Appendix E1: Location of Emissions Points

NAME		LABEL
A2-1	● (blue)	STACK AIR EMISSION/MONITORING POINT
A2-2	● (blue)	EMERGENCY GENERATOR AIR EMISSION
AA1-1	● (blue)	DOWNWIND ODOUR MONITORING
AA1-2	● (blue)	UPWIND ODOUR MONITORING
SW1	● (yellow)	SURFACE WATER DRAINAGE OUTFALL EMISSION
MSW1-1	● (yellow)	SURFACE WATER MONITORING CHAMBER 1
MSW1-2	● (yellow)	SURFACE WATER MONITORING CHAMBER 2
GW1	● (green)	GROUNDWATER PERCOLATION AREA EMISSION
MGW1-1	● (green)	GROUNDWATER PURAFLO MONITORING CHAMBER
AGW1-1	● (green)	UPSTREAM GROUNDWATER MONITORING WELL
AGW1-2	● (green)	DOWNSTREAM GROUNDWATER MONITORING WELL 1
AGW1-3	● (green)	DOWNSTREAM GROUNDWATER MONITORING WELL 2
N1	● (red)	STACK NOISE EMISSION
N2	● (red)	AIR CONDENSOR NOISE EMISSION
N3	● (red)	TURBINE COOLING NOISE EMISSION
N4	● (red)	FAN TURBINE BUILDING NOISE EMISSION
N5	● (red)	COMPRESSOR LOUVER GRIDS NOISE EMISSION
N6	● (red)	COOLING OVEN GRID NOISE EMISSION
AN1-1	● (red)	AMBIENT NOISE MONITORING 1
AN1-2	● (red)	AMBIENT NOISE MONITORING 2
AN1-3	● (red)	AMBIENT NOISE MONITORING 3
AN1-4	● (red)	AMBIENT NOISE MONITORING 4
AA2	● (blue)	WEATHER MONITORING STATION

REV.	DESCRIPTION.	BY.	APPR.	DATE.
A.	ISSUED FOR WASTE LICENCE	KKG	NK	????

CLIENT. INDAVER

INDAVER IRELAND
4 HADDINGTON TCE
DUN LAOGHAIRE
CO. DUBLIN
TEL: +353 1 2145830
FAX: +353 1 2807865

PROJECT.
70MW
WASTE TO ENERGY FACILITY
CARRANSTOWN

TITLE.
PROPOSED EMISSIONS
AND MONITORING POINT LOCATIONS

McElroy Associates
Consulting Engineers
72 Haddington Road, Ballsbridge, D4.
Tel: 660 9000 Fax: 660 9099
E Mail: info@mea.ie

DESIGNED: NK	CHECKED: NK	APPR'D: NK
DRAWN: KKG	DATE: MAY' 08	SCALE: 1:1000 @ A0

DRG.No. 15013\WL\013 REV. A

Appendix E2: Point Source Emission Tables E.1 (ii) (a) and E.1 (iii) (a)

TABLE E.1(ii)(a) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-1
Source of Emission:	Waste to energy plant (stack)
Location :	Main process building - See drawing 15013\WL\013 in Appendix E1
Grid Ref. (12 digit, 6E,6N):	306331E, 270963N
Vent Details Diameter: Height above Ground(m):	 2m 65m
Date of commencement:	Hot commissioning of the facility will commence 24 months after construction begins, expected September 2010

Characteristics of Emission :

(i) Volume to be emitted:			
Average/day	3,528,000 Nm^3/d[1]	Maximum/day[2]	4,896,000 Nm^3/d
Maximum rate/hour	204,000 Nm^3/h	Min efflux velocity	17.8 m/sec

(ii) Other factors			
Temperature	150°C(max)	130°C(min)	140°C(avg)
For Combustion Sources: Volume terms expressed as :	☐ wet.	✓ dry.	11 %O_2

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)[3]	60 min/h 24 h/day 318 day/y

[1] Based on a maximum annual average flowrate of 147,000 Nm^3/h.
[2] Based on a maximum 24 hour average flowrate of 204,000 Nm^3/h. Note emissions at this flowrate are only representative of potential maximum daily emissions and not annual emissions.
[3] Based on an average of 7,500 hours operation per year

TABLE E.1(iii)(a): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: A2-1

Parameter[4]	Prior to treatment				Brief description of treatment	As discharged [5]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.[6]		kg/year	
	Avg	Max	Avg	Max		Avg[7]	Max[8]	Avg	Max	Avg	Max
Dust	2,000	3,000	294	612	Baghouse filter	5	10	0.74	2.04	6,439	17,870
SO_2	658	1,664	97	339	Spray dryer absorber / lime slurry	40	50	5.88	10.20	51,509	89,352
NO_x (as NO_2)	160	160	24	33	SNCR	160	200	23.5	40.8	206,035	357,408
Hg	0.2	0.5	0.03	0.10	Clay injection / baghouse filter / activated carbon	0.04	0.05	0.006	0.01	52	89
HCl	1,472	2,984	216	609	Spray dryer absorber / lime slurry	8	10	1.18	2.04	10,302	17,870
HF	10	30	1.47	6.12	Spray dryer absorber / lime slurry	0.8	1	0.12	0.20	1,030	1,787

[4] All values are at standard conditions of: T=273 Kelvin, P=101.3 kPa, 11% O_2 dry gas. All heavy metals measurements include compounds e.g. Cd represents Cadmium and its compounds

[5] All values are relevant for the sample period specified under Directive 2000/76/EC. For Cd, Tl, Hg and Heavy Metals categories the sample period is between 30 minutes and 8 hours. For dust, TOC, HCl, HF, CO, SO_2 and NO_x the sample period represented in Table E.1 is 24 hours.

[6] The average discharge is based on the maximum annual average flowrate of 147,000 Nm^3/h as modelled in Section 7 of the EIS. The maximum discharge is based on the maximum 24 hour average flowrate and should only be considered for this timeframe.

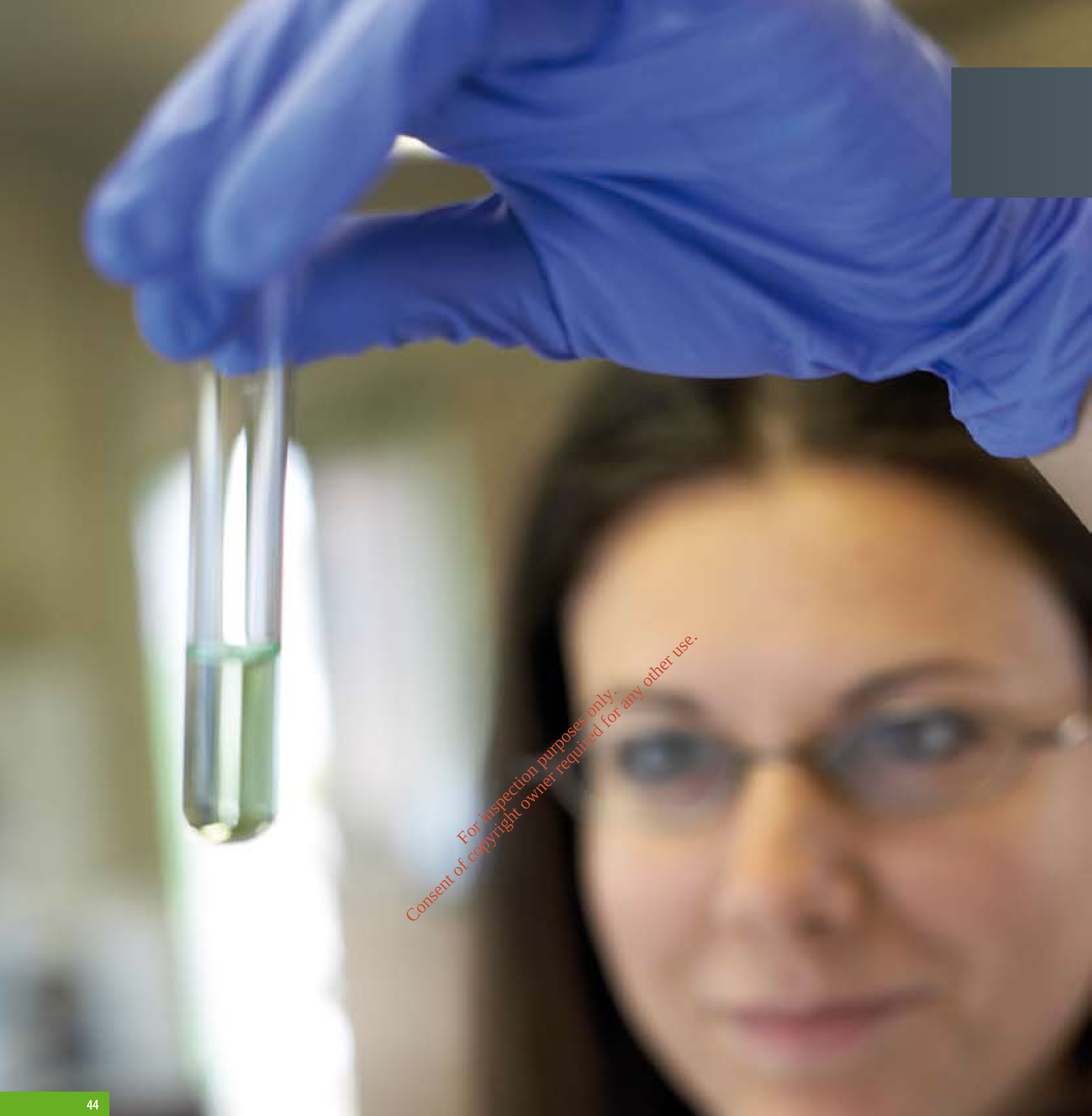
[7] Average values are based on guaranteed emissions limits from the supplier. Actual emissions are expected to be lower, in line with experience from operating facilities in Belgium (see Appendix E3)

[8] Maximum values are based on maximum concentrations permitted under Directive 2000/76/EC over the specified sample period.

Parameter[9]	Prior to treatment				Brief description of treatment	As discharged [10]					
	mg/Nm³		kg/h			mg/Nm³		kg/h.[11]		kg/year	
	Avg	Max	Avg	Max		Avg[12]	Max[13]	Avg	Max	Avg	Max
PCDD/F[14]	0.000005	0.000005	1.0	1.0	Clay injection / baghouse filter / activated carbon	0.000000058	0.0000001	0.0085	0.02	0.0001	0.0002
Heavy metals[15]	100	150	14.7	30.6	Clay injection / baghouse filter / activated carbon	0.4	0.5	0.06	0.10	515	894
Cd & Tl	0.4	1	0.06	0.20	Clay injection / baghouse filter / activated carbon	0.04	0.05	0.006	0.01	52	89
TOC	8	10	1.18	2.04	Combustion optimisation	8	10	1.18	2.04	10,302	17,870
CO	40	50	5.9	10.2	Combustion optimisation	40	50	5.9	10.2	51,509	89,352

[9] All values are at standard conditions of: T=273 Kelvin, P=101.3 kPa, 11% O_2 dry gas. All heavy metals measurements include compounds e.g. Cd represents Cadmium and its compounds
[10] All values are relevant for the sample period specified under Directive 2000/76/EC. For Cd, Tl, Hg and Heavy Metals categories the sample period is between 30 minutes and 8 hours. For dust, TOC, HCl, HF, CO, SO_2 and NO_x the sample period represented in Table E.1 is 24 hours.
[11] The average discharge is based on the maximum annual average flowrate of 147,000 Nm^3/h as modelled in Section 7 of the EIS. The maximum discharge is based on the maximum 24 hour average flowrate and should only be considered for this timeframe.
[12] Average values are based on guaranteed emissions limits from the supplier. Actual emissions are expected to be lower, in line with experience from operating facilities in Belgium (see Appendix E3)
[13] Maximum values are based on maximum concentrations permitted under Directive 2000/76/EC over the specified sample period.
[14] All PCDD/F values are expressed as mg_{TEQ}/Nm^3 or mg_{TEQ}/h according to the units required
[15] Heavy metals includes Antimony (Sb), Arsenic (As), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Manganese (Mn), Nickel (Ni), and Vanadium (V) and their compounds

Appendix E3: Excerpt from Indaver NV Sustainability Report

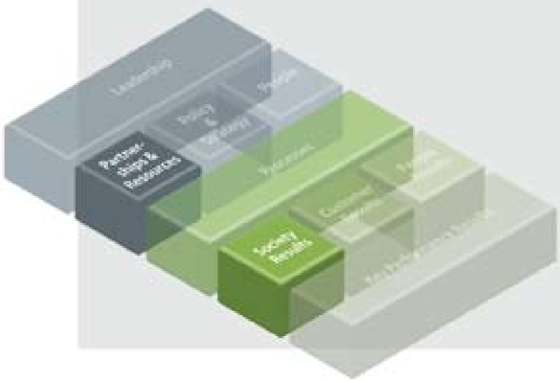


Ensuring transparency in communication and actions

"Everyone who is directly or indirectly involved in the operation of Indaver knows exactly what to expect of that company at all times. Quick and open communication towards all 'stakeholders'– from the shareholders to the people living near the site – creates a relationship of trust. Indaver is an open company with nothing to hide."

Results concerning the environment – environmental responsibility

This chapter considers the use of raw materials and the results as regards the local environment of the grate incinerators and fluidised bed incinerators at Doel, the rotary kilns in Antwerp and Ostrava (Czech Republic) and the hydrochloric acid regeneration unit of AROC in IJmuiden. Based on the mass balance per installation the resources required for the processing procedures are charted on the one hand and the various outgoing flows and their respective environmental impact on the other. The discussion of the environmental results is limited to the thermal processing installations because they are responsible for most of the air emissions, the discharge into the water and recovery of energy and materials. Naturally our recycling activities are also discussed in the framework of the recovery of materials, where we focus on the quality of the materials.



In this chapter we discuss the use of resources and the environmental impact of Indaver's waste treatment processes.

Thermal treatment

The mass balance gives an overview of the raw materials required for the thermal treatment of waste procedure and the residual materials and emissions created after processing. On the 'in' side there are the amounts of additives, water and energy required to remove the waste efficiently. On the 'out' side there are the amounts of set residual matter left over after the process, the amount of flue gases emitted through the chimney, the amount of wastewater and energy released during processing.

Hydrochloric acid regeneration AROC

The hydrochloric acid unit is responsible for regenerating reacted hydrochloric acid into reusable hydrochloric acid.

IN

Waste acid	165,510 tonnes
Energy	
Natural gas	11,850,925 m³
Electricity	5,498 MWh
Additives	
Compressed air	1,278 m³
Water	
River water	105,329 m³
Demineralised water	129 m³
Tap water	372 m³
Acidic rinsing water Corus	292,543 m³

OUT

Regenerated acid *	158,014 m³
Emissions to atmosphere	
Flue gases	208,887 (x 10³) Nm³
Water	
Wastewater	250,806 m³
Residual products	
Iron oxide	19,394 tonnes

* regenerated acid comprises 3,980 tonnes of fresh acid

Grate incinerators Doel

The three grate incinerator lines at Doel ensure thermal processing of non-toxic, non-recyclable household waste and comparable industrial waste. The processing procedure is realised with thorough reclamation of energy and materials. The installations are equipped with extensive flue gas cleaning. The energy aspect is considered in more detail in this report.

The ash treatment installation processes bottom ashes from the grate incinerators or from third party installations into secondary raw materials. Indaver strives for a sustainable solution, not only for the waste delivered but also for the residual fraction released during processing.

IN

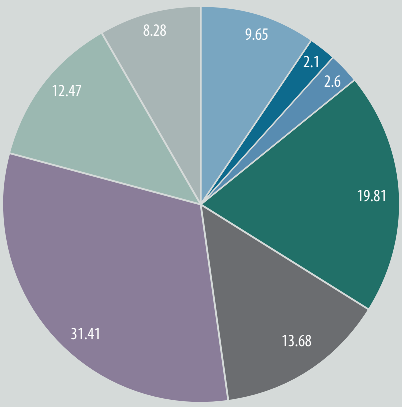
Waste	408,427 tonnes
Energy	
Fuel oil	942 tonnes
Steam	216,890 GJ
Electricity	35,225 MWh
Additives for flue gas cleaning	
Unslaked lime	1,953 tonnes
Limestone	3,436 tonnes
Activated charcoal	213 tonnes
DeNOx reagent	1,424 tonnes
Water	
Tap water	163,591 m^3
Rainwater	35,662 m^3

OUT

Emissions to atmosphere	
Flue gases	2,115,376 (x 10^3) Nm^3
Energy	
Energy	3,451,920 GJ
Water	
Wastewater	0 m^3
Residual products	
Boiler ash	8,660 tonnes
Bottom ash *	94,724 tonnes
Flue gas cleaning residue	11,939 tonnes
Plaster	1,295 tonnes

* Bottom ash:

Ferrous fraction	9.65 %
Non-ferrous fraction	2.10 %
Weak magnetic fraction	2.60 %
Granulate 6-50 mm	19.81 %
Granulate 2-6 mm	13.68 %
Sand fraction 0.67-2 mm	31.41 %
Filter cake / sludge fraction < 0.67 mm	12.47 %
Residual fraction	8.28 %



Fluidised bed incinerators Doel

The three fluidised bed lines in Doel provide for combined thermal treatment of non-recoverable industrial waste, industrial sludge and sludge from water purification plants.

IN

Waste	358,489 tonnes
Energy	
Fuel oil	6,028 tonnes
Steam	173,966 GJ
Electricity	65,137 MWh
Flue gas cleaning additives	
Unslaked lime	8,954 tonnes
NaOH	335 tonnes
Lignite	242 tonnes
DeNOx reagents	1,235 tonnes
Incinerator additives	
Sand	8,799 tonnes
Water	
Tap water	165,959 m^3
Rainwater	5,119 m^3

OUT

Emissions to atmosphere	
Flue gases	1,760,860 (x 10^3) Nm^3
Energy	
Energy	2,785,965 GJ
Water	
Wastewater	0 m^3
Residual products	
Bottom ash	20,654 tonnes
Electrostatic filter and boiler ash	46,713 tonnes
Flue gas cleaning residue	12,581 tonnes
Scrap from pre-treatment *	10,152 tonnes
Scrap after incineration	1,085 tonnes

* the quantity stated is the quantity of scrap discharged in the pre-treatment plant of the fluidised bed incinerators. The scrap recovered has a purity level of 60 %. Shredded scrap is cleaned in the HCW plant for further recycling.

Rotary kilns

The rotary kilns are responsible for the thermal treatment of industrial and hazardous waste not eligible for recycling.

Antwerp

IN

Waste	96,875 tonnes
Energy	
Fuel oil	407 tonnes
Waste oil	1,899 tonnes
Steam	257,300 GJ
Electricity	18,534 MWh
Incinerator additives	
Lining material (KSP, sand, glass)	4,397 tonnes
Flue gas cleaning additives	
CaO	2,771 tonnes
NaOH	2,417 tonnes
Lignite	36 tonnes
Carbamine (DeNOx)	572 tonnes
Wastewater purification additives	
Purification reagents *	172 tonnes
Water	
Tap water	128,102 m^3
Groundwater	314,034 m^3
Rainwater	88,056 m^3
Demineralised water	41,392 m^3

OUT

Emissions to atmosphere	
Flue gases	713,014 (x 10^3) Nm^3
Energy	
Energy	1,116,007 GJ
Water	
Wastewater	134 ,904 m^3
Residual products	
Bottom ash	22,126 tonnes
Boiler ash	683 tonnes
Fly ash	1,829 tonnes
Wastewater purification residues	3,246 tonnes

* The reagents for water purification are TMT and $FeCl_3$

Ostrava

IN

Waste (incl. waste oil)	13,341 tonnes
Energy	
Natural gas (fuel oil eq.)	282 tonnes
Steam	13,151 GJ
Electricity	4,407 MWh
Flue gas cleaning additives	
CaO	481 tonnes
Activated charcoal	2.9 tonnes
Water	
Demin water	43,302 m^3
Cooling water	204,205 m^3
Surface water	23,968 m^3
Tap water	1,767 m^3

OUT

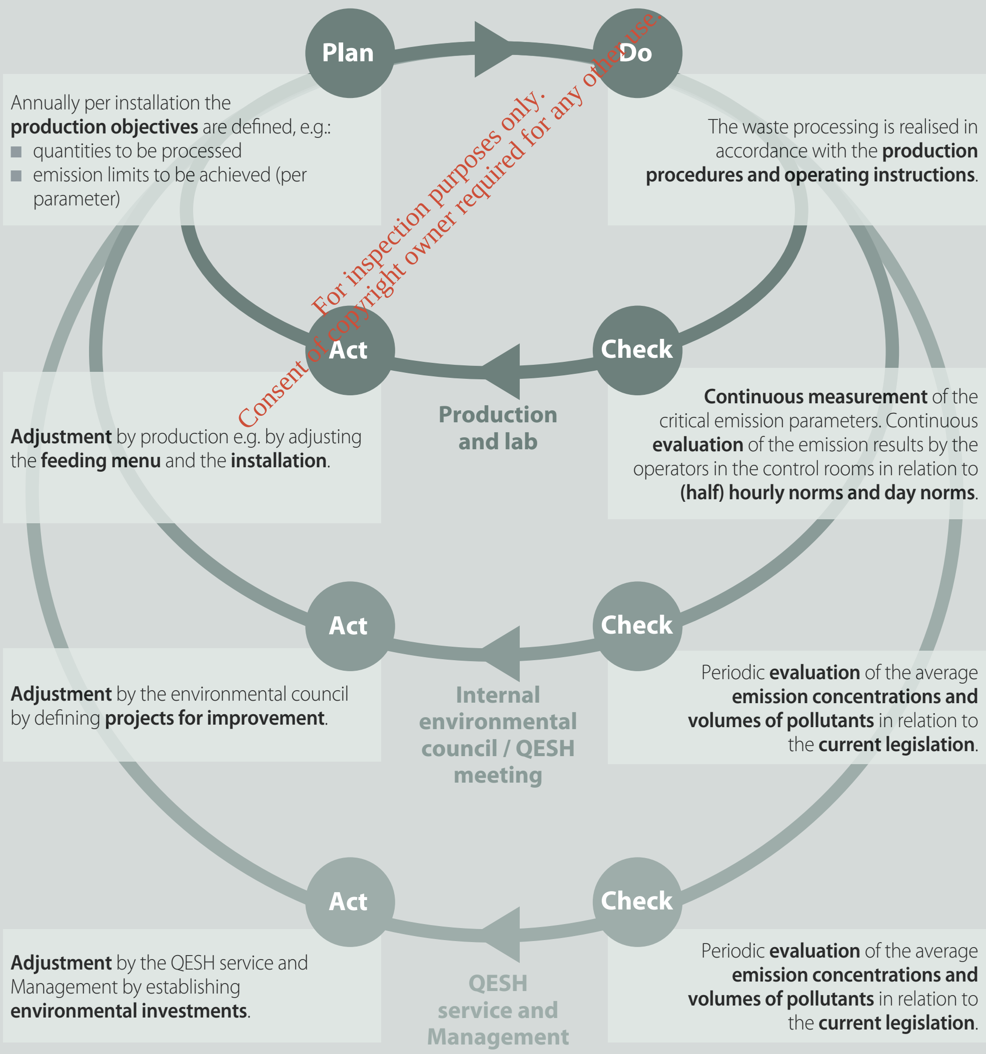
Emissions to atmosphere	
Flue gases	101,908 (x 10^3) Nm^3
Water	
Wastewater	19,039 m^3
Energy	
Energy for valorisation	42,427 GJ
Residual products	
Wastewater purification residues	177 tonnes
Bottom ash	2,909 tonnes
Fly and boiler ash	378 tonnes
Other non-hazardous waste	360 tonnes

Monitoring air emissions

Indaver also implements the 'Plan-Do-Check-Act' approach when monitoring its environmental performance. The proposed performance is carefully monitored at the level of production, the internal environmental board and the management and adjusted where necessary.

The attested measuring devices of the emission labs of the various incinerators produce thousands of measurement results daily. Based on this data the panel operator adjusts the process where necessary.

The many measurements are processed statically through the LIMS system (Laboratory Information Management System). They are expressed in a number of Key Performance Indicators (KPI), such as volume of pollutants and average concentrations. These KPIs are evaluated on a regular basis with a view to formulating new improvement and investment projects.



Plan-Do-Check-Act approach for monitoring environmental performance

Volume of pollutants

The table below shows the quantity of volume of pollutants, expressed in tonnes, of contaminated components that are emitted via the incinerator chimneys. The volume of pollutants is considered per site: Doel site (grate incinerators and fluidised bed incinerators), Antwerp site (rotary kilns and static kiln) and Ostrava (rotary kiln).

In Antwerp both the flue gases of the static kiln and of the rotary kilns are emitted via the chimneys of the rotary kilns. The rotary kilns are responsible for 95 % of the total emission, 5 % of the emissions originate from the static kiln.

The CO_2 emission is the total emission from waste incineration that is both biodegradable and contains a fossil fraction. By recovering energy (as steam or as electricity) a significant amount of CO_2 is saved in the broader economy namely in the traditional energy sector.

The detection limit in determining heavy metals depends on the analytical methods used and the way in which the conversion is realised locally (for each of the installations) from concentrations to volume of pollutants. The tonnages calculated for metals are negligible.

	Grate incinerators Fluidised bed incinerators (Doel)	Rotary kilns Static kiln (Antwerp)	Rotary kiln (Ostrava)	Hydrochloric acid regeneration unit (IJmuiden)
Waste	**766,916**	**105,556**	**13,343**	**165,510**
• Dust	4.0	0.3	0.4	4.4
• CO	56.7	9.6	5.0	12.8
• CO_2	759,269	113,242	ca 10,000	16,261
• TOC	3.8	0.9	0.1	
• HCl	2.8	0.4	0.5	< 2.3
• SO_2	9.0	0.7	1.1	9.7
• NOx	500.4	97.6	4.2	23.4
• Cd. Tl	< 0.06	< 0.006	0.003	< 0.005
• Hg	< 0.006	< 0.003	0.002	< 0.00005
• Metals*	< 0.28	< 0.03	0.02	0.03

Volume of pollutants (in tonnes)

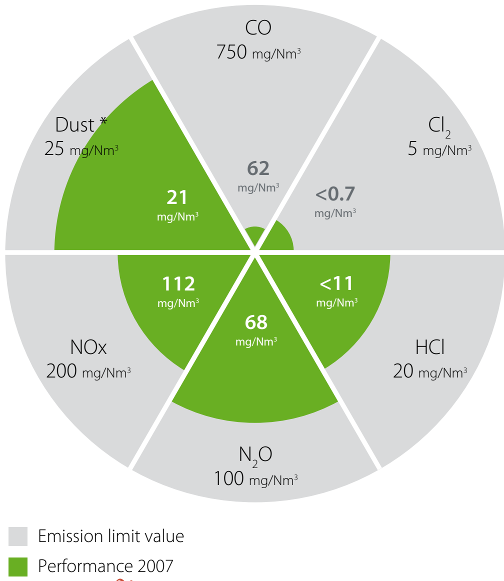
* Metals = sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Sn

Performance in relation to emission limits

The star graphs show the annual average performance of the incinerators as compared with the daily average standard, unless otherwise specified in the environmental licence. For example, in the fluidised bed incinerators, the standard for NOx is the annual standard. AROC does not have a standard for metals, SO_2, Hg or Cd/Tl in its environmental licence. The annual average performances for these parameters were as follows: 0.15 mg/Nm³ for metals, 47 mg/Nm³ for SO_2, <0.0002 for Hg and <0.025 for Cd/Tl. AROC thus remains below the daily average standard which applies to incineration installations for these parameters.

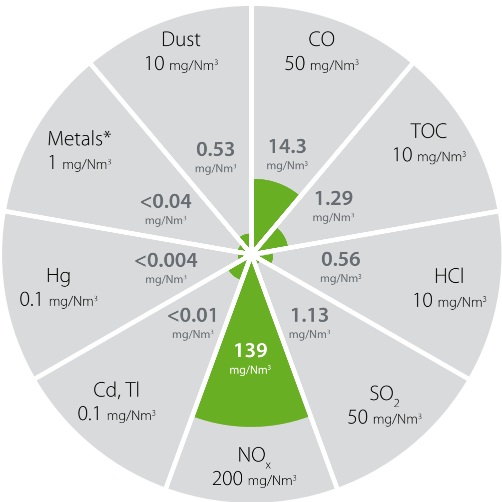
The results are obtained by measurement instruments that are certified in accordance with VLAREM and that measure within the measurement range set by VLAREM. For every licensing parameter the results are well under the norm stipulated by law.

Hydrochloric acid regeneration unit (AROC) IJmuiden

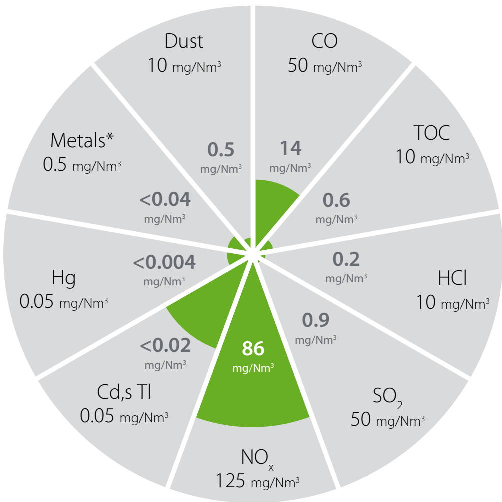


* A few increased values for dust were established via the internal air measurement programme. The necessary measures were taken. The annual average value remains below the limit for this parameter.

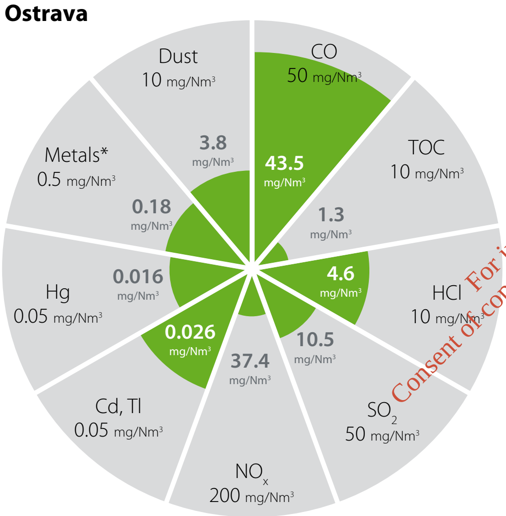
Rotary kilns + static kiln
Antwerp



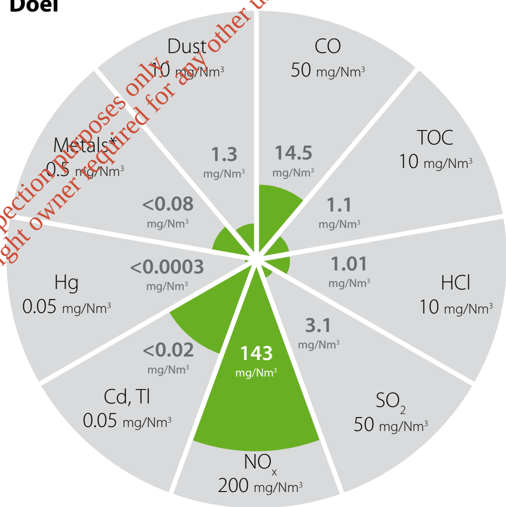
Fluidised bed incinerators
Doel



Rotary kiln
Ostrava



Grate incinerators
Doel



Emission limit value
Performance 2007

* Metals = sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Sn

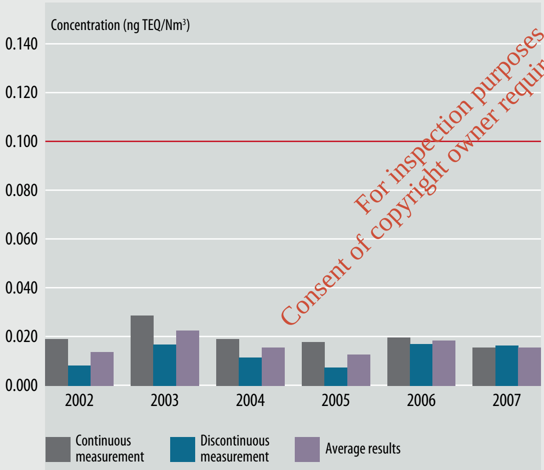
Dioxins

Because dioxins are only present in flue gases in very small concentrations, large gas volumes must be sampled and advanced techniques are required for the chemical analyses. A continuous measurement – as with other pollutants in the flue gases – is not possible for dioxins. In practice a distinction is made between a discontinuous measurement and a continuous sampling with biweekly analysis.

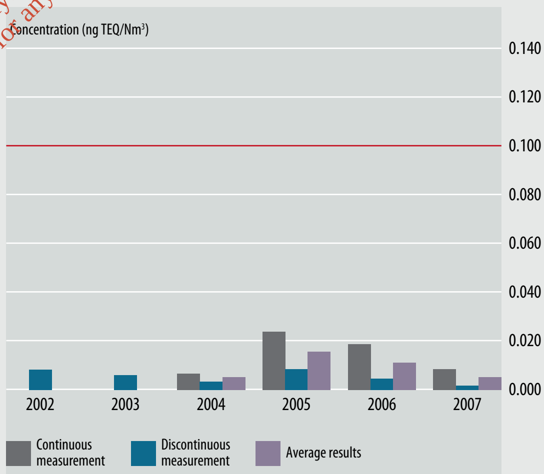
A discontinuous measurement gives a representative image of the dioxin emission at a specific time during the activities. This must take place twice a year and is carried out by a certified external lab. During continuous sampling the dioxins in the flue gases are sampled and determined over the course of fourteen days. This gives a representative image of the average dioxin emission over a longer period.

If it is apparent from the results of a continuous dioxin measurement that an increased value is measured above the reference value of 0.1 ng/Nm^3, this must be reported to the environmental inspectorate LNE and the appropriate measures adopted. Consequently three discontinuous measurements must be taken.

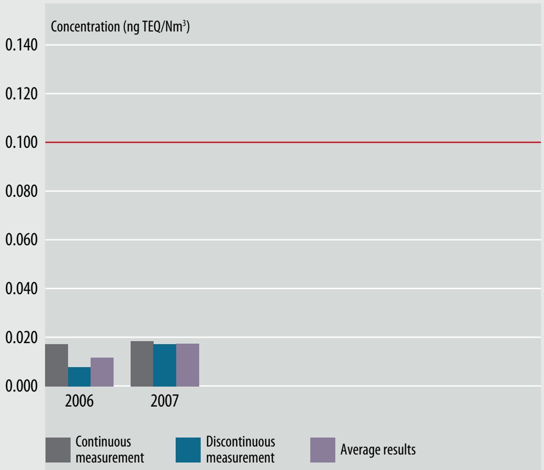
The averages of the continuous sampling in the graphs and the control values of the discontinuous measurements take account of all measured and validated values. This relates to around 200 dioxin measurements on a yearly basis for all incinerators. For all facilities operated by Indaver and where around 0.9 Million tonnes of waste are processed, the annual volume of pollutants is less than 0.07 g TEQ.



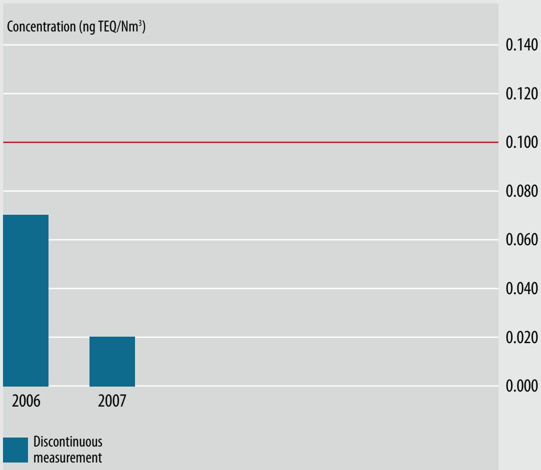
Dioxin results grate incinerators (Doel)
Total volume of pollutants = 31.9 mg TEQ



Dioxin results rotary kilns + static kiln (Antwerp)
Total volume of pollutants = 3.3 mg TEQ



Dioxin results fluidised bed incinerators (Doel)
Total volume of pollutants = 30.6 mg TEQ



Dioxin results rotary kiln (Ostrava)
Total volume of pollutants = 2 mg TEQ

Recovery of materials

Indaver always strives for a sustainable solution, not only for the waste materials delivered, but also for the residual substances released during processing. Investment is made for this into maximum recovery possibilities, so that only a limited amount of the residual substances need to be removed to a landfill. Metals are reclaimed during all processing procedures. Depending on the waste processed, organic materials (paper, plastic, biomass) or inorganic materials (metal, chemical and inert matter) are recovered.

The bottom ash from the various incinerators is processed further with a view to recycling or useful application. The ash treatment processes the bottom ash from the grate incinerators into various end products, which can be marketed or used. Less than 10 % is definitively removed to the category 1 landfill. The bottom ash from the rotary kilns has the iron removed for recycling through slag processing so that a high quality metal fraction is achieved for recycling. Unlike the grate incinerators and rotary kilns the metal fraction in the fluidised bed incinerators is removed to a great extent beforehand. The scrap fraction from the pre-treatment of the fluidised bed incinerator is cleaned in the pre-treatment installation for high energy waste (HCW) to be reused.

The hydrochloric acid that AROC regenerates, meets the specifications as set in the 'Build-Own-Operate'-contract between Corus and AROC. In 2007 no quality deviations were established.

The sorted PMC fractions constitute valuable raw materials for the recycling industry. Using visual inspections and sampled analyses Indaver constantly tests the purity of the sorted products through the quality criteria. In 2007 very high purity results were achieved for all fractions: white PET: 99.4 %, blue PET: 97.2 %, green PET: 97.51 %, HDPE: 97.2 %, drink cartons: 97.6 %.

The paper and cardboard that Indaver delivers to the recycling industry at least meets the definitions and gradations stipulated in the European list of standard types of recyclable paper and cardboard, EN 643 from June 2002. Depending on the application of the various paper and cardboard fractions more specific demands are agreed. For recycling to make for example packaging cardboard Indaver supplies its clients with a quality that consists of at least 80 % cardboard and 20 % other types of paper, with a humidity of at least 10 % and at most 1 % unusable and/or non pulpable inert matter, completely free of hazardous substances and/or damaging pollutants.

Energy recovery

At the EU summit of March 2007 the EU ministers launched ambitious goals in the fight against climate change. On 23 January 2008 the EU President Barosso announced the first draft guidelines for the EU member states with measures for the achievement of these goals by 2020.

Indaver has always endeavoured to implement the following basic principles concerning energy management from the design stage of its installations:

- Maximise energy recovery;
- Minimise energy consumption;
- Limit fossil sources of energy;
- Maximise renewable sources of energy.

These principles are being further applied and optimised, and this will ensure that the new EU guidelines are also complied with fully and the EU objectives supported.

Benelux

In the Benelux region Indaver recovers energy released from its own grate and rotary kiln incinerators. A similar energy policy is implemented at the installations in which Indaver participates. This relates to the fluidised bed incinerator of SLECO nv at the Indaver site in Doel, the anaerobic fermentation installation of the waste intermunicipal company IVVO, the landfill site of the Intermunicipal company Vereniging Hooge Maey (organic and landfill gas valorisation) and IVAGO's incinerator.

Rotary kilns

The energy required by the Antwerp site for processing waste in diverse installations corresponds to the energy release during the processing in the rotary kilns. Consequently the site is predominately self-sufficient as regards energy consumption both as regards electricity and steam consumption. The execution of a revamping project on the turbo generator condenser in 2007 will make it possible still to increase the yield from the generation of electricity, especially during the summer months.

The high calorific waste materials fulfil the function of traditional fossil fuels in the processing, fossil fuels which would otherwise have been needed to achieve and continuously guarantee the processing conditions for thermal processing as imposed by the EU incineration guideline. If these high calorific waste materials should no longer be available, Indaver would be forced to purchase fossil fuels or alternative sources of energy in order, for example, to be able to process low calorific waste such as medical waste, laboratory waste and household hazardous waste in accordance with the permit. The energy benefit as a result of this intelligent 'waste-to-waste' strategy is not expressed in the table on the following page nor the CO_2 emissions saved in the broader economy as a result.

Approximately 97,000 tonnes of waste was processed in the rotary kilns in 2007. The energy content of the steam (20 bar and 215 °C) produced in 2007 by the rotary kilns was 1,116,007 GJ. A proportion of this steam was used directly, for example in the distillation of solvents and in the heating of the buildings. The rest of the steam was converted into electricity in a turbine with a capacity of 3.3 megawatt. 23,044 MWh of electricity was produced in 2007.

Indaver strives for maximum recovery of the energy released from waste-processing.

In the Central and Eastern Europe region and more specifically in the Czech Republic, a turbine-driven generator was commissioned in 2007 for the SPOVO rotary kiln in Ostrava. This unit is equipped with a high-performance steam boiler for energy recovery. The electricity produced is exclusively for in-house consumption of the incinerator. During the second half of 2007 the in-house consumption was consequently largely covered.

Rotary kilns Antwerp	2007	
Energy recovery in the boiler	1,116,007	GJ
On-site use of steam	257,300	GJ
Electricity generation	23,044	MWh
Electricity consumption DTOx	18,534	MWh
Electricity consumption - other	7,108	MWh

Energy recovery
Rotary kilns Antwerp

Rotary kiln Ostrava	2007	
Energy for valorisation	42,427	GJ
Steam purchased	1,907	GJ
Steam used on-site	13,151	GJ
Steam delivered externally	5,959	GJ
Electricity purchased	3,356	MWh
Electricity generated	1,051	MWh

Energy recovery
Rotary kiln Ostrava

Grate incinerators

Due to its efficient energy recovery and the limited pre-treatment, grate incinerator technology is the best ecological and forward-looking choice for final treatment of a substantial proportion of non-recyclable residual waste. The treatment process runs on the basis of the energy content of the waste itself. It is only during the start-up phases (for example after a shut-down) that fossil fuels are mainly used. In order to ensure maximum energy recovery, recovery takes place using steam at the highest possible pressure and temperature. Part of the steam is used at its production pressure and temperature for heating applications in neighbouring industries. Part of it is converted to electricity in a steam turbine driven generator and primarily delivered directly to the electricity grid.

Indaver recovers around 80 percent of the energy content from residual waste incinerated in the grate incinerators in the form of usable energy.

408,000 tonnes of waste was processed in the grate incinerators in 2007. The energy content of the steam (40 Bar, 400 °C) produced during cooling of the flue gases in the grate incinerators was 3,451,920 GJ in 2007. Approximately a third of the steam produced was used as processing heat in a neighbouring chemical factory, two-thirds was converted to 165,408 MWh electricity.

Fluidised bed incinerators

Rational energy management was a consideration right from the design stage of SLECO's fluidised bed incinerator, a joint venture with SITA. The incinerators are equipped with an efficient energy recovery system. Value is derived from the energy content of the waste in the form of electricity. Fluidised bed incinerators with electricity generation are considered to be the best choice for treatment of sludge and high calorific value waste in terms of both ecology and energy. The heat released during processing of the high calorific waste is used to dry the sludge. In this way fossil fuels that would otherwise be used in external sludge drying are saved. This energy benefit is not expressed in the table below.

In 2007, the three fluidised bed incinerators processed 358,000 tonnes of waste. In 2007 the energy content of the steam (40 Bar and 400 °C) produced during cooling of the flue gases in the fluidised bed incinerators was approximately 2,785,965 GJ. From September 2007 the steam circuit of the grate incinerators was connected to the steam turbine generator of the fluidised bed incinerator further to optimise the electricity generation and consequently the energy yield at the Doel site. Partly as a result of this connection 210,411 MWh electricity was generated by the fluidised bed incinerators in 2007.

Grate incinerators Doel	2007	
Energy recovery in the boiler	3,451,920	GJ
Process steam on-site use	216,890	GJ
Process steam external use	1,181,689	GJ
Electricity generation total	165,408	MWh
Electricity, on-site use	35,225	MWh
Electricity, external use	130,183	MWh

Energy recovery
Grate incinerators Doel

Fluidised bed incinerators Doel	2007	
Energy recovery in the boiler	2,785,965	GJ
Process steam on-site use	173,966	GJ
Process steam external use	0	GJ
Electricity generation total	210,411	MWh
Electricity, on-site use	65,137	MWh
Electricity, external use	145,274	MWh

Energy recovery
Fluidised bed incinerators Doel

Indaver is involved in deriving energy value from landfill gas via its participation in the Intermunicipal company Vereniging Hooge Maey. This is an important component of the decontamination project of this category 2 landfill. The waste disposed of there contains a high level of organic-biological components that are converted into methane, a greenhouse gas, via anaerobic fermentation. By covering the dumped mass the uncontrolled emission of methane is prevented and can be directed to a collection system of gas engines instead, which generate electricity. Green power certificates are also awarded for energy recovered in this way.

Ireland

As an EU member state Ireland also wants to make a significant contribution to meeting the Kyoto objectives, however there is still a long way to go to meet the planned energy objectives due to the rapid growth of the Irish economy since the early nineties. Indaver's waste-to-energy projects will contribute to this. A proportion of the energy will be generated on the basis of organic-biological waste. The country will need to import and process less fossil energy thanks to these renewable sources of energy.

Doel Site as a power station

The grate incinerators are equipped with a 21-megawatt turbine and the fluidised bed incinerators have a 34-megawatt turbine. Both electricity generating turbines are used optimally through a connection between the steam circuits. If we combine external steam and electricity output, Indaver is capable of supplying electricity to meet the needs of around 140,000 families with an average annual consumption of 3,500 kWh. Once the fourth line of the grate incinerator has been realised the external energy output will be sufficient to meet the energy needs of 175,000 families.

Water management

Water consumption

Indaver uses various sources of water in the treatment processes: mains water, pumped groundwater, river water, rainwater collected selectively from roofs and potentially contaminated rainwater collected selectively from roads and paved areas. Indaver handles water sparingly and rationally and tries to restrict the use of mains water as far as possible. A major portion of the rainwater that falls on our sites is collected and put to good use. Depending on the quantity of water required for the various treatment processes this rainwater is supplemented by groundwater and mains water. In the following review we do not take into account the water contained in the waste itself.

The Antwerp site covers a total surface area of 24.42 ha. On this site Indaver collects rainwater falling on the landfill area and the paved areas with around 88,056 m^3 of rainwater being reused in 2007, or approximately 13 % of the total process water requirement. Total water consumption for 2007 was 658,063 m^3, the majority of which was accounted for by rotary kiln incinerators' flue gas purification. Rainwater collected was supplemented with 328,034 m^3 of groundwater pumped up and 241,973 m^3 of mains water.

On the Doel site 21.25 ha of the total of 39.15 ha of land is in use. In Doel Indaver collects rainwater from the roads and paved areas and from the roofs of the grate incinerators and the fluidised bed incinerators. In 2007 40,781 m^3 of rainwater was reused meeting approximately 8 % of the total water requirement for the site. This was supplemented with 451,733 m^3 of mains water.

In Grimbergen rainwater is collected and used as process water. The total water requirement for the site in 2007 amounted to 15,755 m^3. This requirement was met by 7,412 m^3 of rainwater, 7,175 m^3 of groundwater and 1,168 m^3 of mains water.

In Willebroek 40,935 m^3 of potentially contaminated rainwater was collected. Treatment on the site is carried out by dry processes and the water requirement for 2007 came to just 1,247 m^3 (63 m^3 groundwater and 1,184 m^3 mains water).

In AROC the water requirement in 2007 for the hydrogen chloride regeneration unit was 398,373 m^3, of which 292,543 m^3 was met by acid flushing water from Corus. This was supplemented with 105,329 m^3 river water, 372 m^3 of mains water and 129 m^3 demineralised water. Rainwater collected on this site is negligible in the overall water balance.

Kallo consumed 604 m^3 of mains water. Rainwater collected on this site is potentially contaminated and is discharged for external treatment.

In the Czech Republic rotary kiln 43,302 m^3 of demineralised water, 204,205 m^3 of cooling water, 23,968 m^3 of river water and 1,767 m^3 of mains water was used in order to meet the overall water requirement.

Water results

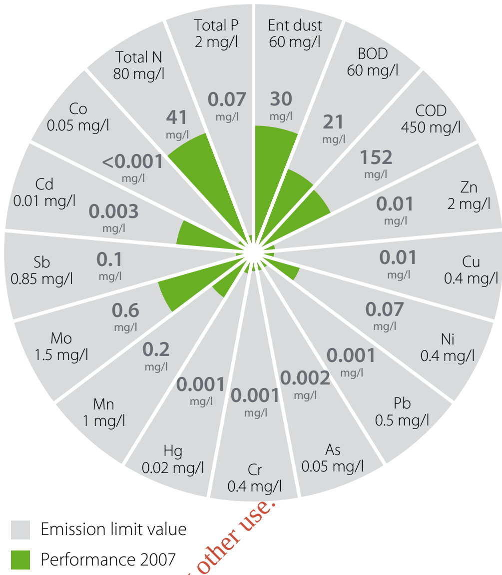
The site in Doel has zero discharge status. Only non-contaminated rainwater and sanitation wastewater may be discharged. The amount of sanitation wastewater discharged may be estimated on the basis of the data from the Vlaamse Milieumaatschappij (30 m³/employee/year). In this way a maximum discharge of 4,080 m³ may be calculated as a part of the total quantity of rainwater discharged. This figure is calculated on the basis of 136 employees on the site.

The Indaver site in Antwerp is responsible for the vast majority of the total output and the total discharged volume of pollutants of Indaver. The discussion of the water quality is consequently limited to the performance at this site. In 2007 a total of 774,256 m³ of wastewater was discharged into the surface water of the Scheldt after treatment at the on-site water purification plant.

The star structure indicates the concentration of the most relevant discharge parameters in relation to the emission limits in force for the controlled discharge. All average annual measurements conform to the discharge conditions and are fully in line with the historic values.

Currently an appeal procedure is still pending with the Council of State concerning the stricter norms imposed on Indaver in the new discharge permit of March 2007.

Concentration most relevant parameters for piped discharge of wastewater (Antwerp site)



Volume of pollutants in tonnes

The table below gives an overview of the controlled discharge of the volume of pollutants discharged in tonnes for the most relevant discharge parameters. These values are also in line with historic results. No specific trends can be noted.

Parameter	2007 (tonnes)
Ent dust	21
BOD	16
COD	117
Zn	0.01
Cu	0.01
Ni	0.05
Pb	0.0006
As	0.002
Cr	0.0005
Hg	0.0006
Mn	0.19
Mo	0.49
Sb	0.07
Cd	0.002
Co	0.0001
Total N	29
Total P	0.05

Discharged volume of pollutants in tonnes (Antwerp site)

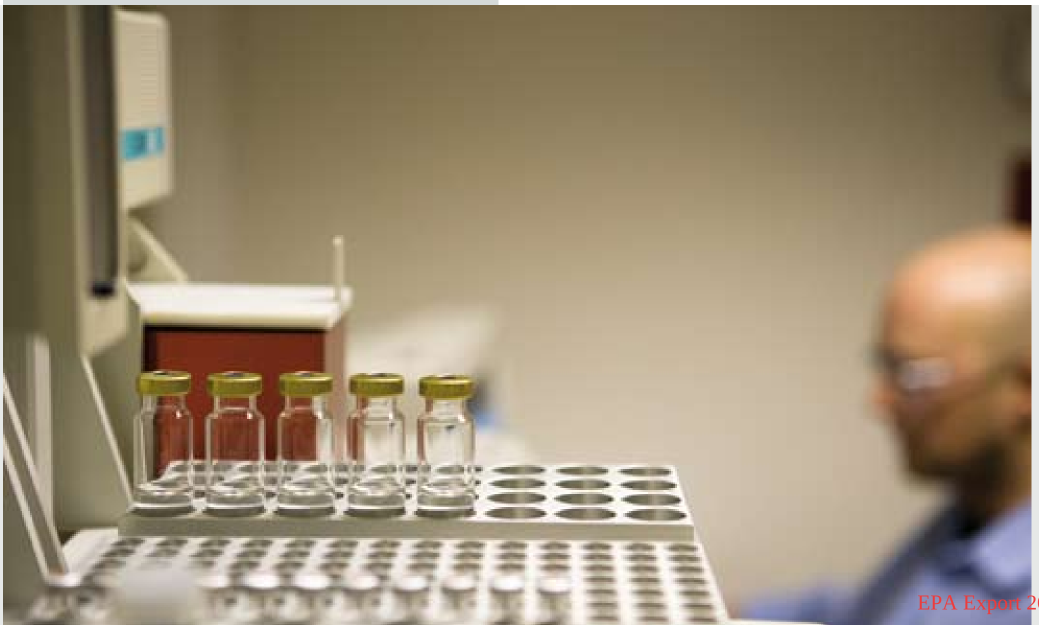
calculated on the basis of the controlled discharge of the 24-hour sample

Other discharge parameters

Indaver continuously evaluates and checks its results. In the framework of this self-inspection Indaver implements a far-reaching analytical inspection schedule with daily measurements for some parameters and very frequent measurements for others. Both sampling and analyses are carried out by a certified Indaver laboratory. The self-inspection schedule is audited regularly in the framework of the ISO 14001 certification.

The detailed monitoring schedule generates thousands of measurements on an annual basis. In 2007, three accidental discharges were established and reported to the government in accordance with VLAREM regulations. An increased absorption of CO_2 in the gas cleaning of the rotary kilns resulted in the accidental discharge of a water flow supersaturated with calcium carbonate. As a result the norm for entrained dust was exceeded temporarily. Processing of cadmium-containing waste in the physicochemical unit resulted in an accidentally increased measurement. The increased values for the total nitrogen parameter can be explained by the commissioning of the DeNOx installation in 2006. Currently the feasibility study for optimising the DeNOx process is in progress.

The level of conformity in relation to the permit conditions is over 99 % over the entire year.



Soil

Indaver implements internal monitoring programmes for soil quality at all its sites. We focus on the Antwerp site in this paragraph, as there is no relevant information concerning the soil to report regarding the other sites.

In Antwerp sample tests were carried out in the framework of the soil remediation plan (BSP) with soil air extraction. The tests with vertical and horizontal extraction did not give the expected result. One reason for this is the low mobility of the groundwater layer in Antwerp. Using diverse observation wells the contaminated area was regularly checked by analysis. The first results indicate that the contamination with organic contaminants has remained stable considering the condition of the soil.

A plan for the further progress of the soil remediation activities shall be submitted to OVAM during the course of 2008 on the basis of the tests in the trial project and the results of the analytical monitoring. Indaver will work together with a certified soil remediation expert for this.

The Indaver landfill sites: state-of-the-art

Indaver has landfill facilities available at the sites in Antwerp and Doel. The landfill is equipped with a multilayer soil protection that can be considered as BAT. Moreover the choice was made, in addition to the existing safeguards, to work with an electronic leak detection. The leak detection system, which works according to the principle of electrical conductivity, "feels" a possible leak between two sealing layers. Indaver has the electronic leak detection measured every 3 months in the first phase of the construction of the landfill by the supplier of the system. If an anomaly is established at the measurement, the company will verify whether this concerns a technical fault or an actual perforation of the film. If the latter, the system is able to define the exact location of the perforation so that repairs may be carried out. In the actual operation phase these measurements will be repeated annually until 5 years after the commissioning of the landfill site (cf. VLAREM).

Observation wells are located at the corners of the landfill, with the intention of verifying the influence of the landfill on the quality of the groundwater in the medium and long term. The observation wells are sampled and analysed every 6 months. The schedule of analyses indicates that the observation wells show low to very low load. All the values are lower than the respective VLAREBO treatment norm.

Because the quality of the landfill must also be guaranteed in the long term, accounting provisions are made. In this way Indaver has provided for the after-care of the landfill until 2055. In addition to the guarantee required under environmental law, a provision of EUR 1,896,619.51 was included in the accounts at the end of 2007. Of this amount, around EUR 1.2 million is intended for the aftercare of the landfill site in Antwerp and EUR 660,000 for the landfill site in Doel.

Appendix E4: Minor Emission Tables E.1 (ii) (b) and E.1 (iii) (b)

TABLE E.1(ii)(b) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-2
Source of Emission:	Emergency Generator
Location :	Main process building - See drawing 15013\WL\013 in Appendix E1
Grid Ref. (12 digit, 6E,6N):	306287E, 270938N
Vent Details Diameter: Height above Ground(m):	 0.25m 3m
Date of commencement:	Hot commissioning of the facility will commence 24 months after construction begins, expected September 2010

Characteristics of Emission :

(i) Volume to be emitted:			
Average/day	0 m^3/d	Maximum/day	3,656 m^3/d
Maximum rate/hour	3,656 m^3/hr	Min efflux velocity	20.7 m/sec
(ii) Other factors			
Temperature			150^oC(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. 11 %O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/h 1 h/day 12 day/y

TABLE E.1(iii) (b): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-2***

Parameter	Prior to treatment				Brief description of treatment	As discharged[16]					
	mg/Nm³		kg/h			mg/Nm³		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
NO_x	As discharged				Maintenance for efficient operation		500		1.83		21.94
CO	As discharged				As above		650		2.38		28.52
TOC	As discharged				As above		150		0.55		6.58
Particulates	As discharged				As above		100		0.37		4.39

[16] All values are at standard conditions of: T=273 Kelvin, P=101.3 kPa, 11% O_2 dry gas

Appendix E5: Surface Water Emission Table E2(i)

TABLE E.2(i): EMISSIONS TO SURFACE WATERS (One page for each emission)

Emission Point:

Emission Point Ref. Nº:	SW1
Source of Emission:	Surface water drainage outfall
Location :	Wet drain to west of site- See drawing 15013\WL\013 in Appendix E1
Grid Ref. (10 digit, 5E,5N):	30612E, 27086N
Name of receiving waters:	River Nanny
Flow rate in receiving waters:	0.04 m^3/s Dry Weather Flow 0.25 m^3/s 95%ile flow
Available waste assimilative capacity:	Not Available

Emission Details:

(i) Volume to be emitted			
Normal/day[17]	113.8 m^3	Maximum/day[18]	1,467.1m^3
Maximum rate/hour[19]	61.1 m^3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	The period or periods during which surface water will be discharged will depend on rainfall patterns and cannot be defined exactly. The normal volumetric emission per day given above assumes a continuous discharge based on annual average rainfall.

[17] Flow will depend on rainfall periods but for the purposes of this assessment, the normal flow is averaged over the year's rainfall of 760mm and a non-permeable collection area of 54,660m^2
[18] Based on maximum discharge rate of 16.98 litres per second
[19] Based on maximum discharge rate of 16.98 litres per second

Appendix E6: Groundwater Emissions Table E.4 (i)

TABLE E.4(i): EMISSIONS TO GROUNDWATER (1 Page for each emission point)

Emission Point or Area:

Emission Point/Area Ref. Nº:	GW1
Emission Pathway: (borehole, well, percolation area, soakaway, landspreading, etc.)	Percolation area
Location :	Northern margin of site- See drawing 15013\WL\013 in Appendix E1
Grid Ref. (10 digit, 5E,5N):	30632E, 27101N
Elevation of discharge: (relative to Ordnance Datum)	31m O.D
Aquifer classification for receiving groundwater body:	Rkd (regionally important , diffuse karst aquifer, good development potential)
Groundwater vulnerability assessment (including vulnerability rating):	M (moderate)
Identity and proximity of groundwater sources at risk (wells, springs, etc):	Table 10.2 of the EIS identifies wells within a 3km radius of the site. This shows there are 2 domestic wells 600m to the west of the site, 5 domestic wells 1 to 1.5km to the south-east and 1 domestic well to the north. Other wells are further than 2.5km from the site.
Identity and proximity of surface water bodies at risk:	River Nanny (tributary), 180m from site River Boyne 3.5km from site

Emission Details:

(i) Volume to be emitted			
Normal/day	7.2 m^3	Maximum/day	2.7 m^3
Maximum rate/hour	0.3 m^3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/h 24 h/day 365 day/y

Appendix E7: Noise Emission Table E.5 (i)

Table E.5(i): NOISE EMISSIONS - Noise sources summary sheet

Source	Emission point Ref. No	Grid Reference	Equipment Ref. No[20]	Sound Pressure[1] dBA at reference distance	Octave bands (Hz) Sound Pressure[1] Levels dB(unweighted) per band									Impulsive or tonal qualities	Periods of Emission
					31.5	63	125	250	500	1K	2K	4K	8K		
Stack	N1	30633E, 27095N	Not available	94	-	82	89	92	79	75	69	70	70	None	Continuous
Air Cooled Condensers	N2	30622E, 27094N	Not available	98	-	82	87	88	88	93	91	83	80	None	Continuous
Turbine Cooling	N3	30622E, 27094N	Not available	86	-	64	69	72	83	80	77	72	64	None	Continuous
Fan Turbine Building	N4	30622E, 27094N	Not available	91	-	72	78	88	87	82	76	72	64	None	Continuous
Compressor Louver Grids	N5	30629E, 27094N	Not available	85	-	74	73	78	82	76	70	65	64	None	Continuous
Cooling Oven Grid	N6	30622E, 27094N	Not available	86	-	69	74	77	81	80	76	71	63	None	Continuous

1. For items of plant sound power levels may be used.

[20] Equipment reference numbers will be made available to the EPA once the Piping and Instrument Diagrams (P&ID) have been completed as part of the detailed design phase.

Appendix E8: Cumulative Traffic Assessment submitted as Additional Information

Waste to Energy Facility at Carranstown, Co Meath

Traffic Impact Assessment Request For Additional Information

Issue 1
June 2006

Roughan & O'Donovan

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Waste to Energy Facility at Carranstown, Co Meath

Transport Impact Assessment
Request For Additional Information

Document No: 05.186.10

Made:... Gareth Mitchell

Checked:... Gareth Mitchell

Approved: .... Seamus MacGearailt

Description	Issue	Made	Checked	Approved	Date
RFI	Issue1	GTM	GTM	SMG	June 06

Waste to Energy Facility at Carranstown, Co Meath

Transport Impact Assessment Report
Request for Additional Information

TABLE OF CONTENTS

1.0 INTRODUCTION

This report is prepared by Roughan & O'Donovan, Consulting Engineers to address a Request for Additional Information made by Meath County Council following an application planning permission for a waste to energy facility at Carranstown, Duleek, County Meath. The EIS included a traffic section that addressed that the traffic implications of the proposed development. This report provides the additional information requested relating to traffic only.

2.0 ADDITIONAL INFORMATION REQUESTED.

Applicant to take account of the traffic levels and access point associated with the extant Scottish and Southern Energy permission granted adjacent to the site for a 400MW electricity generating plant; and traffic movement associated with staff to be employed on the site during its operational phase.

3.0 PROPOSED POWER STATION AT PLATIN.

The proposed Scottish & Southern Power Energy permission for a proposed power station at Platin has been granted permission by Meath County Council. The traffic generated by this development is detailed within the EIS for that project. The EIS included a traffic impact assessment carried out by Alpha Engineering Services in March 2000. It is this traffic data that is used to assess the cumulative impacts assessment requested by Meath County Council. Extracts from the traffic section of the EIS.

Extracts from the Power Station at Platin EIS are included in Appendix C to this Report.

4.0 EXISTING TRAFFIC

The traffic assessment for the Power Station at Platin was based on traffic flows measured carried out on the R152 between the N2 and Duleek. Between the 10th February 1999 and 16th February 1999. These surveys indicated a two-way peak hour flow of 876 vehicles on the R152. As a comparison, the survey carried out as part of traffic assessment for the Waste to Energy Facility indicated a two-way peak hour flow of 1,108 vehicles on the R152. This shows that the pre-development flows measured in 2006 are greater than those on 1999. Due to the difference in flows, the existing traffic flows from the Power Station at Platin traffic analysis are not being used in this assessment.

5.0 GENERATED TRAFFIC

5.1 Generated Traffic During Construction Phase

Paragraph 12.3.2 of the EIS for the Power Station at Platin estimates the traffic generated during peak construction activity as shown in Table 3.1 below.

Time Period	Deliveries & Other Vehicles		Employees (Vehicles)		Total	
	In	Out	In	Out	In	Out
Peak Generation (07.00 – 0800)	2	2	245	245	247	247
All Day	25	25	320	320	345	345

Table 5.1 Traffic Generation by Power Station at Platin during Construction Phase

Table 3.1 suggests that there would be an equal number of employee arrivals and departure during the AM peak. Comparing the AM Peak with the daily flow shows that 320 vehicles would leave the site during the AM peak, leaving only 75 departures distributed over the remainder of the day. This would suggest that the majority of the employees would arrive and depart during the AM Peak. This is unlikely. It is more likely that the AM peak would be predominantly arrivals with the bulk of the departures occurring during the PM Peak. The traffic assessment for the Power Station at Platin does not assign any generated traffic flows for the background traffic peak hour (7.45 – 8.45) so it is not possible to determine the impact based on the flows within that analysis.

The traffic assessment for the Power Station at Platin shows that the peak flows for the generated traffic during the construction phase will occur during the 7.00 to 8.00 period. The traffic assessment for the Waste to Energy Facility shows that the peak construction traffic movements occur during the 6.00 – 7.00 period. The traffic counts carried out as part of the traffic assessment for the Waste to Energy Facility indicated that the peak hour for the background traffic flows is 7.45 to 8.45. This shows that the majority of the construction traffic for both sites precedes the background peak.

The above details show the following:

- The peak hour for the Waste to Energy Facility is 06.00 to 07.00
- The peak hour for the Power Station at Platin is 07.00 to 08.00
- The peak hour for the background traffic is 07.45 to 08.45

Comparison between the existing traffic flows and the 2 proposals show that the construction flow and background peaks are not coincidental. This shows that there would be a spread of the peak period but that the will not be a cumulative impact due to simultaneous work on both sites.

It should be noted that the 2 sites are being developed independently and there in no information to show that the work would run concurrently. The above analysis is based on the potential for works to be coincidental, not any information that they will be.

5.2 Generated Traffic During Operational Phase.

Paragraph 12.5 of the EIS for the Power Station at Platin assesses the traffic impacts during the operational phase of the facility. The EIS estimates a total employment level of 25-30 people. Paragraph 4.2 of the Traffic Impact Assessment report by Alpha Engineering Services goes on to give a maximum occupancy at any one time of 15 people.

Assuming a worst case scenario of a vehicle occupancy of 1, the generated traffic will result in an additional 15 traffic movements during the AM peak, assuming all 15 staff members arrive during the AM peak. The Traffic Impact Assessment report by Alpha Engineering Services assumes that there will be a 50:50 split on the R152. The same assumption is used in this analysis.

6.0 CAPACITY ANALYSIS

The EIS for the Power Station at Platin assesses the capacity of the entrance junction only, not the junctions remote from the site. The traffic assessment for the Waste to Energy Facility assessed a number of remote junctions to determine the impact of the development. This analysis showed that there was no significant impact from the proposed Indaver Waste to Energy Facility and that the further the junction from the development, the greater the traffic dispersal and therefore the lower the impact on the junction capacity. As the previous analysis shows that the greatest impact is on the 2 adjacent junctions, the R152/150 and R152/M1junctions, it is these junctions that will be analysed in this report. The more remote junctions will be impacted to a lower, insignificant degree, as demonstrated in the traffic assessment for the Waste to Energy Facility.

6.1 R152 Capacity Analysis

The traffic assessment for the Waste to Energy Facility assessed the capacity of the R152 in terms of Level of Service (LOS), as defined in the National Road Authority National Roads Needs Study. The assessment showed the existing flows on the R152 are 1,108veh in the peak hour. The Indaver Waste to energy facility would increase the flow to 1,142 veh. The Power Station at Platin would result in an additional 15 vehicles, raising the peak hour flow to 1,157 veh. This shows that there would be an increase of 4.4% in the R152 as a result of the combined generated traffic from the two sites.

The LOS for the R152 under existing traffic conditions is LOS E. Table 3.1b of the traffic assessment for the Waste to Energy Facility shows that LOS E relates to traffic flows between 8,600 and 15,600. The combined generate peak hour flow of 1,157 vehicles equates to an AADT of 11,570. This shows that under the cumulative flows generated by the two sites, the R152 continues to operate within LOS E. As stated in the traffic assessment for the Waste to Energy Facility, it is considered that LOS E is appropriate for the class of road.

6.2 R150/R152 Junction Capacity Analysis

The traffic assessment for the Waste to Energy Facility assessed the capacity of the R150/R152 junction under pre-development and post development traffic flows. The assessment concluded that there was no significant impact on the junction capacity as a result of the additional traffic generated by the proposed Indaver Waste to Energy Facility.

In order to assess the cumulative impact of the Waste to Energy Facility and the Power Station at Platin, the junction was re-analysed with the cumulative traffic flows. The results of the analysis are shown in Table 6.1 below. Figure RFI1 in Appendix A shows the cumulative traffic flows at the junction.

Junction Arm	Existing Traffic	Waste to Energy Facility Traffic	Cumulative Traffic
R152 North	0.441	0.487	0.488
R152 South	0.014	0.014	0.013
R150 East	0.151	0.151	0.149
R150 West	0.678	0.718	0.737

Table 6.1: PICADY Results for the R152/R150 Junction Under Cumulative Post Development Conditions

The results of the analysis shows that under the cumulative traffic flows, the junction operates below the desirable maximum RFC of 0.85, showing that the junction operates within capacity. The analysis also shows that there is not a large increase in the RFC above the level estimated for the Waste to Energy Facility alone. The full PICADY results for the junction analysis are given in Appendix B.

This demonstrates that the cumulative traffic generated by the proposed Waste to Energy Facility and the Power Plant at Platin does not adversely affect the operation of the R150/R152 Junction.

6.3 M1/R152 Junction Capacity Analysis (Western Interchange Roundabout)

The traffic assessment for the Waste to Energy Facility assessed the capacity of the M1/R152 junction (western roundabout) under pre-development and post development traffic flows. The assessment concluded that there was no significant impact on the junction capacity as a result of the additional traffic generated by the proposed Indaver Waste to Energy Facility.

In order to assess the cumulative impact of the Waste to Energy Facility and the Power Station at Platin, the junction was re-analysed with the cumulative traffic flows. The results of the analysis are shown in Table 6.2 below. Figure RFI2 in Appendix A shows the cumulative traffic flows at the junction.

Junction Arm	Existing Traffic	Waste to Energy Facility Traffic	Cumulative Traffic
R152 to Duleek	0.258	0.264	0.274
R152 to Drogheda	0.339	0.345	0.345
M1 Exit Slip	0.033	0.033	0.033

Table 6.2: PICADY Results for the M1/R152 Junction Under Cumulative Post Development Conditions

The results of the analysis shows that under the cumulative traffic flows, the junction operates below the desirable maximum RFC of 0.85, showing that the junction operates within capacity. The analysis also shows that there is not a large increase in the RFC above the level estimated for the Waste to Energy Facility alone. The full PICADY results for the junction analysis are given in Appendix B.

This demonstrates that the cumulative traffic generated by the proposed Waste to Energy Facility and the Power Plant at Platin does not adversely affect the operation of the western roundabout of the M1/R152 Junction.

7.0 SUITABILITY OF THE R152 ALIGNMENT

To the north of the proposed entrance to the development, there is a crest curve. The NRA Design Manual for Roads and Bridges (TD9/04) requires forward sight visibility of 160m as a desirable minimum for a design speed of 85kph. However, where there is not a junction within the sight lines, a one step relaxation, to 120m, may be used. On the R152, the forward sight visibility is reduced to 145m minimum at one point (based on a site survey) due to a crease curve to the north of the proposed Waste to Energy Facility. This is below the desirable minimum but greater than the allowable relaxation distance. As there are no existing junctions within section of reduced visibility, a relaxation is permitted. The available forward sight visibility therefore therefore complies with the requirements of the NRA DMRB.

The construction of the access junction for the proposed Indaver Waste to Energy Facility would not change the compliance with the sightline requirements. The access junction would not be within 1.5 times the minimum stopping sight distance (240m) available from the crest curve. Within 1.5 times the minimum Stopping Sight Distance (240m) the full stopping sight distance (160m) is available. Therefore the forward sight visibility along the R152 would meet the requirements of TD9/04 following the construction of the proposed Indaver Waste to Energy Facilitly.

However, the proposed access to the Power Station at Platin would result in a junction within 1.5 times the Sight Stopping Distance of a section where visibility is reduced. This relaxation in Stopping Sight Distance is not permitted by the DMRB. It should be noted that the planning application for the Power Station at Platin pre-dates the DMRB and therefore the requirement for full Stopping Sight Distance on the approach to a junction did not apply. Section 5 of the Traffic Impact Assessment report by Alpha Engineering Services refers to RT 180. This document has been superseded by the NRA DMRB and is no longer applicable.

The issue of substandard sight lines relates to the proposed Power Station at Platin rather than the Waste to Energy Facility. The insufficient forward sight visibility issue is completely independent of the Indaver Waste to Energy Facility. Were the Indaver Waste to Energy Facility to proceed in the absence of the Power Station at Platin, the DMRB sight line requirements would be achieved. Were the Power Station at Platin to proceed in the absence of the Indaver Waste to Energy Facility, the DMRB sight line requirements would not be achieved and the forward sight visibility on the approach to the Power Station at Platin access junction would be deficient. It is therefore considered that the issue of forward sight visibility and the impact of the Power Station at Platin access on that visibility is independent of the Indaver Waste to Energy Facility and is an issue to be addressed during the development of the details of the Power Station at Platin.

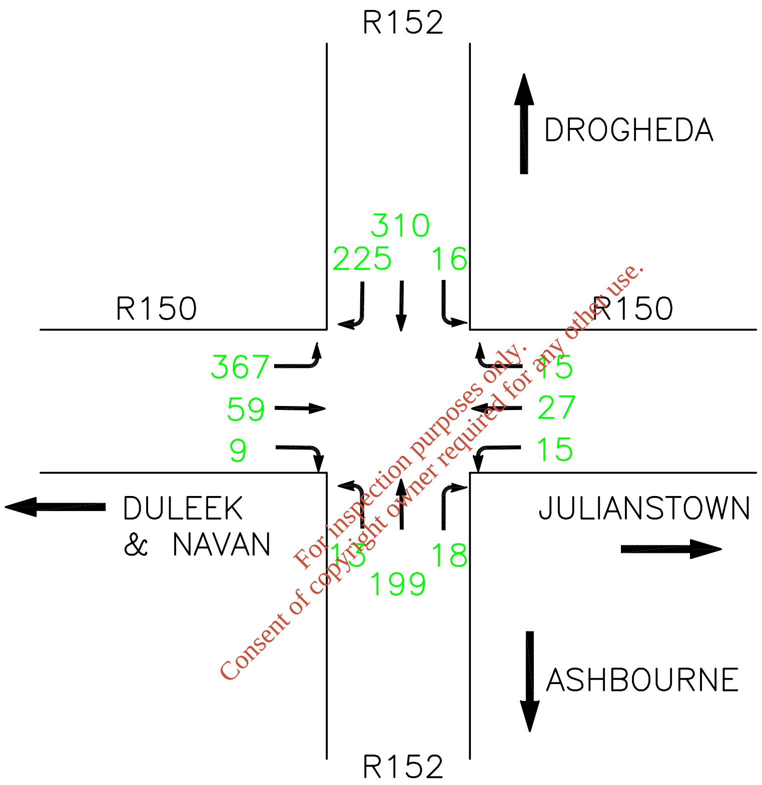
Based on the revised Traffic Impact Study the construction of the Waste to Energy Facility on it's own does not require the R152 to be upgraded, as it currently has sufficient capacity to cater for the generated traffic. Construction of a new access junction to the Waste to Energy plant will be required as part of the development. Realignment of the R152 is only necessary if the Power Station is constructed. Therefore Indaver Ireland propose that the realignment of the R152, as indicated on the planning drawings, be omitted from the current application in favour of the provision of the new access junction to the facility.

8.0 CONCLUSIONS

The conclusions of this Additional Information Report are as follows:

- Comparison between the existing traffic flows and the 2 proposals show that the construction flow and background peaks are not coincidental. This shows that there would be a spread of the peak period but that there will not be a cumulative impact due to simultaneous work on both sites.
- The R152 currently operates with a Level of Service (LOS) E, as defined by the NRA. With the development generated traffic, combined with the generated traffic from the proposed Power Station at Platin, the road will continue to operate with a LOS E.
- The R152/R150 junction at Duleek will operate within capacity under the expected traffic conditions as a result of the development, combined with the generated traffic from the proposed Power Station at Platin.
- The M1/R152 junction will operate well within capacity under the expected traffic conditions with no significant loss in spare capacity as a result of the traffic generated by the development, combined with the generated traffic from the proposed Power Station at Platin.
- A review of the geometry of the R152 and particularly the forward sight visibility on the approach to the Power Station at Platin should be carried out as part of the development of the Power Station at Platin.
- Realignment of the R152 is only necessary if the Power Station is constructed.

Appendix A
Figures



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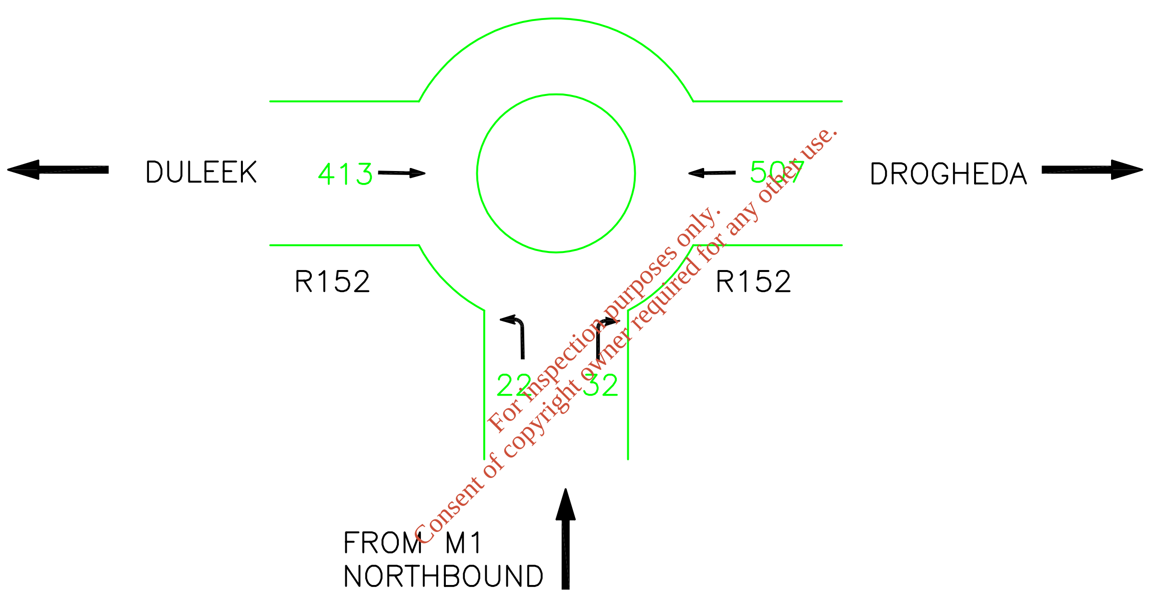
www.roughanodonovan.com

Project Title	WASTE TO ENERGY FACILITY AT CARRANSTOWN, Co MEATH							
Drawing Title	R150/R152 JUNCTION CUMULATIVE POST DEVELOPMENT AM PEAK HOUR FLOWS							
Date: May '06	Scale: N.T.S	CAD File: RFI FIGURE1	Project No.: 05.186	Drawn: JC	Checked: GTM	Approved: SMG	Drawing No.: FIGURE RFI1	Rev.: -

May 24, 2006 - 8:52am Drawing Location: L:\acaddwg\2005\05186\Drawings\RFI FIGURE 1.dwg



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Project Title	WASTE TO ENERGY FACILITY AT CARRANSTOWN, Co MEATH
Drawing Title	M1/R152 WESTERN ROUNDABOUT CUMULATIVE POST DEVELOPMENT AM PEAK HOUR FLOWS

Date	Scale	CAD File	Project No.	Drawn	Checked	Approved	Drawing No.	Rev.
May '06	N.T.S	RFI FIGURE7	05.186	SP	GTM	SMG	FIGURE RFI 8	-

May 24, 2006 - 8:52am Drawing Location: L:\acaddwg\2005\05186\Drawings\RFI FIGURE 2.dwg

Appendix B
Junction Capacity Analysis

TRL LIMITED

CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
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Run with file:-
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R150/ R152 Junction Pre Development

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY
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INPUT DATA

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                                     I
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                                     I
                                     I
                                     I
     MAJOR ROAD (ARM C) ------------------------ MAJOR ROAD (ARM A)
                                     I
                                     I
                                     I
                                     I
                                     I
                                     I
                                 MINOR ROAD (ARM B)
```


ARM A IS R152 North
ARM B IS R150 East
ARM C IS R152 South
ARM D IS R150 West

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

GEOMETRIC DATA

DATA ITEM		MINOR ROAD B		MINOR ROAD D
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	7.00 M.	(W)	7.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	3.00 M.	(WA-D)	3.00 M.
- VISIBILITY	(VC-B)	250.0 M.	(VA-D)	0.0 M.
- BLOCKS TRAFFIC		NO		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	250.0 M.	(VD-A)	150.0 M.
- VISIBILITY TO RIGHT	(VB-A)	150.0 M.	(VD-C)	250.0 M.
- LANE 1 WIDTH	(WB-C)	-	(WD-A)	-
- LANE 2 WIDTH	(WB-A)	-	(WD-C)	-
- WIDTH AT 0 M FROM JUNC.		4.40 M.		4.40 M.
- WIDTH AT 5 M FROM JUNC.		2.20 M.		2.20 M.
- WIDTH AT 10 M FROM JUNC.		2.20 M.		2.20 M.
- WIDTH AT 15 M FROM JUNC.		2.20 M.		2.20 M.
- WIDTH AT 20 M FROM JUNC.		2.20 M.		2.20 M.
- LENGTH OF FLARED SECTION		1 VEHS		1 VEHS

TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 07.45 AND ENDS 08.45

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

FLOW DATA USED IN THE ESTIMATION OF TURNING PROPORTIONS (VEH/MIN):

TIME INTERVAL	ARM A	ARM B	ARM C	ARM D
07.45 - 08.00				
ENTRY	9.1	0.9	3.8	7.0
EXIT	9.4	1.5	5.5	4.3
08.00 - 08.15				
ENTRY	9.1	0.9	3.8	7.0
EXIT	9.4	1.5	5.5	4.3
08.15 - 08.30				
ENTRY	9.1	0.9	3.8	7.0
EXIT	9.4	1.5	5.5	4.3
08.30 - 08.45				
ENTRY	9.1	0.9	3.8	7.0
EXIT	9.4	1.5	5.5	4.3

TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D
		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)			
07.45 - 08.45	ARM A	0.000 (0.0)	0.035 (10.0)	0.548 (10.0)	0.417 (10.0)
	ARM B	0.652 (10.0)	0.000 (0.0)	0.144 (10.0)	0.205 (10.0)
	ARM C	0.857 (10.0)	0.033 (10.0)	0.000 (0.0)	0.110 (10.0)
	ARM D	0.778 (10.0)	0.155 (10.0)	0.067 (10.0)	0.000 (0.0)

TURNING PROPORTIONS ARE CALCULATED FROM ENTRY AND EXIT FLOWS

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
07.45-08.00								
B-CD	0.24	6.45	0.037		0.0	0.0	0.5	
B-AD	0.68	4.50	0.151		0.0	0.2	2.5	
A-B	0.31							
A-C	4.96							
A-D	3.77	8.56	0.441		0.0	0.8	10.8	
D-AB	6.06	8.94	0.678		0.0	2.0	26.1	
D-BC	0.96	3.78	0.255		0.0	0.3	4.6	
C-D	0.42							
C-A	3.28							
C-B	0.12	8.75	0.014		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.00-08.15								
B-CD	0.24	6.43	0.037		0.0	0.0	0.6	
B-AD	0.68	4.45	0.153		0.2	0.2	2.7	
A-B	0.31							
A-C	4.96							
A-D	3.77	8.56	0.441		0.8	0.8	11.6	
D-AB	6.06	8.90	0.680		2.0	2.1	30.3	
D-BC	0.96	3.67	0.262		0.3	0.3	5.1	
C-D	0.42							
C-A	3.28							
C-B	0.12	8.73	0.014		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
B-CD	0.24	6.43	0.037		0.0	0.0	0.6	
B-AD	0.68	4.45	0.153		0.2	0.2	2.7	
A-B	0.31							
A-C	4.96							
A-D	3.77	8.56	0.441		0.8	0.8	11.7	
D-AB	6.06	8.90	0.681		2.1	2.1	31.0	
D-BC	0.96	3.67	0.262		0.3	0.4	5.2	
C-D	0.42							
C-A	3.28							
C-B	0.12	8.73	0.014		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
B-CD	0.24	6.43	0.037		0.0	0.0	0.6	
B-AD	0.68	4.45	0.153		0.2	0.2	2.7	
A-B	0.31							
A-C	4.96							
A-D	3.77	8.56	0.441		0.8	0.8	11.8	
D-AB	6.06	8.90	0.681		2.1	2.1	31.3	
D-BC	0.96	3.66	0.262		0.4	0.4	5.3	
C-D	0.42							
C-A	3.28							
C-B	0.12	8.73	0.014		0.0	0.0	0.2	

QUEUE FOR STREAM B-CD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.0
08.15	0.0
08.30	0.0
08.45	0.0

QUEUE FOR STREAM B-AD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.2
08.15	0.2
08.30	0.2
08.45	0.2

QUEUE FOR STREAM A-D

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.00	0.8	*
08.15	0.8	*
08.30	0.8	*
08.45	0.8	*

QUEUE FOR STREAM D-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.00	2.0	**
08.15	2.1	**
08.30	2.1	**
08.45	2.1	**

QUEUE FOR STREAM D-BC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.3
08.15	0.3
08.30	0.4
08.45	0.4

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.0
08.15	0.0
08.30	0.0
08.45	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
B-CD	14.4	14.4	2.3	0.16	2.3	0.16
B-AD	40.8	40.8	10.5	0.26	10.5	0.26
A-B	18.8	18.8				
A-C	297.8	297.8				
A-D	226.4	226.4	45.9	0.20	45.9	0.20
D-AB	363.5	363.5	118.6	0.33	118.9	0.33
D-BC	57.7	57.7	20.2	0.35	20.2	0.35
C-D	25.4	25.4				
C-A	196.9	196.9				
C-B	7.5	7.5	0.9	0.11	0.9	0.11
ALL	1249.2	1249.2	198.4	0.16	198.7	0.16

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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[Printed at 14:52:10 on 12/05/2006]

CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
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R150/ R152 Junction Post Development

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY
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                                    I
                                    I
                                    I
                                    I
                                    I
                                    I
                                MINOR ROAD (ARM B)
```


ARM A IS R152 North
ARM B IS R150 East
ARM C IS R152 South
ARM D IS R150 West

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

GEOMETRIC DATA

DATA ITEM	MINOR ROAD B	MINOR ROAD D
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W) 7.00 M.	(W) 7.00 M.
CENTRAL RESERVE WIDTH	(WCR) 0.00 M.	(WCR) 0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B) 3.00 M.	(WA-D) 3.00 M.
- VISIBILITY	(VC-B) 250.0 M.	(VA-D) 0.0 M.
- BLOCKS TRAFFIC	NO	NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C) 250.0 M.	(VD-A) 150.0 M.
- VISIBILITY TO RIGHT	(VB-A) 150.0 M.	(VD-C) 250.0 M.
- LANE 1 WIDTH	(WB-C) -	(WD-A) -
- LANE 2 WIDTH	(WB-A) -	(WD-C) -
- WIDTH AT 0 M FROM JUNC.	4.40 M.	4.40 M.
- WIDTH AT 5 M FROM JUNC.	2.20 M.	2.20 M.
- WIDTH AT 10 M FROM JUNC.	2.20 M.	2.20 M.
- WIDTH AT 15 M FROM JUNC.	2.20 M.	2.20 M.
- WIDTH AT 20 M FROM JUNC.	2.20 M.	2.20 M.
- LENGTH OF FLARED SECTION	1 VEHS	1 VEHS

TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 07.45 AND ENDS 08.45

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

FLOW DATA USED IN THE ESTIMATION OF TURNING PROPORTIONS (VEH/MIN):

TIME INTERVAL	ARM A	ARM B	ARM C	ARM D
07.45 - 08.00				
ENTRY	9.5	0.8	3.8	7.3
EXIT	9.8	1.6	5.5	4.7
08.00 - 08.15				
ENTRY	9.5	0.8	3.8	7.3
EXIT	9.8	1.6	5.5	4.7
08.15 - 08.30				
ENTRY	9.5	0.8	3.8	7.3
EXIT	9.8	1.6	5.5	4.7
08.30 - 08.45				
ENTRY	9.5	0.8	3.8	7.3
EXIT	9.8	1.6	5.5	4.7

TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D
		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)			
07.45 - 08.45					
	ARM A	0.000	0.033	0.529	0.438
		(0.0)	(10.0)	(10.0)	(10.0)
	ARM B	0.682	0.000	0.123	0.195
		(10.0)	(0.0)	(10.0)	(10.0)
	ARM C	0.872	0.028	0.000	0.100
		(10.0)	(10.0)	(0.0)	(10.0)
	ARM D	0.789	0.155	0.056	0.000
		(10.0)	(10.0)	(10.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM ENTRY AND EXIT FLOWS

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
07.45-08.00								
B-CD	0.19	6.23	0.030		0.0	0.0	0.4	
B-AD	0.61	4.29	0.143		0.0	0.2	2.3	
A-B	0.31							
A-C	5.04							
A-D	4.17	8.56	0.487		0.0	0.9	12.8	
D-AB	6.39	8.90	0.718		0.0	2.3	30.5	
D-BC	0.93	3.42	0.271		0.0	0.4	4.9	
C-D	0.38							
C-A	3.34							
C-B	0.11	8.56	0.013		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.00-08.15								
B-CD	0.19	6.21	0.030		0.0	0.0	0.5	
B-AD	0.61	4.23	0.145		0.2	0.2	2.5	
A-B	0.31							
A-C	5.04							
A-D	4.17	8.56	0.487		0.9	0.9	13.9	
D-AB	6.39	8.86	0.722		2.3	2.5	36.3	
D-BC	0.93	3.28	0.283		0.4	0.4	5.6	
C-D	0.38							
C-A	3.34							
C-B	0.11	8.54	0.013		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
B-CD	0.19	6.21	0.030		0.0	0.0	0.5	
B-AD	0.61	4.23	0.145		0.2	0.2	2.5	
A-B	0.31							
A-C	5.04							
A-D	4.17	8.56	0.487		0.9	0.9	14.1	
D-AB	6.39	8.86	0.722		2.5	2.5	37.4	
D-BC	0.93	3.28	0.283		0.4	0.4	5.8	
C-D	0.38							
C-A	3.34							
C-B	0.11	8.54	0.013		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
B-CD	0.19	6.21	0.030		0.0	0.0	0.5	
B-AD	0.61	4.23	0.145		0.2	0.2	2.5	
A-B	0.31							
A-C	5.04							
A-D	4.17	8.56	0.487		0.9	0.9	14.1	
D-AB	6.39	8.86	0.722		2.5	2.5	37.8	
D-BC	0.93	3.27	0.283		0.4	0.4	5.8	
C-D	0.38							
C-A	3.34							
C-B	0.11	8.54	0.013		0.0	0.0	0.2	

QUEUE FOR STREAM B-CD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.0
08.15	0.0
08.30	0.0
08.45	0.0

QUEUE FOR STREAM B-AD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.2
08.15	0.2
08.30	0.2
08.45	0.2

QUEUE FOR STREAM A-D

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.00	0.9	*
08.15	0.9	*
08.30	0.9	*
08.45	0.9	*

QUEUE FOR STREAM D-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.00	2.3	**
08.15	2.5	**
08.30	2.5	***
08.45	2.5	***

QUEUE FOR STREAM D-BC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.4
08.15	0.4
08.30	0.4
08.45	0.4

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.0
08.15	0.0
08.30	0.0
08.45	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND		* QUEUEING * * DELAY *		* INCLUSIVE QUEUEING * * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
B-CD	11.2	11.2	1.8	0.16	1.8	0.16
B-AD	36.8	36.8	9.8	0.27	9.8	0.27
A-B	18.9	18.9				
A-C	302.4	302.4				
A-D	249.9	249.9	54.9	0.22	55.0	0.22
D-AB	383.5	383.5	141.9	0.37	142.3	0.37
D-BC	55.7	55.7	22.2	0.40	22.2	0.40
C-D	23.0	23.0				
C-A	200.4	200.4				
C-B	6.4	6.4	0.8	0.12	0.8	0.12
ALL	1288.2	1288.2	231.5	0.18	231.9	0.18

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

****** PICADY 4 run completed.

== end of file ==

[Printed at 15:03:33 on 12/05/2006]

TRL LIMITED

CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

FOR SALES AND DISTRIBUTION INFORMATION,
PROGRAM ADVICE AND MAINTENANCE CONTACT:
TRL SOFTWARE BUREAU
TEL: CROWTHORNE (01344) 770758, FAX: 770864
EMAIL: SoftwareBureau@trl.co.uk

Run with file:-
"p:\Projects\2005 Files\05.186 Waste Management Facility at Carranstown\calcs\
CUMULATIVE R150_R152 pre development.vpi"
(drive-on-the-left) at 15:00:53 on Friday, 12 May 2006

RUN TITLE
****
R150/ R152 Junction Post Development with power station

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY
****

INPUT DATA

```
                              MINOR ROAD (ARM D)
                                  I
                                  I
                                  I
                                  I
                                  I
                                  I
  MAJOR ROAD (ARM C) ---------------------- MAJOR ROAD (ARM A)
                                  I
                                  I
                                  I
                                  I
                                  I
                                  I
                              MINOR ROAD (ARM B)
```

ARM A IS R152 North
ARM B IS R150 East
ARM C IS R152 South
ARM D IS R150 West

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

GEOMETRIC DATA

DATA ITEM		MINOR ROAD B		MINOR ROAD D
TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	(W)	7.00 M.	(W)	7.00 M.
CENTRAL RESERVE WIDTH	(WCR)	0.00 M.	(WCR)	0.00 M.
MAJOR ROAD RIGHT TURN - WIDTH	(WC-B)	3.00 M.	(WA-D)	3.00 M.
- VISIBILITY	(VC-B)	250.0 M.	(VA-D)	0.0 M.
- BLOCKS TRAFFIC		NO		NO
MINOR ROAD - VISIBILITY TO LEFT	(VB-C)	250.0 M.	(VD-A)	150.0 M.
- VISIBILITY TO RIGHT	(VB-A)	150.0 M.	(VD-C)	250.0 M.
- LANE 1 WIDTH	(WB-C)	-	(WD-A)	-
- LANE 2 WIDTH	(WB-A)	-	(WD-C)	-
- WIDTH AT 0 M FROM JUNC.		4.40 M.		4.40 M.
- WIDTH AT 5 M FROM JUNC.		2.20 M.		2.20 M.
- WIDTH AT 10 M FROM JUNC.		2.20 M.		2.20 M.
- WIDTH AT 15 M FROM JUNC.		2.20 M.		2.20 M.
- WIDTH AT 20 M FROM JUNC.		2.20 M.		2.20 M.
- LENGTH OF FLARED SECTION		1 VEHS		1 VEHS

TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 07.45 AND ENDS 08.45

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

FLOW DATA USED IN THE ESTIMATION OF TURNING PROPORTIONS (VEH/MIN):

TIME INTERVAL	ARM A	ARM B	ARM C	ARM D
07.45 - 08.00				
ENTRY	9.5	0.8	3.9	7.5
EXIT	10.0	1.6	5.5	4.7
08.00 - 08.15				
ENTRY	9.5	0.8	3.9	7.5
EXIT	10.0	1.6	5.5	4.7
08.15 - 08.30				
ENTRY	9.5	0.8	3.9	7.5
EXIT	10.0	1.6	5.5	4.7
08.30 - 08.45				
ENTRY	9.5	0.8	3.9	7.5
EXIT	10.0	1.6	5.5	4.7

TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D
		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)			
07.45 - 08.45					
	ARM A	0.000	0.033	0.528	0.438
		(0.0)	(10.0)	(10.0)	(10.0)
	ARM B	0.687	0.000	0.123	0.189
		(10.0)	(0.0)	(10.0)	(10.0)
	ARM C	0.875	0.027	0.000	0.097
		(10.0)	(10.0)	(0.0)	(10.0)
	ARM D	0.793	0.152	0.056	0.000
		(10.0)	(10.0)	(10.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM ENTRY AND EXIT FLOWS

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
07.45-08.00								
B-CD	0.19	6.21	0.031		0.0	0.0	0.4	
B-AD	0.63	4.24	0.149		0.0	0.2	2.4	
A-B	0.32							
A-C	5.03							
A-D	4.17	8.54	0.488		0.0	0.9	12.9	
D-AB	6.55	8.88	0.737		0.0	2.5	32.8	
D-BC	0.93	3.29	0.284		0.0	0.4	5.2	
C-D	0.38							
C-A	3.41							
C-B	0.11	8.56	0.013		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.00-08.15								
B-CD	0.19	6.19	0.031		0.0	0.0	0.5	
B-AD	0.63	4.17	0.151		0.2	0.2	2.6	
A-B	0.32							
A-C	5.03							
A-D	4.17	8.54	0.488		0.9	0.9	14.0	
D-AB	6.55	8.84	0.741		2.5	2.7	39.6	
D-BC	0.93	3.13	0.298		0.4	0.4	6.0	
C-D	0.38							
C-A	3.41							
C-B	0.11	8.54	0.013		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
B-CD	0.19	6.19	0.031		0.0	0.0	0.5	
B-AD	0.63	4.17	0.151		0.2	0.2	2.6	
A-B	0.32							
A-C	5.03							
A-D	4.17	8.54	0.488		0.9	0.9	14.2	
D-AB	6.55	8.84	0.741		2.7	2.8	41.0	
D-BC	0.93	3.12	0.299		0.4	0.4	6.2	
C-D	0.38							
C-A	3.41							
C-B	0.11	8.54	0.013		0.0	0.0	0.2	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
B-CD	0.19	6.19	0.031		0.0	0.0	0.5	
B-AD	0.63	4.17	0.151		0.2	0.2	2.7	
A-B	0.32							
A-C	5.03							
A-D	4.17	8.54	0.488		0.9	0.9	14.2	
D-AB	6.55	8.83	0.741		2.8	2.8	41.5	
D-BC	0.93	3.12	0.299		0.4	0.4	6.3	
C-D	0.38							
C-A	3.41							
C-B	0.11	8.54	0.013		0.0	0.0	0.2	

QUEUE FOR STREAM B-CD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.0
08.15	0.0
08.30	0.0
08.45	0.0

QUEUE FOR STREAM B-AD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.2
08.15	0.2
08.30	0.2
08.45	0.2

QUEUE FOR STREAM A-D

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.00	0.9	*
08.15	0.9	*
08.30	0.9	*
08.45	0.9	*

QUEUE FOR STREAM D-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.00	2.5	***
08.15	2.7	***
08.30	2.8	***
08.45	2.8	***

QUEUE FOR STREAM D-BC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.4
08.15	0.4
08.30	0.4
08.45	0.4

QUEUE FOR STREAM C-B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.0
08.15	0.0
08.30	0.0
08.45	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

STREAM	TOTAL DEMAND		* QUEUEING * * DELAY *		* INCLUSIVE QUEUEING * * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
B-CD	11.4	11.4	1.9	0.16	1.9	0.16
B-AD	37.8	37.8	10.3	0.27	10.3	0.27
A-B	19.1	19.1				
A-C	301.8	301.8				
A-D	250.3	250.3	55.3	0.22	55.4	0.22
D-AB	392.8	392.8	154.9	0.39	155.3	0.40
D-BC	56.0	56.0	23.8	0.42	23.8	0.43
C-D	22.7	22.7				
C-A	204.9	204.9				
C-B	6.4	6.4	0.8	0.12	0.8	0.12
ALL	1303.2	1303.2	246.9	0.19	247.4	0.19

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

****** PICADY 4 run completed.

=== end of file ==

[Printed at 15:04:12 on 12/05/2006]

A R C A D Y 6

ASSESSMENT OF ROUNDABOUT CAPACITY AND DELAY

Analysis Program: Release 3.0 (JUNE 2005)

For sales and distribution information,
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Run with file:-
"p:\Projects\2005 Files\05.186 Waste Management Facility at Carranstown\calcs\western roundabout predevelop.vai"
(drive-on-the-left) at 15:57:32 on Friday, 12 May 2006

FILE PROPERTIES

RUN TITLE: R152/M1 Interchange Western Roundabout
LOCATION: Duleek
DATE: 10/01/2006
CLIENT: Indevar
ENUMERATOR: Traffic [580130J]
JOB NUMBER: 05.186
STATUS: TIA
DESCRIPTION: Analysis of Western Roundabout

INPUT DATA

ARM A - R152 to Duleek
ARM B - R152 to Drogheda
ARM C - M1 exit slip

GEOMETRIC DATA

ARM	V (M)	E (M)	L (M)	R (M)	D (M)	PHI (DEG)	SLOPE	INTERCEPT (PCU/MIN)
ARM A	4.00	7.00	10.00	20.00	43.00	30.0	0.629	27.930
ARM B	3.75	6.50	12.00	20.00	43.00	30.0	0.618	26.950
ARM C	6.00	8.00	12.00	20.00	43.00	30.0	0.735	36.887

V = approach half-width
E = entry width
L = effective flare length
R = entry radius
D = inscribed circle diameter
PHI = entry angle

TRAFFIC DEMAND DATA

(Only sets included in the current run are shown)

ARM	FLOW SCALE(%)
A	100
B	100
C	100

TIME PERIOD BEGINS 08.00 AND ENDS 09.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.
DEMAND SET TITLE: Cumulative

FLOW DATA USED IN THE ESTIMATION OF TURNING PROPORTIONS (VEH/MIN) -

TIME INTERVAL	ARM A	ARM B	ARM C
08.00 - 08.15			
ENTRY	6.9	8.4	0.9
EXIT	8.8	7.4	0.0
08.15 - 08.30			
ENTRY	6.9	8.4	0.9
EXIT	8.8	7.4	0.0
08.30 - 08.45			
ENTRY	6.9	8.4	0.9
EXIT	8.8	7.4	0.0
08.45 - 09.00			
ENTRY	6.9	8.4	0.9
EXIT	8.8	7.4	0.0

DEMAND SET TITLE: Cumulative

TIME	TURNING PROPORTIONS (PERCENTAGE OF H.V.S)			
	FROM/TO	ARM A	ARM B	ARM C
08.00 - 09.00	ARM A	0.000	1.000	0.000
		(10.0)	(10.0)	(10.0)
	ARM B	1.000	0.000	0.000
		(10.0)	(10.0)	(10.0)
	ARM C	0.463	0.537	0.000
		(10.0)	(10.0)	(10.0)

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
08.00-08.15									
ARM A	6.87	25.09	0.274		0.0	0.4	5.5		0.05
ARM B	8.45	24.50	0.345		0.0	0.5	7.7		0.06
ARM C	0.90	27.35	0.033		0.0	0.0	0.5		0.04

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
08.15-08.30									
ARM A	6.87	25.09	0.274		0.4	0.4	5.6		0.05
ARM B	8.45	24.50	0.345		0.5	0.5	7.9		0.06
ARM C	0.90	27.32	0.033		0.0	0.0	0.5		0.04

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
08.30-08.45									
ARM A	6.87	25.09	0.274		0.4	0.4	5.6		0.05
ARM B	8.45	24.50	0.345		0.5	0.5	7.9		0.06
ARM C	0.90	27.32	0.033		0.0	0.0	0.5		0.04

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
08.45-09.00									
ARM A	6.87	25.09	0.274		0.4	0.4	5.6		0.05
ARM B	8.45	24.50	0.345		0.5	0.5	7.9		0.06
ARM C	0.90	27.32	0.033		0.0	0.0	0.5		0.04

QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.15	0.4
08.30	0.4
08.45	0.4
09.00	0.4

QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
08.15	0.5	*
08.30	0.5	*
08.45	0.5	*
09.00	0.5	*

QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.15	0.0
08.30	0.0
08.45	0.0
09.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND (VEH)	TOTAL DEMAND (VEH/H)	* QUEUEING * * DELAY * (MIN)	* QUEUEING * * DELAY * (MIN/VEH)	* INCLUSIVE QUEUEING * * DELAY * (MIN)	* INCLUSIVE QUEUEING * * DELAY * (MIN/VEH)
A	412.2	412.2	22.4	0.05	22.4	0.05
B	507.0	507.0	31.3	0.06	31.3	0.06
C	54.0	54.0	2.0	0.04	2.0	0.04
ALL	973.2	973.2	55.8	0.06	55.8	0.06

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD.
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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Appendix C
Extracts from Power Station at Platin EIS

12. TRAFFIC

12.1 Introduction

12.1.1 Scope

The scope of this assessment is to consider the potential effects of traffic due to the proposed development on traffic and the roads infrastructure under the following:

- Construction
- Operation

The proposed development site lies on the R152 between Duleek and Drogheda, and the assessment considers the impact of additional traffic on this road. Alpha Engineering Services were commissioned to carry out a traffic survey and impact assessment, which is included in Attachment 9 to this document. The original assessment carried in November 1999 allowed for a right turn storage lane for traffic travelling from Duleek, this has since been removed. A second assessment was carried out in March 2000 on the proposed junction layout i.e. no right turn storage lane.

The potential effect of the development on the planned new motorway bypassing Drogheda is also addressed.

12.1.2 Approach

The approach used in assessing the potential impacts is to establish the existing traffic flows and the capacity of the road. The increase in traffic due to the construction and operation of the development, is projected based on the experience of MPIL and SSE in the power generation business. The impact of this increased traffic is then assessed by comparing the projected traffic flow with the capacity of the road.

12.1.3 Methodology and Standards

The potential for congestion to arise at the entrance to the site is assessed using the UK Department of Transport Model PICADY, which predicts capacities, queues and delay at junctions.

In calculating the capacities, queues and delays PICADY carries out the following:

- The profile of demand flows in time is calculated and derived for each 10 mins.
- For each 10 minutes the traffic demand in each stream is calculated. The junction entry capacity and final queue length are then calculated for each stream, taking into account the flows from other conflicting streams and the initial queue at the start of the 10 minutes time segment.

For each time segment the maximum preferable ratio of flow to capacity for a junction is 0.85.

The traffic flow capacity of the R152 is established using design guideline RT180 'Geometric Design Guidelines' published by the Environmental Research Unit.

12.2 Description of the Existing Environment

12.2.1 Roads Infrastructure

Access to the site from the R152 will be facilitated by the purchase of a portion of an adjoining field. The R152 is a single lane carriageway with a 60mph speed limit.

The programme to improve the national roads network by National Roads Authority (NRA) includes a plan to by-pass Drogheda. Work began on sections of the bypass in 1999, however it will not be opened until 2004. This by-pass will form an important addition to the North/South strategic road corridor improving traffic flow. The proposed development will be located approximately 1.5 – 2km from the route of the proposed by-pass.

12.2.2 Current Traffic Flows

Baseline traffic flows were obtained from Meath County Council and from a traffic count carried out by Alpha Engineering Services. The Meath County Council data is from a seven day volumetric traffic count carried out in February 1999. Alpha Engineering carried out a further traffic count over a 12 hour period in August 1999. The data on peak flows and Annual Average Daily Traffic (AADT) flows obtained from the traffic counts are summarised in Table 33.

Table 1: Existing Traffic Flows on the R152

Traffic Count	AADT	Peak Hour AM	Peak Hour PM
Meath County Council	6400	560	470
Current Study	5600	650	760

The peak traffic flows were observed to occur between 7am and 8am and also from 5pm and 6:30pm during the count for the current study and were recorded as occurring from 7am to 9am and 5pm to 7pm in the Meath Co. Co. data.

During peak times the percentage of HGVs was measured as being 20% for southbound traffic and 13% for northbound traffic. During non peak flows the percentage of HGVs varied from 15% to 45%.

12.3 Construction Impacts

12.3.1 Introduction

Access to the site will be the same during construction as during operation. The access will consist of a single junction onto the R152. The access road arrangements will be in accordance with current design standards and the development control policies of Meath County Council.

12.3.2 Projected Construction Traffic

During the construction phase the number of people employed at the site is expected to peak at c. 400 people. It is assumed that 80% of construction employees will travel to work by car with an average occupancy of 1.3 persons per vehicle. The peak construction traffic is predicted to be 640 vehicles as a two way daily traffic flow.

It is also assumed that the morning and evening peak flows will coincide with the existing peak flows. Based on the above occupancy levels and number of employees the construction peak hour flows will be 245 vehicles.

It is not expected that the development of the site will require significant earth works which would entail the movement of earth, onto or off the site, by truck. The peak construction HGV movements is expected to be in the order of 50 movements per day.

The projected traffic flows are summarised in Table 34.

Table 2: Peak Construction Traffic

Time Period	Deliveries & Other Vehicles		Employees Vehicles		Total	
	In	Out	In	Out	In	Out
All Day (AADT)	25	25	320	320	345	345
Peak Hour Flows	2	2	245	245	247	247

12.3.3 Abnormal Loads

There will be a number of deliveries to the site which constitute abnormal loads by virtue of their size and weight. Such items will include the gas turbine, the waste heat boiler and the electrical generator. The gas turbine alone weighs approximately 300 tonnes. As discussed in Section 2.4 a route survey was carried out by the Freight Handling Division of Irish Rail to ensure that such a load could be transported to the proposed site. A proposed transportation route from the Dublin docks to Platin was identified. The route was checked to ensure the bridges were adequate and turning circles sufficient. The route would take the load from the docks out through Clontarf, Coolock, Santry, briefly along the M50, before heading from the Ballymun roundabout towards the airport and across then to the N2. Along the route there are some road signs and traffic bollards, such as the traffic calming measures in Ashbourne, that may need to be removed. There are also a number of electricity and telecom overhead lines that will need to be raised or possibly removed. In addition tree cutting may need to be organised particularly along the road from Cushinstown to Duleek.

Permits for the passage of the load will be the responsibility of Dublin Corporation, Fingal County Council and Meath County Council. Permission is also required from the Chief Civil Engineer, Infrastructure, Iarnrod Eireann and Dublin Port and Docks Board. In addition the Gardai will also have to be notified of the times and route of the movement.

12.3.4 Assessment of Impacts

In assessing the impacts the following assumptions were made:

- Percentage of HGVs is 20%.
- Peak background traffic of 7.3 vehicles/min in either direction on the R152. This is the peak flow as measured in August 1999.
- A 50:50 north:south, split for traffic generated by the development.

The peak construction phase traffic will result in a 32% to 37% increase in peak hour traffic, which effectively means that the two way morning and evening peak hour traffic will increase from c. 700 vehicles/hour to c. 950 vehicles/hour. This is below the capacity of the road, estimated to be between 1150 and 1600 vehicles per hour.

The analysis of the junction using PICADY found that the maximum ratio of flow to capacity for all streams is less than 0.85 (this is the maximum preferable Ratio of Flow to Capacity – RFC ratio – for a junction). This analysis was based on all the construction traffic (i.e. 245 vehicles) arriving over a 30 minute period in the morning and leaving over a 30 minute period in the evening. As far as possible the developers will allow for this to happen.

In the morning, the maximum predicted queue length for vehicles turning right into the plant is 5.5 vehicles, with an average queuing time of approximately 0.5 min/vehicle. In comparison to the Traffic Impact Assessment carried out in November 1999, there is an increase in queuing length (previously 1.5 vehicles) with no apparent increase in queuing time (previously also less than 1 minute). This is primarily due to the improved sight lines of the revised junction layout.

In the evening, the maximum predicted queue lengths for traffic leaving the facility was 15 vehicles with a maximum queuing time of less than 1.5 minutes. This is an increase from a queue length of 3.2 vehicles and queuing time of less that one minute.

Implementation of the mitigation measures stated below will minimise the impact of the construction generated traffic.

12.4 Construction Traffic Mitigation Measures

In order to minimise the potential impacts of construction traffic a new junction layout will be provided. The layout will be designed in accordance with the RT180 guidelines for a RRU100 road, providing the required stopping distances, sight lines, etc. To achieve the required sight lines to the north, approximately 0.5m will be skimmed from the brow of the hill. This will be carried out in such a manner to minimise disturbance to existing road entrances. In addition existing services e.g. gas, water, etc., will be maintained.

The layout will include a deceleration lane for all traffic entering the plant from the north (Drogheda). The deceleration lane will be incorporated into the road frontage of the new development.

The new road layout will be agreed with Meath County Council before construction commences. The work itself will be carried out by Meath County Council or an approved contractor. The full costs of providing the entrance and all alterations to the public road (associated with the new entrance) shall be borne by the developer.

In addition to minimise impact on the local environment, a traffic management plan will be put in place during the construction phase. The management plan will include, *inter alia*, the following:

- Provision of traffic calming measures, by use of traffic cones and road signs.
- The delivery of materials to the site shall be minimised during the morning and evening peak traffic periods.
- The removal of surplus material off-site shall be minimised during the morning or evening peak traffic periods. It should be noted that the development will not require significant earth movements off site. As far as possible all spoil will be used on site for landscaping.
- Temporary parking of vehicles on the public road will be prohibited.
- A truck wheel wash will be provided to maintain a clean public road.
- A temporary right turn storage may be incorporated into the junction layout during the peak construction phase, if necessary. It is noted that from the November 1999 Traffic Impact Assessment that with the right turn storage facility the junction was able to cope with all contractors arriving in a 15 minute period in the morning time.
- The developers will consider the option of providing buses to transport contractors to/from the site during the peak construction period. Implementation of this proposal would almost alleviate any impact associated with traffic during the construction phase.

12.5 Operation Impacts

The expected employment levels during operation are in the order of 25-30 people working in shifts. The traffic flows generated by these personnel is not considered significant. During annual shutdowns for maintenance the number of staff may increase to 100 for a two to three week period. This will result in a 4% increase in morning and evening peak flows which will not result in a significant impact.

This minor level of traffic during the operational phase will not have a significant impact on the Drogheda bypass due to be opened in 2004.

12.6 Operation Mitigation Measures

As no significant impact is anticipated from traffic during operation, there are no specific mitigation measures proposed. The new road layout installed for the construction phase will remain in place for the long term operation of the plant.

12.7 Conclusions

The traffic movements generated by the construction phase will not significantly impact on the daily flow movements. A temporary increase in peak hour flows during the height of the construction phase (i.e. when the maximum number of contractors are on site) will be experienced.

The operational phase of the development will not have a significant impact on the daily or peak hour traffic flows on the R152. Local community traffic, such as associated with Mount Hanover School, will not be affected.

TRAFFIC IMPACT ASSESSMENT

OF

PROPOSED POWER STATION

AT

PLATIN

FOR

PROJECT MANAGEMENT LTD.

Alpha Engineering Services
February 2000
A202

REPORT ISSUE

Report Title: Traffic Impact Assessment of Proposed Power Station, for Platnin for Project Management Ltd.

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CONTENTS

1.0 INTRODUCTION

In August 1999 Alpha Engineering Services were commissioned by Project Management Ltd. to prepare a traffic impact statement for a proposed power station development in Platin, Co. Meath.

The report details the likely impact of the additional development generated traffic on the immediate local public road.

Following this introduction, the report comprises six further chapters. Chapter 2 describes the existing conditions which includes site locations and current traffic flows. Chapter 3 describes the proposed development. Chapter 4 describes the expected traffic generated by the development including construction and operational generated traffic. Chapters 5 and 6 describe the analysis and findings of the analysis respectively. Finally, Chapter 7 presents the conclusions of the report.

2.0 EXISTING CONDITIONS

2.1 Site Location

The proposed development site is 13 ha in size and is located on the R152 between Dundalk and Duleek. The site is currently green field and is used for agricultural purposes. The proposed development site is adjacent to an existing cement factory.

The R152 is a single carriageway road and forms the northern boundary of the site. The existing speed limit on the road is 60 mph.

2.2 Current Traffic Flows

Consultation with Meath County Council indicated that a seven day volumetric traffic count was carried out on the R152 between the N2 National Route and Duleek between the 10th February 1999 and 16th February 1999. The count data is included in Appendix 1.

The result of the count indicated two-way peak morning and evening flows to be 9.3 vehicles/min and 8.8 vehicles/min respectively. The data indicated that morning and evening peak traffic flows occur from 7am to 9am and 5pm to 7pm respectively.

The County Council also indicated that National Roads Authority count data is not available for the R152.

On Wednesday the 25th August 1999 a 12-hour, two-way traffic count from 7am to 7pm was carried out by Alpha Engineering Services. The data from the count is included in Appendix 2. The count indicated the following:

- The peak two-way morning and evening traffic flows were noted to be 14.6 vehicles/min (i.e. 7.3 vehicles/min were recorded in both the southbound and northbound direction).

- The peak traffic periods on the R152 adjacent to the site of interest occur from 7am to 8am and 5.00pm to 6.30pm.

- The percentage HGV's was measured to be 20% for southbound traffic (from Drogheda) and 13% for North bound traffic (to Drogheda).

- Non-peak traffic flows were noted to vary between 1.7 and 4.5 vehicles/min, with the percentage HGV's varying between 15 and 40%.

Table 1 below summarises the existing conditions as predicted by both of the above counts. The Annual Average Daily Traffic (AADT) has been calculated using the design guidelines RT201 "Expansion Factors for short period traffic", published by the NRA.

	AADT (Vech/day)	Peak Hour AM	Peak Hour PM
Meath Co. Co.	6400	560	470
Current Study	5600	650	760

Table 1 – Existing Background Traffic Volumes on the R152

The average annual increase in traffic for the next 20 years is. 3.0 – 3.5% according to the NRA. A 3.0% growth factor has been assumed for the traffic analysis, with the target date for completion of the development being approximately 2002.

3.0 PROPOSED DEVELOPMENT

The proposed development consists of a gas-fired power station. At this stage of design it is understood the proposed development will have one access to the R152.

The access road is also proposed as the main access to the development during construction. The proposed layout of the future access junction on to the R152 is discussed in Section 5.

The expected construction phase for the development is two years, with a target completion date of approximately 2002.

Employment levels during operational stage are in the order of 25-30 with a maximum occupancy at any one time of 15 people. Therefore it is recommended that 40 parking spaces be provided to accommodate total parking demands generated by employees, deliveries and visitors when the development is operational.

During the construction phase a hardstanding parking area will be provided to cater for the peak parking demand generated by construction employees and activities. This temporary carpark or a section of it should be located outside the permanent building and carpark areas if feasible, where it may be used as an overflow carpark during maintenance periods when employment levels may increase to one hundred.

4.0 FUTURE TRAFFIC FLOWS ON PUBLIC ROAD

4.1 Construction Traffic Generation

During the construction phase the number of people employed on site is estimated to peak at approximately four hundred people. It is envisaged that 80% of construction traffic employees will travel to work by car or other vehicle with an average occupancy of 1.3 persons/vehicle. Accordingly, during this period construction employment will generate a total two-way daily traffic volume of 640 vehicles, assuming that 30% of all construction employees also leave and return to site once during the working day.

During the construction phase, it is assumed that the minimum daily working hours will be 7.00am to 7.00pm for the purpose of the analysis. The peak hour period for traffic generated during construction would therefore coincide with the existing morning and evening peak traffic periods on the local road network. It is noted that the construction day may be longer in which case the analysis would be conservative. The peak morning and evening traffic flows generated by the construction phase will be 245 vehicles using the above occupancies.

A bus service may be considered to transport construction workers from adjacent provincial towns (Navan, Duleek, Drogheda) to the proposed construction sites. If two buses were provided daily, one servicing northern areas and the other servicing southern areas, the two-way peak morning and evening flows generated by the site would be reduced to approximately 150 vehicles. It is noted it may prove difficult to enforce the use of bus transport on construction work employees.

It is anticipated that development of the site will not require significant earth works which would result in excavated spoil being taken off site or imported material to be taken onto the site which could potentially result in significant traffic flows.

The peak construction phase two-way daily traffic volumes generated by deliveries and other activities are therefore expected to be in the order of 50 vehicle movements. These movements will generally not coincide with peak flows associated with construction employees.

A summary of the traffic flows generated during peak construction activity is provided in Table 2 below.

Time Period	**Deliveries & Other Vehicles**		**Employees (Vehicles)**		**Total**	
	In	**Out**	**In**	**Out**	**In**	**Out**
All Day (AADT)	25	25	320	320	345	345
Peak Generation Hour (7.00 – 8.00am)	2	2	245	245	247	247

Table 2 – Peak Construction Activity (Vehicles)

4.2 Operational Traffic Generation

The expected employment levels during operational stage are in the order of 25-30 people with a maximum occupancy at any one time of 15 people. The traffic flows generated during the operational period are therefore not considered to be significant. During annual shutdowns, when maintenance of the plant is carried out the number of contracting staff may increase to 100, for a two to three week period.

5.0 ANALYSIS

5.1 Methodology

An analysis of the capacity of the junction was carried out using the UK Department of Transport programme Visual PICADY (Priority and Intersection Capacity and Delay). The programme predicts capacities, queues and delay at major/minor priority junctions.

In calculating the capacities, queues and delays at the junction the following is carried out:

1. The profile of demand flows in time is calculated and derived for each segment of time, which is 10 minutes.

2. For each time segment the traffic demand in each stream is calculated. The junction entry capacity and final queue length are then calculated for each stream, taking into account the flows from other conflicting streams and the initial queue at the start of the time segment.

For each time segment the calculated maximum preferable Ratio of Flow to Capacity (RFC ratio) for a junction is 0.85.

The junction was analysed for a peak backround traffic flow of 7.3 vehicles/min on the R152 plus 245 vehicles accessing and egressing the facility over a half hour period in the morning and evening respectively. A similar analysis was also carried out with the peak construction traffic arriving over a 15-minute period.

The traffic flow capacity of the R152 was checked using design guideline RT180 "Geometric Design Guidelines ", ERU.

5.2 Model Input and Assumptions

The percentage HGV's in both directions was taken to be 20%. The traffic count suggested a HGV% of 13% for northbound traffic, making the analysis conservative.

A 50:50 north:south split on the existing R152 has been assumed to distribute traffic flows generated by the proposed development during construction. This determination is based on the following:

- The existing traffic flow distribution on the local road network.
- The location of urban centres within a 15-45 minute connecting time of the proposed development.
- The likely profile of potential employees in the immediate area.

It is assumed also for the purpose of determining the worst case scenario traffic impact, that all traffic generated by the proposed development will be new traffic to the local road network.

The geometry of the junction analysed included the following:

(1) De-acceleration lane for all traffic entering the plant from the R152 travelling from Drogheda.

(2) A single lane exit from the plant providing one lane for traffic both turning left and right.

(3) It is noted that the total width of the road carriageway and hard shoulder is approximately 11m at the proposed junction. Therefore, there is sufficient width for cars to pass on the inside while right hand turning movement occurs. In addition, by converting the existing grass verge to a hard shoulder the additional 1-2m should allow for trucks to pass on the inside. A right turn storage lane will not be provided for north bound traffic.

This revision to an earlier entrance improves visibility by extending sight lines. The new layout is designed in accordance with RT180 guidelines, ensuring the required stopping distances are provided.

6.0 FINDINGS

6.1 Operational Phase

The total all day (AADT) increase in traffic volumes on the R152 resulting from the operational stages is only 0.6%. These will not have a significant impact on traffic movement on the R152.

The operational stage traffic flows will result in a 4% increase in morning and evening peak hour flows which will also not have a significant impact on traffic movements in the area.

The analysis carried out for long term traffic associated with operational staff indicated the junction to perform satisfactorily in the morning and evening.

6.2 Construction Phase

The total all day (AADT) increase in traffic volumes on the R152 resulting from the construction stages is only 6%. It is noted this is a temporary increase during the peak occupancy of the plant during construction.

The peak construction stage traffic will result in a 32% to 37% increase in peak hour traffic when the peak amount of site personnel (400 people) are employed on site. This effectively means the two-way morning and evening peak hour traffic will increase from 700 vehicles/hour to 950 vehicles/hour.

Design code RT180, “Geometric Design Guidelines” ERU (Table 4.2) provides the design capacities for undivided rural roads. For a design speed of 60 miles/hr the R152 will have a two way capacity of 1150 vehicles/hour to 1600 vehicles/hour. The increase in traffic flow rates during the morning and evening peak hours are therefore predicted not to exceed the capacity of the road.

As discussed in the previous section an analysis of the capacity of the proposed junction onto the R152 was carried out using the PICADY programme. The following was noted from the analysis:

(1) When the proposed junction was analysed for background traffic flow rates plus 245 vehicles entering the facility over a half hour period it performed relatively satisfactorily in the morning and evening.

The maximum RFC for all streams was less than 0.85. Maximum predicted queue lengths from the right hand turn into the plant was 5.5 vehicle, while average queuing time were approximately 0.5 min/vehicle in the morning. The reduced queuing time to that predicted in the earlier Traffic Impact Assessment (Issue 1, November 1999) is due to the improved sight lines. In the evening peak maximum queue lengths for traffic leaving the facility was 15 vehicles and maximum queuing times were less than 1.5 minutes. Again it is noted that the above queuing will be experienced on a temporary basis during the peak construction occupancy.

As noted earlier, commuter buses may be considered to provide transport for construction workers from adjacent provincial towns, allowing for two buses the peak hour traffic generated by the construction would be reduced to 150 vehicles. An analysis of this scenario indicated that maximum predicted morning queuing lengths reduces to 2.5 vehicles, with maximum queuing time in the order of 20 – 30 seconds.

(2) When the same analysis was carried out, for the construction traffic egressing over a 15-minute period, the junction did not perform as satisfactorily. Unacceptable queue length and times for traffic egressing the plant was noted. Queuing times in the order of 10 minutes were predicted. A maximum RFC value in excess of 0.85 was also noted.

7.0 CONCLUSIONS

1. The operational generated traffic associated with the development will not have a significant impact on the daily (AADT) or peak hour traffic flow movements on the R152.

2. The traffic movements generated by the construction phase will also not have a significant impact on the daily (AADT) flow movements.

3. The construction phase will result in a temporary increase in peak hour flows in the order of 32% to 37% when peak site personnel are on site. The relevant design guidelines indicate that the R152 has sufficient capacity to cater for the increase in flow rates.

   An analysis of the proposed junction indicated that if peak morning and afternoon flows occur over a half-hour period the proposed junction will perform relatively satisfactorily. Morning queue lengths and queuing times for right hand turning movement were 5.5 vehicles and 0.5 min/vehicle respectively. Longer queue lengths in the order of 10 to 15 vehicles were noted in the afternoon peak for traffic egressing the plant. It is noted that the queuing will be experienced on a temporary basis only during the peak construction period.

Also the analysis indicated if construction personnel were to be transported to the site using buses queue morning lengths would be reduced to approximately 2.5 vehicles.

4. A priority junction (not signal controlled) will be satisfactory for the long-term operational staff traffic flows.

APPENDIX 1 MEATH COUNTY COUNCIL TRAFFIC COUNT DATA

APPENDIX 2 ALPHA ENGINEERING SERVICES TRAFFIC COUNT DATA