Question 14: *Identify all sources or potential sources of volatile organic compounds (VOC), dust, aerosol and odour emissions from the installation. Describe and quantify to the extent possible the emissions from each source or potential source. Describe what is in place or proposed to mitigate the risk of emissions and prevent emissions to the extent possible taking into consideration BAT.*

Response

Table 14.1 overleaf presents the information sought under question 14 above. The information provided is based on current operations (at the time of response) and includes details of all abatement installed to date. In addition, due to the discontinuation of the thermal drying process (with oil at @100^{o}C and air sparging) previously carried out in Tanks 24, 25 and 32 this is not proposed under the new licence. The information is supplemented with the details of the on-going spot check measurements undertaken at the site (using a calibrated PID Analyser) coupled with a subsequent targeted air monitoring survey undertaken by an ISO 17025 Monitoring Team.

Table 14.1: Summary of air emission sources at the Enva Installation

Source	Reference in Table E.1	Nature of Emissions	Level of Emissions	Current Abatement	Proposed Abatement
Oil Intake Area	A4-1 and A4-2	Fugitive VOCs	< 5ppm VOC	Tanker unloading is carried out using dedicated manifolds and hosing. Potential for significant fugitive emissions is normally relatively low. Where waste collections pose a high odour risk vacuum valves have been provided for placement on tanker vent openings to mitigate potential fugitive venting during unloading of potentially odorous waste oils.	None.
Oil Dispatch Area	A4-6 and A4-7	Fugitive VOCs	< 5ppm VOC	Tanker loading is carried out at loading gantries with dedicated manifolds and hosing. Potential for significant fugitive emissions is relatively low.	None.
Waste Oil Storage Tanks	Various see Table 2.1	Minor VOCs	< 5ppm VOC	Storage tanks are normally at ambient temperatures and are not heated (but can receive oils that have been heated). And therefore the potential for significant emissions is low. In Quarter 2 2016, all waste storage tanks vents have been fitted with an air filter (activated carbon) to mitigate the potential for any significant fugitive emissions.	All storage tanks to be routed to the vapour balancing ducting to reduce emissions with provision for venting as necessary through a common activated carbon filter (e.g. A3-52) or alternative abatement process (e.g. the RTO at A2-1).
Waste Oil Heating	Various see Table 2.1	Minor VOCs	< 0.1kg/hour VOC	Similar risk to the Processing Tanks above but oil is only heated to 60^{o}C max. In Quarter 2 2016, all waste storage tanks vents have been fitted with an air filter (activated carbon) to mitigate the	All precipitation tanks to be routed to the vapour balancing ducting and vented as necessary through a common activated carbon filter (e.g. A3-52) or alternative

Source	Reference in Table E.1	Nature of Emissions	Level of Emissions	Current Abatement	Proposed Abatement
				potential for any significant fugitive emissions.	abatement process (e.g. the RTO at A2-1).
Waste Oil Dewatering/ Demetallising Tanks	Various see Table 2.1	Minor VOCs	< 0.1kg/hour VOC	Processing tanks may be heated up to a maximum of 80^{0}C and pose a higher risk of emissions than the storage tanks. In Quarter 2 2016, all processing tanks have been fitted with an air filter (activated carbon) to mitigate the potential for any significant fugitive emissions. Monitoring undertaken by an ISO17025 monitoring team indicated that post abatement, the level of emissions from these tanks with oil at 70-80^{0}C were very low, i.e. circa <10mg/m^3 at low volume flows (circa 20m^3/hr) resulting in a very low mass emission.	All processing tanks to be routed to the vapour balancing ducting and vented as necessary through a common activated carbon filter (e.g. A3-52) or alternative abatement process (e.g. the RTO at A2-1).
Finished Product Storage	Various see Table 2.1	Minor VOCs	< 0.1 kg/hour VOC	Like waste oil storage tanks, the finished product storage tanks are typically at ambient temperatures and are generally not heated. However, in some instances the product may be heated to facilitate pumping/handling (to 20-30^{o}C). In Quarter 1 2016, all storage tanks have been fitted with a filter mechanism (carbon or condensing unit) to mitigate the potential for any significant fugitive emissions. Monitoring undertaken by an ISO17025 monitoring team in May 2016 indicated that during tank filling, the level of discharge post abatement from these tanks were low, i.e. circa 50mg/m^3 at low volume flows (circa 50m^3/hr) resulting in a	All storage tanks to be routed to the vapour balancing ducting and vented as necessary through a common activated carbon filter (e.g. A3-52) or alternative abatement process (e.g. the RTO at A2-1).

Source	Reference in Table E.1	Nature of Emissions	Level of Emissions	Current Abatement	Proposed Abatement
				very low mass emission.	
Tank Cleaning Operation	NA	Minor VOCs	< 0.1kg/hr VOC	During cleaning of the large processing tanks (Tanks 18 & 19) to remove settled solids, there is a significant risk of VOC emissions and odour nuisance (as happened in 2015). To mitigate the risk the operation is currently suspended on site pending the installation of new abatement.	It is proposed to install a new carbon filter in the tank farm (A3-54) that will be periodically used for the short term tank cleaning operation of these three tanks on an annual basis. Vapours will be contained during cleaning (with 5-10 air changes per hour) and ducted to the new filter during cleaning (A3-54).
Oil Filtration Plant	A3-52	Minor VOCs	< 0.1kg/hr VOC	In February 2016, Enva installed a new odour abatement system to capture and treat the previously fugitive emission from this process. A negative air extraction system has been introduced to the enclosed oil filtration plant. All headspace air is ducted to a carbon filter prior to discharge to atmosphere. Monitoring undertaken in May 2016 indicated that at an elevated temperature during tank filling, the level of discharge post abatement from these tanks were low, i.e. circa <50mg/m^3 at low volume flows (circa 2,000m^3/hr) resulting in a very low mass emission.	None (Note: this carbon filter may be relocated to an adjacent location and used to provide abatement for the proposed vapour balancing ducting).
Oil Transfer Equipment	A4-4	Fugitive VOCs	< 5ppm VOC	Fully enclosed pipework with limited potential for emissions once routine maintenance and inspection is maintained. Monitoring to date has shown low levels of fugitive emission (less than 5ppm)	None.

Source	Reference in Table E.1	Nature of Emissions	Level of Emissions	Current Abatement	Proposed Abatement
Tank/Tanker Wash Out Bay/ Waste Repackaging Area	A4-5	Fugitive VOCs	< 5ppm VOC	Open area used for tanker cleaning and repackaging of wastes. All monitoring to date indicates that either in dormant state or during tanker cleaning the observed levels of odour and VOC are low (<5ppm). Low risk for odour nuisance but potentially a risk with variability of odour potential from different wastes.	Enva propose to enclose this area to allow for capture and treat odorous headspace odours. Carbon filter employed proposed to be the same unit proposed for Cleaning Tanks 18 &19 outlined above (A3-54).
Oily waste sorting, shredding & Repackaging (Building K)	A4-8	Fugitive VOCs	< 5ppm VOC	Low odour risk as ambient temperatures and low volatility of any residual oil. All monitoring to date indicates that the observed levels of odour and VOC are low (<5ppm).	None.
Waste Paint Sorting & De-packing; (Building K)	A4-9	Fugitive VOCs	< 10ppm VOC	As above, all work is undertaken at ambient levels but greater potential for fugitive emissions exists for oil based paints. All monitoring undertaken in the area to date indicates that in such circumstances the levels are localised with low risk of emissions outside of the building.	Enva is currently installing a localised extraction and treatment (activated carbon) system for this process but there will be no emissions to atmosphere and the system will recirculate air within the building.
Waste Processing & Repackaging (Building J)	A4-11	Fugitive VOCs	< 5ppm VOC	Low odour risk as ambient temperatures of all material and all drums and containers are fully closed in this area. Crushing of fluorescent tubes currently suspended. All monitoring to date indicates that the observed levels of odour and VOC are low (<5ppm).	None.
Wastewater Interceptor	A3-53	Fugitive VOCs and H_2S	<0.1kg/hr	In the tank farm there is a newly replaced interceptor that assists in the oil/effluent separation process. As the water may be	None

Source	Reference in Table E.1	Nature of Emissions	Level of Emissions	Current Abatement	Proposed Abatement
				hot (40-75^{o}C) there is the potential for emissions. Enva recently replaced the previous unit with a new covered interceptor and installed an extraction system to treat extracted headspace air, consisting of a caustic scrubber coupled with a carbon filter. Monitoring undertaken by an ISO17025 monitoring team in May 2016 indicated that the level of discharge post abatement from these tanks were low (i.e. less than 0.1kg/hr).	
Effluent Holding and Treatment Tanks	6 in total, see Table 2.1	Minor VOCs	< 0.1kg/hour VOC <1 ppm H_2S	As above, effluent may enter the tank at elevated temperatures (40-70^{o}C) but the tanks are not directly heated. Limited potential for VOC emissions but potential exists during tank filling (displaced headspace). In Quarter 2 2016, all effluent tanks have been fitted with an air filter (copper impregnated & standard activated carbon) to mitigate the potential for any significant fugitive emissions of VOCs and H_2S.	All effluent tanks to be routed to the vapour balancing ducting and vented as necessary through a common activated carbon filter (e.g. A3-52) or alternative abatement process (e.g. the RTO at A2-1).
Effluent Treatment Plant	A4-13	Fugitive VOCs and H_2S	< 5ppm VOC <1 ppm H_2S	Potential for fugitive emissions exists as effluent may be hot (40-70^{o}C) during processing. Emissions are mitigated as the effluent is treated with agents to neutralise the potentially odorous compounds prior to entering the plant. Extraction system provided in the area which includes a misting system for odour neutralisation if required.	None.
Soil Recovery	A4-10	Fugitive	< 5ppm VOC	Mobile water/odour abatement misting	Planning consent has been sought

Source	Reference in Table E.1	Nature of Emissions	Level of Emissions	Current Abatement	Proposed Abatement
Building		Dust, VOCs and Bio-aerosols	<1 ppm H_2S	unit. Northern and eastern facades of the building closest to sensitive receptors have been enclosed since March 2016.	to fully enclose the building and mitigate the potential for any fugitive release. Additional misting equipment planned for soil screening equipment.
Steam Raising Boiler	A1-1	Combustion Gases	CO: <2mg/Nm^3; NO_X: <150mg/Nm^3; SO_x: <10mg/Nm^3	None	None

Question 15: *In relation to the proposal to install a regenerative thermal oxidiser, provide the following information*

Response

a) Describe in detail the nature of the gas stream to be oxidised

As stated it is not proposed to recommence the previously employed thermal drying technique (where oil, heated to circa 100^{o}C, was air sparged to remove residual water) therefore, the requested air monitoring programme relating to this process was not carried out. It is however proposed to introduce an alternative thermal drying technique which would operate as a continuous process rather than the past and current batch methods. This continuous process (Flash Distillation) is still under final design but would operate whereby the oil is heated to approximately 170^{o}C (by means of a steam powered heat exchanger) while being pumped in a pipeline to place it under positive pressure prior to entry into an (enclosed) expansion vessel. The sudden exposure to the larger volume of the expansion vessel (and small vacuum ~100 millibars) immediately depressurises the liquid causing the more volatile components (including water) to become gaseous where they can be separated from the liquid oil stream. The gaseous fraction (mainly water but including VOCs) would be routed to the proposed Regenerative Thermal Oxidiser (RTO) for treatment.

Further work remains to characterise the full nature and composition of the gaseous stream that this process would generate however this will include the water and more volatile hydrocarbon fractions. This will be characterised after the design is finalised and used to ensure that RTO is sized appropriately. Furthermore once the proposed vapour balance ducting is installed in the main tank farm the combined emissions from all the waste storage and processing tanks can be more easily characterised than is currently the case (due to the number of separate emission points for the tanks). The vapour balancing system will also reduce the mass emissions from the tank farm due to the effect of vapour balancing (i.e. the displaced air from one tank returns to the tank being emptied potentially without the need for any air to be discharged to atmosphere.

The potential for Dioxin formation has also been considered in the design of the RTO and has been determined not to present a significant risk. Dioxin formation is generally associated with the presence of chlorinated compounds in the air stream being treated in a thermal oxidiser. The potential for significant concentrations of chlorinated compounds in the exhaust air from the oil drying process is considered very low (primarily as the use of these compounds is very limited and well regulated). The proposed RTO supplier (Durr) currently has several RTO units operating within Ireland some of which have relatively high levels of chlorinated compounds (up to 10g /Nm^3). These RTOs are operated at the same temperature (850^{o}C) as the RTO proposed for the installation and monitoring of their emissions has demonstrated no significant dioxin formation occurring (<0.1ng/m^3). As such, the high temperature of the RTO coupled with the absence of elevated chlorinated solvents in the waste stream means the dioxin risk is very low.

b) Describe in detail the operation of the RTO. In particular state how the operating temperature and residence time will be maintained.

Step 1 Capture & Preheat: The warm moist airstream from the flash distillation process (and any additional sources such as the proposed vapour balancing ducting) will be captured by new ductwork to be installed and delivering the airstream to an initial preheat step to increase the temperature to over 110^{o}C. This is to ensure there are no air droplets in the airstream and prevent corrosion in the RTO. The preheat step will be facilitated by a heat exchanger with the heat feed being provided by steam from the existing steam raising boiler.

Step 2 Thermal Oxidation: Subsequent to the pre-heat step the exhaust airstream is then drawn into the RTO by the RTO fan.

Step 2a: Once within the RTO the exhaust stream is directed alternately by time controlled dampers to the appropriate zones of hot ceramic heat exchanger media. The heat exchanger bed is comprised of three regenerator columns of ceramic media. At any given moment, the exhaust stream moves upwards through the media taking on heat and raising the temperature (to approximately 780 °C) such that the odorous/VOC compounds start to oxidise.

Step 2b: The air is then routed through to the combustion chamber in the upper section of the RTO. In the combustion chamber of the RTO, the natural gas fired burner increases the temperature of the exhaust gas to at least 850 °C, thus completing the oxidation process. The gas feed is varied depending on the load on the RTO and is increased or decreased as necessary to ensure the operating temperature is maintained. The temperature is controlled by separate independent Thermocouples one in the top of each tower and by the burner. In addition there is a high temperature and a low temperature monitor in the combustion chamber that will alarm and shut down the RTO (and the input vapour stream via an interlock) if the temperature gets too low. The residence time (1 second) cannot change as the combustion chamber is fixed in volume so the residence time is depends solely on the airflow through the unit and the plant will provide the necessary residence time at the maximum airflow and achieve the emission limits required.

After the combustion chamber the oxidised airstream then travels up through one chamber and then down through another to facilitate heat transfer (back into the ceramic media) before being discharged to atmosphere through the exhaust stack. There are 3 chambers of ceramic media in the RTO, and the airstream travel path is altered depending on the temperature in each of the chambers. The airstream will travel through 2 of the 3 chambers, the path being controlled by the valves at the bottom of the chambers – they open and close on a cyclical basis, determined by the temperature in each of the chambers.

In the RTO, part of the clean air flows through one of the two upward zones in order to purge the zone prior to entering the clean side. Due to this mode of operation, one of the columns is always purged clean preventing any pollutant leaks during switching over of the RTO inlet valves.

The RTO is started and heated up at a reduced flow rate by the natural gas burner system. For safety reasons, the RTO will be operated for start-up and shut-down only with fresh air.

The system is designed for a high thermal efficiency to reduce the energy consumption of the burner to a minimum. Any VOC/hydrocarbon loading in the exhaust air provides additional energy for the oxidation process. The potential for additional heat recovery was considered as part of the design and discussed with the proposed supplier of the RTO. However because the proposed system is highly efficient in recovering heat with an outlet temperature of only circa 120^{o}C it is not currently proposed to install such a heat recovery system.

The RTO requires approximately 90 minutes to come up to the required temperature (850^{o}C) from a cold start. As the oil drying process also entails heating of the oil this is straightforward to interlock the system such that drying will not commence until the RTO is operating at the required temperature of 850^{o}C. In any case it is proposed that the RTO can be automatically set to start at a particular time and thus be available at the operating temperature when required.

See also **Attachment 15,1** Functional Description of Proposed RTO

c) Provide evidence that the Proposed RTO is designed and sized to have the capacity to process the worst case loading of hydrocarbons and other pollutants in the waste gas. State how many oil tanks will be connected to the RTO and/or operated at any one time and state the relevant design parameters in this regard.

Until the design of the proposed flash distillation system is completed the gaseous stream generated by the newly proposed waste oil drying process cannot be fully characterised and therefore it is not yet possible to provide the requested evidence. However the design of the system will take into account the sizing of the RTO and provide for a worst case scenario. In any case the process could be stopped almost immediately if the loadings exceeded the design value (based on RTO performance monitoring).

If the RTO is installed then the proposed vapour balancing duct (which will connect all waste oil storage and processing tank vents) could then be connected to the RTO instead of discharging through the existing carbon filter (A3-52). This effectively means all vents from waste storage/processing tanks would be abated by the RTO instead of a carbon filter.

Abnormal Operation & Safety Measures

In the event that the RTO shuts down for any reason, an emergency valve will automatically open and allow the exhaust air to bypass the RTO and discharge to the atmosphere via the proposed RTO stack. The flash distillation process drying the oil will also be stopped in an orderly and safe manner and no drying will take place subsequently until the RTO is operating correctly and the operating temperature is at least 850^{o}C. All such events will be recorded and communicated to the Agency.

In the event of a by-pass of the RTO an alarm will provide visual and audible indication of the by-pass to production operators and a controlled shutdown of the drying process will take place. All by-pass events will be recorded and reported to the Agency.

The system has been designed to prevent the establishment of a potentially explosive atmosphere within the ductwork system prior to treatment in the RTO. This involves the provision of LEL sensors monitoring in the exhaust ductwork to ensure that the maximum concentration of VOCs in the exhaust is maintained below 25% LEL by controlling the addition of dilution air and isolating the header in the event of LEL's above 25% (bypassing the RTO). See schematic of the RTO in the more detailed functional Description of the RTO.

d) State how particulates should they arise in the gas stream, will affect the operation of the regenerative thermal oxidiser, or outline what measures are to be taken to avoid the passage of particulates to the oxidiser.

The processes generating the gas stream for oxidization in the proposed RTO are:

i) the proposed Flash Distillation unit which will only process waste oils that have already been filtered through very fine filters (<100 micron) and therefore present very low potential for any significant particulates to arise.

ii) Vapour balancing system – this manifold will facilitate the vapours from all the waste oil storage and processing tanks being transferred between the tanks and reduce the volume of emissions to air. The vapours from tanks are only fugitive and will not have any significant level of particulates present. The vapour balancing system will be inclined so as drain to a small condensate tank at the opposite side of the take off for the RTO thus reducing the loading on the RTO and potential for particulates (which would also drain to the condensate tank.

Certain substances if present in the exhaust air (e.g. silicon) can potentially lead to the formation of dust/particulates in the RTO unit which if not removed can build up and block the ceramic heat exchanger packing over time. The proposed system provides easy access for cleaning the ceramic heat exchanger packing when build ups occur in order to reduce the required down time for this cleaning to a minimum. A spare layer of ceramic media (used in the heat exchanger) will be provided to facilitate the removal of a layer for cleaning and replacement with the spare layer.

e) Describe in detail the nature of the oxidised gas stream. The following details are pertinent: constituents and concentrations, oxygen content, dioxins & furans, moisture content, temperature and flow rate:

The proposed abatement system will significantly reduce the existing impact associated with the facilities current emissions to atmosphere. Thermal oxidation is widely acknowledged as the most effective odour abatement technique and the proposed RTO supplier (Durr) provide a performance warranty of at least 95% abatement in relation to organic odours. Thermal oxidation can also achieve very high destruction rates for inorganic odorous compounds and will deliver at least a 95% reduction in Hydrogen Sulphide, Ammonia and Mercaptans. While the proposed system is primarily an odour abatement system it will in tandem result in a significant reduction in the concentrations of VOCs being emitted currently. Thermal Oxidation can routinely deliver in excess of a 95% reduction in the concentrations of VOCs in an exhaust airstream.

Oxidised Exhaust Stream Characteristics

Removal efficiency of organic odours	> 95	%
TOC	$\leq$ 20	mg/Nm³
CO	$\leq$ 100	mg/Nm³
NOx	$\leq$ 200	mg/Nm³
Purified air temperature at outlet	123 - 140	°C
Flow Rate	30,000Nm^3/hr	
Moisture content	45% of intake concentration	
Oxygen Concentration	~10	%

f) Propose for the Agency's consideration, based on the manufacturers recommendation or from other sources: the emission parameters that should be regulated, appropriate emission limits, minimum release height; the facilities for sampling the emitted gas and a programme or frequency for monitoring regulated parameters, taking into account the need if it exists, for continuous monitoring of emissions for VOC and flowrate.

The proposed emissions stack associated with the RTO will be located in close proximity to the existing boiler stack and will have a minimum height of 13m (i.e. 3 m higher than the adjacent buildings/tanks) but not exceed the height of existing boiler stack at the facility (~19m). In the air dispersion model submitted in this application, the emission height is presented as a minimum of 10m as a conservative approach. If the actual emissions are at heights of 13 to 18m then the impacts will be lower than those presented in the air dispersion model report.

The emissions stack will have a permanent ladder to access an access platform approximately 5-6m above ground level (with safety rails provided) fixed to the stack to facilitate monitoring of stack emissions. A sampling port will be provided a further 1.5m above the platform so that it is at least 5 stack diameters higher than the air inlet from the RTO and at least 3 stack diameters below the stack height (presuming this meets the EPAs requirements).

Proposed Parameter Limits & Monitoring Frequency

The proposed RTO system would include recording of the following parameters:

Monitoring Parameter	Frequency of Monitoring	Parameter Limit
Combustion chamber temperature:	monitored and recorded continuously;	850^{o}C Minimum
Flow rate	monitored and recorded continuously;	30,000m³ /hr Maximum
LEL Meters	monitored and recorded continuously;	N/A
TOC	quarterly;	20 mg/Nm³ Maximum
CO	quarterly	150 mg/Nm³ Maximum
NOx	quarterly	350 mg/Nm³ Maximum
Dioxins	annually	0.1 ng/Nm^3 Maximum

Based on the Air Dispersion model results the emissions will have negligible impact on the surrounding air quality (even at an emission height of 10m) and therefore the need for continuous monitoring of TOC is considered to be very low. While continuous TOC monitoring is not considered necessary this can be discussed further with the Agency and installed if considered appropriate.

Question 16: *In order to generate data sought under item 15a above, in relation to emissions from waste oil drying tanks, and in the context of a proposal to install a regenerative thermal oxidiser a programme of processes and emissions monitoring is required. The purpose of this monitoring programme is to demonstrate that the proposed regenerative oxidiser is designed and sized to have the capacity to treat hydrocarbons and other pollutants in the waste gas and so that the nature of the emissions from the oxidiser can be properly described and regulated.*

Response:

Enva is not proposing to recommence the previous form of thermal drying technique where oil, heated in batches to ~100^{o}C, was air sparged to remove residual water. Therefore the requested monitoring of air emissions from this process to ensure the correct sizing of the Regenerative Thermal Oxidiser (‘RTO’) is not necessary and was not progressed.

However, notwithstanding the current dewatering process (employed since January, 2016) under which chemical demulsification alone has been used in the final stages of the recovery process to remove water from the oil being recovered, Enva are proposing to introduce an alternative thermal drying technique which would be carried out in a continuous manner rather than the previously employed batch mode. This process would be more thermally efficient that the previous batch mode and also provide greater operational efficiencies. The thermal drying process currently under consideration is a process whereby the oil would be heated in a pipeline by means of a steam powered heat exchanger and placed under pressure prior to entry into an expansion vessel where the more volatile components would become gaseous and be removed from the liquid oil stream. The gaseous fraction (mainly water but including VOCs) would be routed to an RTO for treatment before discharging to the atmosphere via a new chimney stack adjacent to the existing stack associated with the sites boiler.

As detailed further in Item 15 once design of the proposed new thermal oil drying process is completed it will include further details of the composition and flow rates of the airstream to be treated by the RTO and ensure the RTO is adequately sized to meet BAT (See submission in relation to question 15). Emissions from the RTO unit will be designed to meet the BAT emission limits for VOCs of 20mg/Nm^3 and therefore the system will be sized and designed to ensure this.

This new process for thermal drying of oils will not be deployed until an RTO plant of sufficient capacity has been approved by the Agency installed and commissioned.

Question 17: *Provide an air dispersion model to describe the impact of emissions from the proposed regenerative thermal oxidiser on air quality in the vicinity of the installation for the following parameters:*

- *NO_x*
- *CO*
- *VOC*
- *NMVOC (Non-methane VOC); and*
- *Any other relevant constituent itemised in accordance with 16 above*

The model and your air dispersion model report should be prepared in accordance with Air Dispersion Modelling from Industrial Installations Guidance note, AG4 (EPA, 2010)

Justify the quantification of all values input to the model.

The sensitive receptors chosen for the model shall include the areas where complainants are located.

Response

See attached report.

Enva Ireland Limited

Air Dispersion Model Report

Document Control Sheet

Client:	Enva Ireland Limited
Project Title:	IED Licence Review – Air Dispersion Model
Document Title:	Air Dispersion Model Report
Document No:	MDE0973Rp0103

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TABLE OF CONTENTS

1 INTRODUCTION

Enva Ireland Limited operates under an Industrial Emissions Licence (Register No. W0184-01) from the EPA for the facility in Clonminam Industrial Estate, Portlaoise, County Laois. On the 26th January 2016, the EPA gave notice to Enva Ireland Limited that the EPA was initiating a review of the licence in accordance with the provisions of Sections 90(4) and 98A of the EPA Act 1992 as amended.

The EPA notification contains a detailed list of information that is sought as part of the review and Requirement 17 requires Enva to submit the following:

Prepare and air dispersion model to describe the impact of the proposed regenerative thermal oxidiser on air quality in the vicinity of the installation for the following parameters:

- *NO_x*
- *CO*
- *VOC*
- *NMVOC*
- *any other relevant constituent itemised in accordance with item 16 above.*

The model and your air dispersion model report should be prepared in accordance with Air Dispersion Modelling for Industrial Installations AG4 (EPA, 2010). Justify the quantification of all values input to the model.

The sensitive receptors chosen for the model shall include the areas where complainants are located.

This report sets out to comply with this requirement to simulate the potential impact of the proposed regenerative thermal oxidiser (RTO, A2-1).

2 METHODOLOGY

2.1 MODELLING APPROACH

To simulate the potential impact of the RTO, emissions have been assessed using a standard air dispersion modelling assessment. The assessment has followed the procedures presented in the EPA Guidance Note AG4 “Air Dispersion Modelling for Industrial Installations”.

The model used for Air Dispersion Modelling is the US EPA approved AERMOD Prime model, which is the current regulatory model in the US and a recommended model under the EPA guidance. This model is a third generation model utilising advanced boundary-layer physics. AERMOD is run with a sequence of hourly meteorological conditions to predict concentrations at receptors for averaging times of one hour up to a year. It is necessary to use many years of hourly data to develop a better understanding of the statistics of calculated short-term hourly peaks or of longer time averages.

2.2 SOURCE INFORMATION

The emissions from proposed RTO (A2-1) are presented as the source information, i.e. proposed stack height, cross sectional diameter, volume flow and temperature are derived from the details presented in Tables E.1 (ii) and (iii) prepared in response to Requirement 9 of the EPA request and these are presented in **Table 2.1**.

The RTO is designed to abate the potential for VOC emissions from the process and hence VOC emissions are the primary pollutant of relevance to this assessment. All work carried out to date on the site indicate that these VOC emissions are largely aromatics and saturated alkanes and there is no potential for methane formation. In this regard, VOCs and NMVOCs (non-methane volatile organic compounds) are the same parameters and are referred to as VOCs in this assessment. The limit expressed in BAT 41 of the BREF for the Waste Treatment Industries is proposed as the ELV.

Combustion gases such as NO_x and CO are not typically considered as emissions from an RTO and hence these are not included in Table E.1(iii) for A2-1 prepared in response to Requirement 9 of the EPA request. However, for the purposes of meeting the EPA requirements, these gases have been included in this simulation for the RTO at the ELVs recommended in the TA Luft 2002. There is no specific BAT or TA Luft limit for CO that may be applied so a standard TA Luft limit for a gas fired combustion source is applied.

All of the relevant emission values employed in the model are presented in **Table 2.1** along with details of the source of this information.

Parameter	A2-1	Note
Grid Reference	646055, 697812	-
Emission Height (m)	10	-
Diameter (m)	0.5	-
Volume Flow (m^3/hr)	30,000	-
Temperature (^{0}C)	150	-
Total VOCs (as C) (mg/m^3)	20	BAT 41 Waste Treatment Industries
NO_x (mg/m^3)	350	Paragraph 5.2.4 TA Luft 2002
CO (mg/m^3)	150	Typical TA Luft Limit

Table 2.1: Air Dispersion Model Source Information

2.3 PATHWAY INFORMATION

The most important parameters governing dispersion in the atmosphere are wind speed, wind-direction and the stability or turbulence of the atmosphere. These parameters along with the ambient temperature and inferred mixing heights for each hour were included in the modelling using data from an appropriate met station with validated met data. Three years (2009, 2011 and 2012) of met data have been employed in the model as per the AG4 guidance note and the year that predicted the highest results for the key averaging periods was 2011.

2.4 RECEPTOR INFORMATION

A set of discreet receptors have been incorporated into the model to simulate the impact of the proposed operation of RTO on the residential receptors in the area. As per the EPA request, the complainants in Old Knockmay Road, Marian Avenue and Rockview are included in the model and these are listed in **Table 2.2**.

Reference	Location	Type	Grid Reference
R1	37/38 Rockview	Residential	645897, 697941
R2	48/49 Rockview	Residential	645948, 697997
R3	29/30 Rockview	Residential	646006, 698032
R4	19/20 Rockview	Residential	646057, 698068
R5	11/12 Rockview	Residential	646110, 698108
R6	1 Marian Avenue	Residential	646352, 697889
R7	88 Marian Avenue	Residential	646283, 697842
R8	Old Knockmay Road	Residential	646257, 697760

Table 2.2: Air Dispersion Model Receptor Information

2.5 ASSESSMENT CRITERIA

In May 2008, the European Commission introduced a Directive on ambient air quality and cleaner air for Europe (2008/50/EC), which has been transposed into Irish Legislation through the Air Quality Standards Regulations (S.I. 180 of 2011). The relevant limits specified under the regulations are presented in **Table 2.3**. These limits are mainly for the protection of human health and are largely based on review of epidemiological studies on the health impacts of these pollutants.

Pollutant	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	50% until 2001 reducing linearly to 0% by 2010	200 µg/m³ NO_2
	Annual limit for protection of human health	50% until 2001 reducing linearly to 0% by 2010	40 µg/m³ NO_2
	Annual limit for protection of vegetation	None	30 µg/m³ NO + NO_2
Benzene	Annual limit for protection of human health	100% until 2003 reducing linearly to 0% by 2010	5 µg/m³
Carbon Monoxide	8-hour limit (on a rolling basis) for protection of human health	50% until 2003 reducing linearly to 0% by 2005	10 mg/m³

Table 2.3: Ambient Air Quality Limits as specified in S.I. 180 of 2011

There is no limit for VOCs in general as different VOCs have differing levels of health impact. Benzene is a known carcinogen and is widely present in the environment from petrol exhaust and hence there is a limit for benzene. While there is no evidence to suggest any benzene is emitted by the Enva facility, the benzene is used as a conservative parameter for determining the impact of Total VOC emissions.

NO_x and CO have specific ambient air quality limits for the protection of human health and these are used as a comparator for impact for these parameters.

2.6 BACKGROUND DATA

2014 background data for the area has been incorporated into the model to determine the impact of the proposed stacks on top of the background relative to the limits. Background data for the Portlaoise area is derived from the EPA "Air Quality in Ireland 2014, Key Indicators of Ambient Air Quality". The Portlaoise monitoring site is located at the Fire Station on the Dublin Road and the data presented in **Table 2.4** refers to data collected between 29 July 2014 and 31 December 2014.

Pollutant	Averaging Period	2014 Data	Limit
Nitrogen Dioxide (NO_2)	Annual Average	16 µg/m³	40 µg/m³
	Maximum 1-hour	57 µg/m³	200 µg/m³
Oxides of Nitrogen (NO_x)	Annual Average	27 µg/m³	30 µg/m³
Carbon Monoxide	Maximum 8-hour	0.5 mg/m³	10 mg/m³
Benzene	Annual Average	0.34 µg/m³	5 µg/m³

Table 2.4: Background Data employed in the model

3 MODEL RESULTS

3.1 TOTAL VOCS

VOC modelling has been carried for the RTO operating at the emission characteristics presented in **Table 2.1**. It is conservatively assumed that the RTO will operate continuously for 24 hours per day 7 days per week for the full year. The results of the VOC modelling are presented in **Table 3.1** for each of the receptors. The results are presented as annual average impact in line with the benzene limit which is used as comparator for this assessment. Background levels for the Portlaoise area are also included.

Reference	Background (μg/m^3)	Enva Impact (μg/m^3)	Cumulative Impact (μg/m^3)	Comparator Limit (μg/m^3)
R1	0.34	0.136	0.476	5
R2		0.186	0.526	
R3		0.283	0.623	
R4		0.308	0.648	
R5		0.287	0.627	
R6		0.249	0.589	
R7		0.259	0.599	
R8		0.261	0.601	

Table 3.1: Results of VOC Modelling (annual averages)

The results indicate that the cumulative impact of the Enva operation on top of the 2014 benzene background will not give rise to levels that breach the annual limit for benzene. The maximum level will be less than 13% of this limit.

The highest levels detected are at R4 to R5 which are to the north east of the site at Rockview and Marian Avenue. This not surprising given the prevailing wind in the area is south westerly dictating the spatial trend for annual results.

3.2 OXIDES OF NITROGEN

NO_x modelling has been carried for the RTO operating at the emission characteristics presented in **Table 2.1**. It is conservatively assumed that the RTO will operate continuously for 24 hours per day 7 days per week for the full year. The results of the NO_x modelling are presented in **Table 3.2** (as annual averages) and **Table 3.3** (for 1-hour averages) for each of the receptors. Background levels for the Portlaoise area are also included.

Reference	Background (µg/m³)	Enva Impact (µg/m³)	Cumulative Impact (µg/m³)	Limit (µg/m³)
R1	16	1.81	17.81	40
R2		2.03	18.03	
R3		2.78	18.78	
R4		3.67	19.67	
R5		4.04	20.04	
R6		7.00	23.00	
R7		6.12	22.12	
R8		3.51	19.51	

Table 3.2: Results of NO_2 Modelling (annual averages)

The annual average levels contributed by the RTO at Enva are 5-17% of the limit for the protection of human health. However, when combined with the background levels, the overall impact remains low and will not breach the limit. As with VOCs, the maximum concentrations are observed to the north east of the site at Rockview and Marian Avenue.

Reference	Background (µg/m³)	Enva Impact (µg/m³)	Cumulative Impact (µg/m³)	Limit (µg/m³)
R1	16	31.67	47.67	200
R2		33.68	49.68	
R3		40.43	56.43	
R4		49.15	65.15	
R5		53.55	69.55	
R6		73.78	89.78	
R7		61.30	77.30	
R8		42.12	58.12	

Table 3.3: Results of NO_2 Modelling (1-hour averages as 98th percentile)

The 1-hour data show similar compliance with the 1-hour limit and the higher concentrations are observed to the east of the site (R6 and R7).

3.3 CARBON MONOXIDE

CO modelling has been carried for the RTO operating at the emission characteristics presented in **Table 2.1**. It is conservatively assumed that the RTO will operate continuously for 24 hours per day 7 days per week for the full year. The results of the CO modelling are presented in **Table 3.4** for each of the receptors as 8-hour averages. Background levels for the Portlaoise area are also included.

Reference	Background (mg/m³)	Enva Impact (mg/m³)	Cumulative Impact (mg/m³)	Limit (mg/m³)
R1	0.5	0.030	0.530	10
R2		0.033	0.533	
R3		0.033	0.533	
R4		0.032	0.532	
R5		0.032	0.532	
R6		0.037	0.537	
R7		0.053	0.553	
R8		0.047	0.547	

Table 3.4: Results of CO Modelling (8-hour averages)

The results of the modelling of CO indicate that at the typical TA Luft guideline of 150mg/m³ specified in **Table 2.1**, the impact will be negligible on the sensitive receptors in the area. The impact is circa 10% of the background level and the combined impact of background and the RTO is less than 6% of the limit for the protection of human health.

4 CONCLUSIONS

This report sets out to comply with the EPA requirement to simulate the potential impact of the proposed regenerative thermal oxidiser (RTO, A2-1) using an air dispersion model.

A set of proposed emission concentrations derived from BAT and TA Luft have been used to simulate the impact to the environment using the US EPA approved AERMOD Prime dispersion model. While the principle emission parameter is VOCs, the EPA has sought additional parameters to be employed in the model and these are also presented.

Impacts are presented as the maximum ground level concentration at the nearest sensitive receptors for all parameters for a range of relevant averaging periods for direct comparison with the limits for the protection of human health.

For all parameters modelled both the short term and long term ground level concentrations are predicted to be below the statutory limits for the protection of human health.

This report concludes that the operation of the RTO at the limits and characteristics presented in **Table 2.1** will not have a significant adverse impact on the air quality in the vicinity of the Enva facility.