W0167-03 Additional Info.

**Ann Kehoe**

**Subject:** FW: Clarification requested - Indaver Ireland (Carranstown)
**Attachments:** IMG_0637 (Small).jpg; 12_6463NR01 (Carranstown_Repeat Attenuator Testing) Issued 7 December 2012.pdf; Eirgrid ESB_Meath waste Op Cert 11-12-2012.pdf; EP_115827AM03_1.pdf; DESOTEC.pptx



**From:** Fiona Marshall [mailto:Fiona.Marshall@indaver.ie]
**Sent:** 27 February 2013 16:34
**To:** Aoife Loughnane
**Subject:** Clarification requested - Indaver Ireland (Carranstown)

Dear Aoife,
Apologies for the delay in our response, we are waiting on Meath County Council to provide the written response to the surface water discharge rate. I will forward that by separate email as soon as we receive same, in the meantime, the answers to your queries are outlined below:

1) Eirgrid Operating Cert – see attached doc "Eirgrid ESB Meath Waste Op Cert" for details.

2) Increase from 17MW to 21MW in the MEC –explain in more detail

An application to increase the MEC – Maximum Export Capacity, has been made to ESB Networks to increase from 17MW to 21MW. This does not mean that we will be generating and exporting 21MW when you look at longer term average output figures but it allows more flexibility when exporting to the grid as the MEC is compared to short term production values (30 minute intervals).
An average of the electricity produced over the course of 2012 was 16MW with 17.5 MW peaks in some months. However, if you look at short term values, then you will see higher values and we are constrained by the grid on these shorter term or spot values if they exceed the MEC. The max design output of the turbine is 20.2 MW so 21MW is the upper ceiling of what we could produce with no house load. Hence, the application for an increase in MEC is to ensure a smooth interaction with the grid during short-term peaks in energy output as opposed to any fundamental change in the overall energy output of the plant.



3) Carbon Odour Abatement Unit:
   a. Provide manufacturers information on the emissions it can achieve; specifically Hydrogen Sulfide, Mercaptan & Amines - the manufacturer does not provide emission values as the input can vary so widely. They have provided indicative values based on case studies they have done (please see attached Power Point "DESOTEC" for overview and the values they give for MSW case study)

   b. Has decision been made to buy or rent? Is it only to cover shutdown periods?
   Indaver has not decided to purchase or rent the unit yet. It would only be required to cover shut-down periods.

4) Noise: Confirm second silencer installed, and describe the work that took place during shut-down to fix the noise issue

During the shutdown in Nov 2012 it was agreed to install a silencer in the top of the stack to reduce the noise levels detected at the site boundary
at the same time is was also agreed to look at the existing silencer at the outlet of the ID fan which was not performing in accordance with the specified design criteria.

In the top of the stack, location supports welded to the internal surface, The new silencer (see attached Photo IMG0637) was then lifted into place by a 250Ton crane and slipped inside the stack tip some 65m in the air.

The existing silencer at the outlet of the ID fan was stripped and the internals replaced with new baffles and a transition
piece to create a laminar flow in the silencer.

After the works where completed AWN where taken back into the plant to carry out noise monitoring and the summary is as follows (see report attached – "12_6463NR01 Carranstown Repeat Attenuator testing)

*"There is a significant improvement in the performance of the [original] silencer after the ID-fan.*

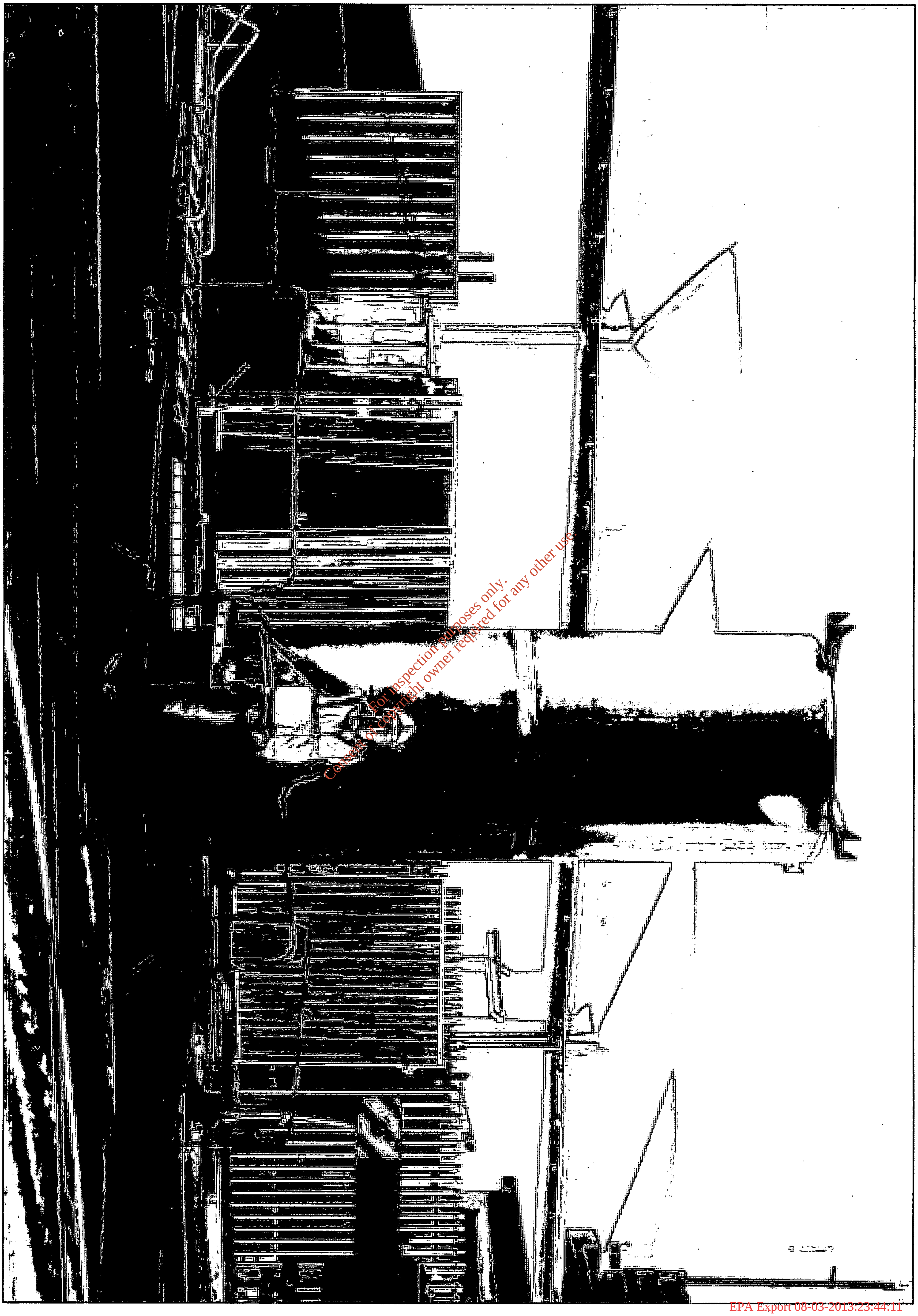
*Based upon a review of the original system calculation sheets, the measured values are close to the minimum values required to achieve the 43dB(A), in each Octave Band (63Hz – 8kHz). T*
*There are some slight shortfalls in performance at certain frequencies remaining.*

*The secondary attenuator [installed during the shutdown in Nov 2012] at the top addresses these slight shortfalls."*

5) Air Dispersion – Dioxins, Furans and PAH not included in the Article 12 response model.
Please see attached Technical Note – EP115827AM03_1 from AWN Consulting.

6) Surface water discharge: Provide written confirmation from Meath Co Co that surface water discharge rate is 59.8 l/s.

Awaiting letter from MCC



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# REPEAT TESTING OF STATIC INSERTION LOSS

# I.D. FAN ATTENUATOR

# NOVEMBER 2012

Technical Report Prepared For

**Anthony JIGOREL**
**LAB SA**
**Project Guarantee Manager**

Technical Report Prepared By

**James Mangan** Acoustic Consultant

Our Reference

JM/12/6463NR01

Date Of Issue

7 December 2012



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AWN Consulting Limited
Registered in Ireland No. 319812
Directors: F Callaghan, C Dilworth,
T Donnelly, T Hayes, D Kelly, E Porter

## EXECUTIVE SUMMARY

AWN Consulting Limited has been commissioned by LAB SA to conduct repeat acoustic tests on an attenuator associated with the I.D. Fan at the Indaver Carranstown Facility, Duleek, Co. Meath.

Various tests have been conducted in order to establish the Static Insertion Loss (SIL, dB) of the attenuator during scheduled shutdowns of the I.D. Fan. Initial testing was conducted on 29/29 August and shortfalls in performance were identified. Repeat testing has been requested following mitigation works that have been conducted in an attempt to increase the performance of the attenuator.

Noise measurements have been conducted under factory test conditions on 29 November. The measurement results have been presented and are discussed in the relevant sections of this report. In summary, the following general observations are made:

- Measured SIL (dB) values have significantly increased when compared to the testing conducted in August 2012;
- Based upon a review of the original system calculation sheets that were furnished to this office for review, the measured SIL (dB) values are close to the minimum values required to achieve the 43dB(A), in each Octave Band (63Hz – 8kHz),as stated within the aforementioned document. There are some slight shortfalls in performance at certain frequencies remaining;
- The secondary attenuator at the top of the stack would be expected to address these slight shortfalls in SIL (dB), however it is recommended that environmental noise measurements be conducted in order to assess noise emissions at noise sensitive locations in the vicinity.



**Report Prepared By:**

**JAMES MANGAN**
Acoustic Consultant

**Report Checked By:**

**DAMIAN KELLY**
Principal Acoustic Consultant

# CONTENTS

## 1.0 INTRODUCTION

AWN Consulting Limited has been commissioned by LAB SA to conduct repeat acoustic tests on the installed attenuator associated with the I.D. Fan at the Indaver Carranstown Facility, Duleek, Co. Meath.

Several tests have been conducted in order to establish the Static Insertion Loss[1] (SIL, dB) of the attenuator during a scheduled shutdown of the I.D. Fan. Results are presented for both tests conducted prior to and following mitigation works that have been completed in attempt to increase the attenuator performance.

Full details of the test are described in the following sections.



1 *Static Insertion Loss* (dB): The Insertion Loss of an attenuator under static (no flow) conditions . This is the data typically provided by product suppliers in their attenuator performance specifications.

*Dynamic Insertion Loss* (dB) is a measure of the acoustic performance of an attenuator when handling the rated flow. This is not necessarily the same as SIL because it includes regenerated noise and / or other velocity effects for which the attenuator and system should have been designed for. To date we have not seen any system calculations that have considered Dynamic Insertion Loss or flow regenerated noise.

## 2.0 SURVEY DETAILS

Details of tests undertaken are contained in the following sections.

### 2.1 Survey Period

Initial noise measurements were conducted on 28 and 29 August 2012 between 14:30 and 17:00hrs.

Post mitigation noise measurements were conducted on 29 November 2012 between 15:30 and 19:30hrs.

### 2.2 Attenuator Details

Following the initial August 2012 testing the I.D. Fan Attenuator has been amended and upgraded internally. In summary it is noted that:

- The overall attenuator cross section and length remains unchanged;
- Internal splitter configuration have been altered;
- Perforated linings have been replaced;
- Mineral fibre infill has been replaced, and;
- Veins have been installed between the fan and the attenuator.

### 2.3 Personnel and Instrumentation

James Mangan (AWN) conducted the sound tests, representatives from LAB SA were present to witness the tests.

The measurements were conducted using a Brüel & Kjær Type 2260D-102 Sound Level Meter. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

Source noise levels were generated in the 125Hz to 8kHz Octave Bands using a Brüel & Kjaer Type 4205 Reference Sound Power Source.

The 63Hz source noise levels were generated using a Brüel & Kjær Building Acoustic Package Type BZ7204-102.



### 2.4 Measurement Procedure

All measurements are made in octave frequency bands averaged over 30 seconds.

The assessment was carried out under factory conditions, the factory was generally unoccupied in order to keep background noise to a minimum. To be considered valid, the measurements taken are generally required to be 6dB above the prevailing background noise level. This was found to be the case during all measurements.

The Brüel & Kjær Type 4205 Reference Sound Power Source was located within the duct at the position of the fan, the sound power source was set to a reference level of 100dB $L_w$ in each Octave Band from 125Hz to 8kHz.

Sound pressure level measurements were conducted at the inlet and at the outlet of the attenuator in each individual Octave Band (125Hz to 8kHz). Background noise measurements were conducted to ensure there was no interference that may impact upon the accuracy of results.

The Brüel & Kjær Type 4205 sound source has the capability to generate known sound power levels in the Octave Bands 125Hz to 8kHz, in order to establish the attenuator performance in the 63Hz Octave Band, the above procedure was repeated using the Brüel & Kjær Building Acoustic Package Type BZ7204-102.

It is possible to conduct attenuator testing in a laboratory and in full accordance with BS EN ISO 7235:2009 *'Acoustics. Laboratory measurement procedures for ducted silencers and air-terminal units. Insertion loss, flow noise and total pressure loss'*. For obvious reasons this was not considered feasible for this scheduled testing.

However, due consideration has been given to the content of the above document in conducting the testing on site. In addition, consideration has been given to the test standard BS EN ISO 5136:2009 *'Acoustics. Determination of sound power radiated into a duct by fans and other air-moving devices. In-duct method'*.

## 3.0 RESULTS & DISCUSSION

The Static Insertion Loss values (dB) for the tested attenuator, prior to and following mitigation works, along with the improvements gained, are detailed in Table 1.

| Ref | Measured Static Insertion Loss Octave Band Centre Frequency (Hz) dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| I.D Fan Attenuator Initial Tested August 2012 | 16.8 | 28.4 | 14.9 | 17.6 | 15.3 | 13.7 | 14.9 | 18.4 |
| I.D Fan Attenuator Tested November 2012 Following Mitigation Works | 14.9 | 36 | 29.8 | 36.3 | 45.5 | 40.6 | 28.3 | 24.8 |
| Improvements Gained | -- | 7.6 | 14.9 | 18.7 | 30.2 | 26.9 | 13.4 | 6.4 |

***Table 1*** Measured Static Insertion Loss values (dB)

The minimum required performance for this attenuator has previously been specified (by others) during the detailed design of the system. These system calculations are included in Appendix A for reference. From our review of this documentation we understand that the supplier stated the minimum performance values that were necessary were:

| Ref | Minimum Required Static Insertion Loss Octave Band Centre Frequency (Hz) dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| I.D Fan Attenuator Minimum Requirement from Initial System Calculations | 17 | 25 | 33 | 36 | 31 | 27 | 20 | 11 |
| I.D Fan Attenuator Tested November 2012 Following Mitigation Works | 14.9 | 36 | 29.8 | 36.3 | 45.5 | 40.6 | 28.3 | 24.8 |
| Shortfall vs. Measured Attenuator Performance | 2.1 | - | 3.2 | - | - | - | - | - |

***Table 2*** Detailed Design Specification vs. Measured Static Insertion Loss values (dB))



It can be seen that at 63Hz and 250Hz there is a slight residual shortfall when compared to the minimum performance requirements from the initial system calculations. This is a significant improvement however in comparison to the shortfalls encountered during the attenuator testing prior to the upgrade works.

The secondary attenuator at the top of the stack would be expected to address these slight shortfalls in SIL (dB), however it is recommended that environmental noise measurements be conducted in order to assess noise emissions at noise sensitive locations in the vicinity.

## 4.0 CONCLUSIONS

AWN Consulting Limited conducted repeat acoustic tests on the Attenuator associated with the I.D. Fan at the Indaver Carranstown Facility. The measurement results have been presented and are discussed in the previous sections.

Significant shortfalls in performance were initially identified and it was considered that the attenuator performance was a significant factor in terms of the noise complaints received from residents.

Following the upgrade works the attenuator performance values have significantly increased. There are some slight shortfalls in performance at certain frequencies remaining, however the secondary attenuator at the top of the stack would be expected to address these slight shortfalls in performance.

It is recommended that environmental noise measurements be conducted in order to reassess noise emissions at noise sensitive locations in the vicinity.

# APPENDIX A

## CALCULATION SHEET (DETAILED DESIGN - BY OTHERS) OUTLINING MINIMUM ATTENUATOR PERFORMANCE REQUIREMENTS

(See Overleaf)

## Verfahren für die Berechnung der Schallimmission von einer Schallquelle

**Projekt: 10994 MEATH – KKS Nr. HNA30 BS001**

Der Schalldruckpegel an einem Immisionssort im Abstand $S_m$ vom Mittelpunkt der Schallquelle wird nach folgender Formel berechnet:

| Frequenz (Hz) | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---|---|---|---|---|---|---|---|---|
| L (dB) | 128 | 127 | 128 | 122 | 117 | 112 | 105 | 98 |
| $L_w$ (dB) | 140 | 139 | 140 | 134 | 129 | 124 | 117 | 110 |
| $K_\Omega$ (dB) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| $\Delta L_s$ (dB) | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| $\Delta L_L$ (dB) | - | - | - | - | - | - | - | - |
| $\Delta L_B$ (dB) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| $\Delta L_D$ (dB) | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| $\Delta L_G$ (dB) | - | - | - | - | - | - | - | - |
| $\Delta L_Z$ (dB) | - | - | - | - | - | - | - | - |
| $\Delta L_M$ (dB) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Restpegel im Aufpunkt | 86 | 84 | 85 | 82 | 74 | 69 | 62 | 55 |
| A-Bewertung | - 26 | - 16 | - 9 | - 3 | 0 | + 1 | + 1 | - 1 |
| geforderter Wert (dB(A)) | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| Differenz | 17 | 25 | 33 | 36 | 31 | 27 | 20 | 11 |

Kürzeldefinition:

$L_w$ - Schallleistungspegel
$\Delta L_s$ - Abstandsmaß
$K_\Omega$ - Richtwirkungsmaß
$\Delta L_L$ - Luftabsorptionsmaß
$\Delta L_B$ - Bodendämpfungsmaß
$\Delta L_D$ - Bewuchsdämpfungsmaß
$\Delta L_G$ - Bebauungsdämpfungsmaß
$\Delta L_Z$ - Abschirmmaß
$\Delta L_M$ - Witterungsdämpfungsmaß

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# TECHNICAL NOTE

| | |
|---|---|
| Project | **Carranstown WTE** |
| Subject | **Article 12** |
| Author | **Edward Porter** |
| Date | **14/02/13** |
| Ref. | **EP/11/5827AM03_1** |

Conor,

Please find enclosed the response to the EPA request for additional information in relation to air quality (Point 10) and specifically in relation to dioxins / furans and PAHs emissions to air.

Kind regards

**Dr. Edward Porter**
AWN Consulting



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10 *Air Dispersion Model*

(v) *Identify the predicted environmental concentrations (PECs) (background plus process contribution) for each modelled parameter in Tables 7.6 to 7.9 of the EIS.*

Response

Modelling of Dioxins, Furans & PAH's was not included in the Article 12 response as they had not been included in the EIS submitted as part of the planning and licensing applications. They had not been included as there are no ambient air quality standards to compare against and small changes in volume flow would not affect significantly the modeling results previously predicted in EIS's of 2009 & 2005. In any event, a technical note has been prepared by AWN Consulting to show the PEC's for the compounds mentioned and compared to the ambient air quality standards where applicable.

The PEC for each modelled parameter in Tables 7.6 to 7.9 of the EIS was outlined in Technical Memo EP_115827AM02_0. Shown in Tables 1 - 4 are the results for dioxins / furans and PAHs scenarios which indicate that compliance with all relevant ambient air quality standards and guidelines (where applicable) are maintained even under all four volume flow scenarios.

**Table 1** Predicted Environmental Concentration (PEC) For Dioxin / Furans & PAHs (Maximum Spot Volume Flow Scenario)

| Compound | Background | Process Contribution (µg/m$^3$) Maximum Spot Volume Flow | Predicted Environmental Concentration (µg/m$^3$) Maximum Spot Volume Flow | Limit Value |
|---|---|---|---|---|
| Dioxin / Furans (Ann) | 0.0028 – 0.0046 pg/m$^3$ | 0.00062 pg/m$^3$ | 0.0034 – 0.0052 pg/m$^3$ | N/A |
| PAH(Ann) | 0.090 ng/m$^3$ | 0.0019 ng/m$^3$ | 0.092 ng/m$^3$ | 1 ng/m$^3$ |

**Table 2** Predicted Environmental Concentration (PEC) For Dioxin / Furans & PAHs (110% Maximum Volume Flow Scenario)

| Compound | Background | Process Contribution (µg/m$^3$) 110% Maximum Volume Flow | Predicted Environmental Concentration (µg/m$^3$) 110% Maximum Volume Flow | Limit Value |
|---|---|---|---|---|
| Dioxin / Furans (Ann) | 0.0028 – 0.0046 pg/m$^3$ | 0.00062 pg/m$^3$ | 0.0034 – 0.0052 pg/m$^3$ | N/A |
| PAH(Ann) | 0.090 ng/m$^3$ | 0.0018 ng/m$^3$ | 0.092 ng/m$^3$ | 1 ng/m$^3$ |

**Table 3** Predicted Environmental Concentration (PEC) For Dioxin / Furans & PAHs (Average Volume Flow Scenario)

| Compound | Background | Process Contribution (µg/m$^3$) Average Volume Flow | Predicted Environmental Concentration (µg/m$^3$) Average Volume Flow | Limit Value |
|---|---|---|---|---|
| Dioxin / Furans (Ann) | 0.0028 – 0.0046 pg/m$^3$ | 0.00060 pg/m$^3$ | 0.0034 – 0.0052 pg/m$^3$ | N/A |
| PAH(Ann) | 0.090 ng/m$^3$ | 0.0018 ng/m$^3$ | 0.092 ng/m$^3$ | 1 ng/m$^3$ |

**Table 4** Predicted Environmental Concentration (PEC) For Dioxin / Furans & PAHs (Minimum Spot Volume Flow Scenario)

| Compound | Background | Process Contribution (µg/m$^3$) Minimum Volume Flow | Predicted Environmental Concentration (µg/m$^3$) Minimum Volume Flow | Limit Value |
|---|---|---|---|---|
| Dioxin / Furans (Ann) | 0.0028 – 0.0046 pg/m$^3$ | 0.00058 pg/m$^3$ | 0.0034 – 0.0052 pg/m$^3$ | N/A |
| PAH(Ann) | 0.090 ng/m$^3$ | 0.0017 ng/m$^3$ | 0.092 ng/m$^3$ | 1 ng/m$^3$ |

10 *Air Dispersion Model*

(vi) *Identify the PECs for each modelled parameter associated with maximum abnormal operations (as per Condition 3.20.2 of licence W0167-02) at the requested volume flow of 183,700 Nm$^3$/hr from the stack, or any revised volume flow as appropriate.*

The PEC of each modelled parameter associated with maximum abnormal operations (as per Condition 3.20.2 of licence W0167-02) at the requested volume flow of 183,700 Nm$^3$/hr from the stack was outlined in Technical Memo EP_115827AM02_0. Shown in Table 5 are the results for dioxins / furans and PAHs scenarios which indicate that compliance with all relevant ambient air quality standards and guidelines (where applicable) are maintained even under abnormal operations based on 60 hours per annum.

**Table 5** Predicted Environmental Concentration (PEC) For Dioxin / Furans & PAHs Associated With Maximum Abnormal Operations At Volume Flow Rate 183,700 $Nm^3/hr$ (110% Maximum Volume Flow Scenario)

| Compound | Background | Process Contribution ($\mu g/m^3$) Maximum Spot Volume Flow | Predicted Environmental Concentration ($\mu g/m^3$) Maximum Spot Volume Flow | Limit Value |
|---|---|---|---|---|
| **Dioxin / Furans (Ann)** | 0.0028 – 0.0046 $pg/m^3$ | 0.00084 $pg/m^3$ | 0.0036 – 0.0054 $pg/m^3$ | **N/A** |
| **PAH(Ann)** | 0.090 $ng/m^3$ | 0.0025 $ng/m^3$ | 0.093 $ng/m^3$ | 1 **$ng/m^3$** |

Note 1 60 hours of abnormal operations based on five hours at the start of every month.
Note 2 Dioxins modelled at 0.5 $ng/m^3$ for 60 hours/year (5 times normal operation emission rate for 60 hours/year)
Note 3 PAHs modelled at 0.015 $mg/m^3$ (5 times normal operation emission rate for 60 hours/year)

10 *Air Dispersion Model*

(viii) *Please submit an electronic copy of all files used in the air dispersion model (input, output, meteorological, terrain, buildings data etc).*

All normal operations modelling scenarios which derive an annual mean averaging period are based on a unitised emission rate (1 g/s). In relation to the abnormal scenarios, both dioxins / furans and PAHs are based on an abnormal operation which is five times normal operation for 60 hours per year (5 hours per month) and is identical to the previously submitted $NO_2$ abnormal operation file. Thus, the modelling files provided previously are also applicable for the current modelling scenarios.

ESB Networks

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To:

Claire Downey
Indaver Ireland Ltd
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Old Dunleary Rd
Dun Laoighaire

Date: 11-12-2012



## Operational Certificate

This is an Operational Certificate for Meath Waste to Energy which is connected to the Distribution System at Carranstown 38 kV Station. This Operational Certificate for Meath Waste to Energy shall be effective as of **Wednesday 5th of December at 06:00.**

The values detailed in Appendix 1 shall be considered the Meath Waste to Energy Operating Characteristics and Registered Data. This data was confirmed or established under the Grid Code Compliance testing process as listed in Appendix 2 and shall be reflected by Indaver Ireland Ltd. in any Standing Technical Offer Data for the Trading and Settlement Code. No derogations against the Grid Code were required as a result of the Grid Code testing performed.

The Operational Certificate for Meath Waste to Energy is conditional on the following:

A. That Indaver Ireland Ltd. ensure that Meath Waste to Energy remains compliant with the Grid Code and Distribution Code and any future revisions thereof communicated and approved by the CER.

B. That Indaver Ireland Ltd. request clarification of Grid Code clause CC.7.3.1.1(r) and noting the clarification "Clarification of Clause CC.7.3.1.1(s) W2E Plant" published on the 20/01/12.

C. Monitoring testing and investigation (Grid Code ref: OC10) of the performance of Meath Waste to Energy will continue to be carried out by EirGrid so to ensure the safe, secure and economic operation of the Transmission System. Any Performance Monitoring issues shall without undue delay be addressed by Indaver Ireland Ltd which may include further testing to verify that Meath Waste to Energy is compliant. Failing an immediate resolution of the issue EirGrid will via ESB Networks, discuss a derogation approach with Indaver Ireland Ltd to address the non-compliance.

**Yours faithfully,**

Tony Hearne
Manager, Renewables Planning,
ESB Networks

Tel: 01 7026276

**Appendix 1 Meath Waste to Energy (IW1) Registered Characteristics**

| | |
|---|---|
| Station Name | IW1 |
| Number of Generating units | 1 |
| Primary Fuel Type / Prime Mover (e.g. gas, hydro etc.) | Municipal Waste |
| Secondary Fuel Type (e.g. oil) | n/a |
| Registered Capacity (MW) | 16MW |

| | Symbol | Units |
|---|---|---|
| * Normal Maximum Continuous Generation Capacity: | 19.5 | MW |
| * Normal Maximum Continuous Export Capacity | 17.5 | MW |
| * Power Station auxiliary load | 2 | MW |
| § Power Station auxiliary load | 0.5 | MVAr |
| | | |
| * Maximum (Peaking) Generating Capacity | 19.5 | MW |
| * Maximum (Peaking) Export Capacity | 17.5 | MW |
| * Normal Minimum Continuous Generating Capacity | 3 | MW |
| * Normal Minimum Continuous Export Capacity | 1 | MW |
| | | |
| * Generator Rating: | 22.47 | MVA |
| | | |
| * Normal Maximum Lagging Power Factor | 0.9 | MVAr |
| * Normal Maximum Leading Power Factor | 0.95 | MVAr |
| § Forbidden zones | n/a | MW |
| § Terminal Voltage adjustment range | 9.250 - 10.750 | kV |
| § Short Circuit Ratio | 0.51 | p.u. |
| § Rated Stator Current | 1297 | Amps |
| | Symbol | Units |
| * Normal Maximum Continuous Generation Capacity: | 19.5 | MW |
| * Normal Maximum Continuous Export Capacity | 17.5 | MW |
| * Power Station auxiliary load | 2 | MW |
| § Power Station auxiliary load | 0.5 | MVAr |
| | | |
| * Maximum (Peaking) Generating Capacity | 19.5 | MW |
| * Maximum (Peaking) Export Capacity | 17.5 | MW |
| * Normal Minimum Continuous Generating Capacity | 3 | MW |
| * Normal Minimum Continuous Export Capacity | 1 | MW |
| | | |

| | | |
|---|---|---|
| * Generator Rating: | 22.47 | MVA |
| | | |
| * Normal Maximum Lagging Power Factor | 0.9 | MVAr |
| * Normal Maximum Leading Power Factor | 0.95 | MVAr |
| § Governor Droop | 3.4% | |
| § Forbidden zones | n/a | MW |
| § Terminal Voltage adjustment range | 9.250 - 10.750 | kV |
| § Short Circuit Ratio | 0.51 | p.u. |
| § Rated Stator Current | 1297 | Amps |

*Reserve Capability*

Primary Spinning Reserve: 1.33 MW at 90% of RC

Secondary Spinning Reserve: 1.98 MW at 90% of RC

Tertiary Reserve: 1.92 MW at 90% of RC

Replacement Reserve 15 MW



Give details of reserve capability of the generator in different operating modes:
Unit co-ordinating, turbine follow, recirculation, base load, etc.
Turbine always in 'turbine follow' mode and frequency response 'always on'.

What reserve, if any, is available when the unit is off load?
None.

### 1.1.1 PC.A4.12.2 Forecast Availability

Apart from the expected scheduled maintenance requirements,

| Availability | Reason | Available Exported MW | Time % |
|---|---|---|---|
| Full availability | n/a | 16MW | 90 |
| | | | |
| Partial availability | Poor CV waste conditions | 12-14MW | 10 |
| | | | |
| Forced outage probability | | | |
| | Total | | 100% |

Reasons for partial availability might include poor fuel, loss of mill, loss of burners, hydro flow restrictions, etc.

The full PC.A4 submission is available from OSP on request to generator_testing@eirgrid.com

## Appendix 2 Overview of Grid Code Compliance testing performed

| | Test |
|---|---|
| 1 | The following to be provided: |
| | ➢ Power System Stabiliser study |
| | ➢ Protection setting list |
| | ➢ Inter-tripping schemes |
| | ➢ Interlocking schemes |
| | ➢ SCADA signal schemes |
| 2 | Power Station to hand over generator transformer data and test sheets including transformer impedance data (positive and zero phase sequence) for top centre and bottom tap positions. |
| 3 | AVR settings to be provided |
| 4 | Agree settings of generator and generator transformer non-unit type protection schemes and witness testing of such relays with the agreed settings applied. Test protocols of factory tests to be available. |
| 5 | Data sheets and test results for excitation system. Available studies of the ability of the generation plant to ride through |
| | Distribution system (short circuit) faults. |
| 6 | Data sheets, design sheets and test results for governor system. Proposed settings also to be provided. |
| 7 | Data Provision on plant output variations with ambient conditions. |
| 8 | Check all interface cabling between Power Station and Distribution Station using as-built circuit and connection diagrams. |
| 9 | Confirm Power Station earthing and lightning protection system is complete for transformers and generator. Hand over of inspection report. |
| 10 | Confirm earthing and lightning protection system is complete for Distribution Station. Hand over of inspection report with earth resistance measurements. |
| 11 | Confirm connection between Power Station earth grid and Distribution Station earth grid is complete. Hand over of inspection report with earth resistance measurements. |
| 12 | Check operation and interlocking for HV CB, HV disconnect, HV ES, Generator CB, Generator disconnect, Generator CB ES, MV CB, MV ES *for those items of plant which are installed at this stage.* |
| | Test that trip signals from Distribution side trip the relevant CB's. |
| 13 | Test all CTs in Power Station on generator bus ducts and MV incomer and Generator and Unit transformers (when in transformer bushings). Test protocols of factory tests and site tests to be provided. |
| 14 | Test all CTs in Distribution Station. Test protocols of factory tests to be available. |
| 15 | Test all VTs in Power Station on generator bus ducts and MV incomer. Test protocols of factory tests and site tests to be provided. |
| 16 | Test all VTs in Distribution Station. |
| 17 | Function and accuracy check of all generator/generator transformer/unit transformer/ Distribution Station and lines protection including secondary cabling, *except for functions that have to be tested with running generator* by secondary current and voltage injection. Test protocols of factory tests and site tests to be provided. *See Item 34 of Phase B tests for remaining tests.* |
| | Visual check of Power Station protection/alarm batteries, chargers etc. |

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| | Check that protection/alarm and generator and MV breaker control is supplied from battery back-up system. |
| 18 | Function check of all Distribution Station trip commands and signals and alarms/recording: |
| | ➢ from Distribution Station to Power Station |
| | ➢ From Power Station to Distribution Station |
| | Check of all signals to SCADA system. |
| | Check Power Station emergency tripping of HV CB and associated signal. |
| 19 | For the initial energising the generator transformer must have differential and buchholz protection and the unit transformer must have overcurrent (HV side preferable), differential and buchholz protection. |
| 20 | Inspection of procedures following tripping of generator transformer, failure of protection, failure of power supplies etc. |
| 21 | Check secondary side and neutral connection of generator and unit transformer is completed up to suitable isolating points and that secondary VT neutral point is connected and earthed. Check that suitable (lockable) earthing facilities are available for the equipment on the other side of the isolating points. |
| | Check access for visual check of earth switch and isolators |
| 22 | Check, calibration and sealing of Distribution Station metering including signals to Power Station. |
| 23 | Insulation resistance test, generator transformer HV side |
| | Insulation resistance test, generator transformer LV side |
| | Insulation resistance test, unit transformer HV side |
| | Insulation resistance test, unit transformer LV side |
| 24 | Insulation resistance test of conductors, to generator transformer with transformers disconnected. |
| | Insulation resistance test generator CB. |
| | Site test protocols of insulation resistance test MV switch gear, performed before energising MV switch gear. |
| 25 | Oil test generator transformer (moisture and breakdown) |
| | Oil test unit transformer (moisture and breakdown) |
| 26 | Insert Conductors, test resistance of connections. |
| 27 | Check safety barriers, fences, safety notices and site procedures for transformers. General site walk around to check site is ready for energising. |
| 28 | Agree Operating Procedures covering all plant and including a check to see that the procedures can be safely followed. |
| | Operational Diagram/Safety Rule Boundaries to be clarified. |
| | Specify Naming of plant, equipment etc. |
| 29 | Agree procedure for energising transformer. |
| 30 | Power Station to issue Declaration of Fitness stating that the transformer is fit to be energised and that other equipment not ready for energising is isolated. Also all agreed protection should be in place and tested and operating properly at the appropriate settings. |
| 31 | Energise transformer |
| 32 | Insulation resistance test of Conductors, generator CB to generator. |
| | Insulation resistance test of generator stator. |
| | Site test protocols of insulation resistance test MV switch gear and generator to be provided. |
| 33 | Insert Conductors, test resistance of connections. |
| 34 | Function and accuracy check of all generator/generator transformer/unit transformer/ Distribution station and lines protection including secondary cabling. Test protocols of factory tests and site tests to be provided. *Note that some or all of these tests may already have been completed as Item 17 of Phase A tests.* |

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| 12a | Check operation and interlocking for HV CB, HV disconnect, HV ES, Generator CB, Generator disconnect, Generator CB ES, MV CB, MV ES *for those items of plant which are installed at this stage. Note that some or all of these tests may already have been completed as Item 12 of Phase A tests.* |
| | Test that trip signals from Distribution side trip the relevant CB's. |
| 35 | Function check of all ~~Distribution Station~~ trip commands and signals and alarms/recording: |
| | ➢ from ~~Distribution~~ Station to Power Station |
| | ➢ From Power Station to Distribution Station |
| | Check of all signals to SCADA system. |
| | Check Power Station emergency tripping of HV CB and associated signal. |
| 36 | Testing of excitation system |
| | - Functional checks (AVR stationer and dynamic control checks at no load condition) |
| | - Open circuit characteristic |
| | - Short circuit characteristic |
| 37 | Function Check of protection alarm by primary voltage and current injection during open and short circuit tests. |
| 38 | Function check of signal transmitters by primary voltage and current injection during open and short circuit tests. |
| 39 | Turbine overspeed test. Test protocols of site tests to be available |
| 40 | Testing of Governor system - Functional checks (governor stationer and dynamic control checks at no load condition) |
| 41 | Testing of synchroniser - Generator CB and check contact closing time. Test protocols of factory tests to be available. |
| 43 | Power Station to issue Declaration of Fitness that: |
| | The generator protection has been fully tested and is fully operational. |
| | The synchroniser has been fully tested and is ready for operation. |
| | The generator is ready to be synchronised to the Grid. |
| 44 | Synchronise generator. |
| 45 | Measurement of initial block load following synchronising. |
| 46 | Testing of POR, SOR and TOR by frequency injection at various loads. |
| 48 | Measurement of governor droop characteristic at various loads. |
| 49 | Measurement of governor deadband characteristic while following the grid frequency. There should be no dead band applied. |
| 50 | Demonstration of minimum load operation. Process parameters (e.g. temperatures and vibration levels) should be recorded during this period and available following the test to demonstrate stable operation at the minimum load. |
| 51 | Demonstration of capability to ramp up and down between defined load points with a rate of not less than 1.5% of Registered Capacity per minute. The generator should demonstrate stable operation at Registered Capacity for some period following ramp up. |
| 52 | Load rejection test at 100% load and resynchronisation across HV CB after 1 hour operating at house load. The unit must remain running at normal frequency, feeding its own auxiliaries while completely disconnected from the grid for the 1 hour up to when resynchronisation takes place. Process parameters (e.g. temperatures and vibration levels) should be recorded during this period and available following the test to demonstrate stable operation at the minimum load. |
| 53 | Demonstration of time to synchronising and to full load on cold, warm and hot starts and following turbine and boiler trips. |
| 54 | Demonstration of shutdown time for selection of cold, warm and hot starts. |
| 57 | Verification of output versus ambient temperature. |
| 60 | Demonstration of accurate transmission of voltage, current and power signals including SCADA signals. |

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| 61 | Demonstration of generator MW capability at minimum and maximum generator voltages at rated power factor. |
| 62 | Demonstration of operation of plant on house load at high frequency and low frequency limits of operation for 60 minutes. |
| 63 | Demonstration of amber, red and blue alerts. |
| 65 | Demonstration of capability of diesel generator to supply Power Station emergency loads and Distribution Station supply. Auto supply to Distribution Station in the event of loss of supply to be demonstrated. Procedure for operation in this mode to be handed over. |
| 69 | Demonstration of Registered Capacity |
| 70 | Provision of generator data following commissioning tests. See attached Planning Code Appendix of the Grid Code. |
| 71 | EirGrid Reliability run |