ensure that the pyrolysis plants are not operated if the respective emission control systems are not fully operational.
	The consent holder shall ensure that all external liquid storage tanks are connected to the odour control system.
	Discharges to air from the pyrolysis combustion exhaust stacks and the odour control system discharge stack shall be from vertical stacks unimpeded by any obstruction above the stack that decreases the vertical efflux velocity below that which would occur in the absence of such obstruction. The discharges shall be no less than 15 metres above ground level.
	The pyrolysis chambers shall only be fuelled using liquid petroleum gas or pyrolysis gas.

Proposed Consent Conditions	
Number	**Condition**
z	The processing building shall be operated under sufficient negative pressure to ensure that there are no fugitive odour emissions from the site. At a minimum negative pressure will be no less than -30 Pa.
	Air Quality Management Plan
	The consent holder shall prepare an air quality management plan (AQMP) that sets out how the site shall be operated to meet the requirements of this consent. The consent shall be prepared and submitted to the Horizons Regional Council for certification three months prior to the commissioning of the site. At a minimum the AQMP shall deal with the following matters: i. How waste on site shall be managed to minimise the potential for odour. ii. Maintenance and operation of the odour control system. iii. Maintenance and operation of the combustion gas treatment system. iv. Stack monitoring procedures v. Site monitoring vi. Complaint investigation and reporting vii. Contingency measures for plant operation viii. Reporting The Consent hold shall review the AQMP at least every two years and provide Horizons with the updated document.
	The site shall be operated in accordance with the certified AQMP.
	Monitoring
xx	Within three months of commissioning of the pyrolysis plant, and once every two years thereafter, the consent holder shall sample and measure the contaminant emission rates from each of the combustion discharge stacks, and odour from the odour treatment system stack to determine compliance with conditions x and y of this resource consent. The testing shall be: a. For the commissioning testing the sampling shall be for: 1. PM_{10} 2. Nitrogen dioxide 3. Sulphur dioxide 4. Hydrogen chloride 5. Volatile organic compounds 6. Heavy Metals 7. Dioxins 8. Odour

Proposed Consent Conditions	
Number	**Condition**
	b. For subsequent rounds of testing sampling will be for: 1. PM_{10} 2. Nitrogen dioxide 3. Sulphur dioxide 4. Odour c. In accordance with the applicable United States Environmental Protection Agency method for that contaminant, or an equivalent method with the agreement of the Horizons Regional Council; d. Undertaken by a testing agency that is accredited by International Accreditation New Zealand for each method being used, or accredited by another quality control organisation with the agreement of the Horizons Regional Council; e. Combustion emissions shall be reported as applicable in terms of adjustment to 0 degrees Celsius, 101.3 hectopascals on a dry gas basis and correction to 12 percent carbon dioxide; and f. Reported in a manner that includes but is not limited to a description of all methods used, assumptions made and plant operating conditions at the time of the tests. The test results shall be provided to the Horizons Regional Council, within ten working days of the consent holder receiving the report.
	The consent holder shall prepare a report that compares the results of the commissioning testing required by Condition xxx against the information that was presented in the Application. If any of the measured concentrations are more than 20 percent greater than those presented in the Application, the report shall provide an assessment to demonstrate the off-site impact of the increased concentration against an appropriate assessment criteria. If the concentrations are greater than the assessment criteria, the report shall indicate what actions the consent holder is going to implement to reduce the emissions to an acceptable level.
	In the event that sampling required by Condition xx for routine monitoring identifies that the consent holder is not complying with the limits set out in conditions x or y, the consent holder shall within four weeks of received the test results submit a report to Horizons Regional Council report that outlines the reason for the non-compliance(s) and identifies actions that shall be implemented to ensure compliance.
	Process Monitoring
	The consent holder shall continuously monitor negative pressure in the process building to ensure that it is maintained at the levels required by condition z.
	The consent holder shall continuously monitor pressure drop across the odour control system particulate filters and carbon filters to ensure that they are operating effectively and in accordance with the manufacturer's specification.

Proposed Consent Conditions	
Number	**Condition**
	The consent holder shall undertake monitoring on the carbon filter in accordance with the manufacturer's specification in order to determine the remaining absorptive capacity of the carbon.
	The consent holder shall undertake regular monitoring on the combustion exhaust treatment systems in accordance with the manufacturer's specification to ensure that they are operating optimally. That shall include as a minimum measuring differential pressure across the baghouses or fitting broken bag detectors on the exhaust stacks.
	Maintenance
	All emissions control equipment, including but not limited to the bag house filters and carbon filters, shall be serviced and maintained at least once every twelve months, by a suitably qualified person. Service and maintenance records shall be kept, and provided to the Horizons Regional Council on request.
	All fuel-burning appliances shall be maintained at least once every year, by a person competent in the maintenance of such appliances. This maintenance shall include: a. Adjustment, if necessary, of the fuel to air ratio to optimise combustion; and b. Testing of the ratio of combustion gases discharged, i.e., carbon monoxide, carbon dioxide and oxygen, using a suitably calibrated instrument.
	Contingency
	The consent holder shall develop appropriate contingency measures to ensure that the site meets the consent limits in conditions xxx to xxx. In particular this should cover the risk of offensive and objectionable odours from: 1. Poor quality syngas composition 2. Loss of mains power supply
	Complaints
	A record of all complaints relating to odour or particulate matter caused by the discharge shall be maintained, and shall include: a. The location where the odour or particulate matter was detected by the complainant; b. The date and time when the odour or particulate matter was detected; c. A description of the wind speed and wind direction when the odour or particulate matter was detected by the complainant; and d. The most likely cause of the odour or particulate matter detected and steps taken to address the cause(s). A copy of the record shall be provided to the Horizons Regional Council, within 10 working days of a complaint received by the consent holder, or otherwise on request.

Proposed Consent Conditions	
Number	**Condition**
	Reporting
	The consent holder shall prepare an annual report for submission to Horizons which summarises all of the monitoring required by this consent as well as any complaints received.