STRATEGIC INFRASTRUCTURE DEVELOPMENT

APPLICATION TO AN BORD PLEANÁLA

(REG NO. PL04.PA0045)

RINGASKIDDY RESOURCE RECOVERY CENTRE, RINGASKIDDY, COUNTY CORK

REPORT OF PROF. PAUL JOHNSTON

REPORT ON DATA CONSISTENCY IN MODELLING OF RISK ASSESSMENT

1. Qualifications and Experience

I am Paul Johnston, engineering hydrologist, an adjunct professor at Trinity College Dublin, former head of the Environmental Engineering group, with forty years of experience in environmental modelling and contaminant hydrogeology with a focus on soil contamination, having postgraduate qualifications in engineering from Canada, UK and Ireland. I have been technical adviser on some of the most complex contaminated soil sites in the UK and Ireland, I have acted as Expert Adviser to the House of Lords Select Committee on the Environment, the Oireachtas Committee on the Environment and as a Technical Advisor to An Bord Pleanala.

2. INTRODUCTION

My task has been to check the data consistency between the report 'Dioxin in Soil' and inputs for modelling risk assessment, as given in the Baseline Reports that formed part of the EIS submitted to An Bord Pleanála with the application for planning permission for the Indaver Waste to Energy facility, Ringaskiddy in January 2016.
Specifically, I was asked to confirm that the data chain used in modelling analysis as reported in the Modelling Report (*Modelling of PCDD/F intake for Ringaskiddy Resource Recovery Centre 2015*, AWN Technical Report FC/14/8104SR02), submitted with the EIS, was complete and consistent. The soil and modelled data given in the body of the report was checked against the printed input/output files from the computer model as printed in the relevant attachments to the report.

3. BACKGROUND

The mathematical computer model was designed to predict the increase in air and soil concentrations of dioxins and furans arising from the proposed waste to energy facility operating at the maximum licensed emission levels over the 30-year life of the plant. The modelling is based on the human receptor being the Maximum At Risk Individual (MARI).
The model used was reported as RISC Human Model Version 3.2 (May 2005) package which models the impact on human receptors through a number of pathways for the pollutants. The pollutants are comprised of 17 key dioxin and furan congeners, for each of which the model analyses the pathways.

The modelling approach as reported has been widely used and adopted in addressing the relevant dioxin exposure pathways for the MARI. As such, it is recognized to be robust and conservative in making predictions of human exposure, based on estimated highest annual average concentrations.

The model requires baseline input of soil and air quality utilizing observed values of dioxin/furan concentrations and superposes the predicted effect of inputs from the emissions from the waste to energy facility.
The input baseline soil data used was based on a single composite soil sample (4a) at a location likely to be in receipt of maximum deposition from the facility, adjacent to the proposed site of the facility. The measured PCDD/F Concentration for this site was 0.3 ng/kg I-TEQ.

It is understood that the single soil sample taken at location (4a) was a composite sample of 150 individual samples taken in a "W" pattern across the land at that location 4a and therefore is considered to be representative of the background soil PCDD/F concentration at that location.

4. METHODOLOGY

To review the model data trail and to check the data consistency, the corresponding appendices of the relevant reports were printed out and I went through each line item of each page of the appendices, and cross checked these with the soil baseline PCDD/F data and the model inputs and outputs recorded in the Modelling Report (*Modelling of PCDD/F intake for Ringaskiddy Resource Recovery Centre 2015)*.

5. DATA

The consistency of the data trail between the measured data, the model inputs and outputs and the reported values in the modelling report (Report FC/14/8104SR02), submitted with the EIS, comprised four separate tasks :

1. The baseline soil dioxin concentrations from site 4a, to be used for model input, are reported in Table 2 of the soil baseline report (Report RH14/8104SR01) of the EIS as extracted and presented in an Excel spreadsheet (attached). These concentration data, for 17 dioxin congeners, were checked against the computer model input data file (BASE2015.LOC) as reproduced in attachment D1 of the modelling report (Report FC/14/8104SR02).

The concentration values are identical between the Table 2 and the computer input file with the following minor exceptions :

		Attachment D1	
PCDD congener	Table 2 (ng/kg)	Model input file (mg/kg)	Difference (mg/kg)
123478 HxCDD	0.094	9.00×10^{-8}	-0.4×10^{-8}
2378 TCDF	0.33	3.01×10^{-7}	$- 0.29 \times 10^{-7}$

These differences may represent transcription errors and are, in any case, minor.

For 2378 TCDD, however, an observed value of 0.061 ng/kg in Table 2 was identical to the 'site soil' input value of 6.10 x 10-8 mg/kg in Attachment D1 but a different component value of 2.61 x 10-7 mg/kg for 'soil in open surface areas' appears in the computer data input file. This anomaly, however, would only result in a more conservative model prediction for *this* component of the site than the composite 'site soil' value might indicate.

2. The WtE model output data (file INT2015.LOC, Ringaskidd intake 2015) for the change in PCDD dose using an air dispersion model, is given in Attachment J : Model output file for change in PCDD/F dose.
These data represent inputs to the risk assessment model, RISC HUMAN, as presented in a separate spreadsheet (attached). These data in Attachment J were checked against the spreadsheet table of input values for calculating the MARI. The two sets of data were identical with the following exceptions :

PCDD congener	Attachment J mg/kg	Predicted values reported as input to RISC HUMAN (mg/kg)
2378 TCDD	6.12×10^{-8}	6.12×10^{-8} ('site soil')
	6.12×10^{-6}	…arising from a different value for 'open surface area' soil from Attach.D:baseline data.
23478 PeCDF	2.71×10^{-7}	2.70×10^{-7}
234678 HpCDF	5.63×10^{-7}	5.60×10^{-7}

These differences represent minor transcription errors in transferring data from the computer file to the data table reported in the spreadsheet as input to RISCHUMAN.

3. The baseline PCDD/F intake values for MARI as predicted by the model are given in Table 5.1 in the modelling report FC/14/8104 SR02 ('Modelling of PCDD/F intake for Ringaskiddy Resource Recovery Centre 2015').

The concentration values for the 17 congeners given in Table 5.1 in mg/kg/day are identical to those presented in the computer output file (uptake table, File BASE2015.LOC: Ringaskidd baseline 2015:Attachment D1). The minor transcription errors from the reported soil data in Table 2 have been carried through the modelling, to give the accurately reported modelled results in Table 5.1.

4. The calculated dioxin concentrations, with the waste to energy plant in operation, for the 17 congeners were presented in Table 7.1 of the modelling report FC/14/8104 SR02. These were compared to the results given in the computer output file (data file INT2015.LOC) in Attachment J. Each line of the computer model output file was checked against the corresponding results given in the Modelling Report. Although the two sets of presented results were not numerically identical (see table below), the differences were very small, all <4% and would not be significant in the context of the calculated results/risks.

PCDD congener	Attachment J (mg/kg/d)	Table 7.1 (mg/kg/d)
2378 TeCDD	5.04×10^{-11}	5.20×10^{-11}
12378 PeCDD	8.72×10^{-11}	8.41×10^{-11}
123678 HxCDD	1.65×10^{-10}	1.58×10^{-10}
123478 HxCDD	7.79×10^{-11}	7.44×10^{-11}
123789 HxCDD	1.18×10^{-10}	1.13×10^{-10}
1234678HpCDD	1.57×10^{-9}	1.50×10^{-9}
OCDD	1.23×10^{-8}	1.17×10^{-8}
2378 TCDF	3.36×10^{-11}	3.48×10^{-11}
12378 PeCDF	6.44×10^{-11}	6.32×10^{-11}
123478 HxCDF	2.93×10^{-10}	2.81×10^{-10}
23478 PeCDF	6.88×10^{-11}	6.67×10^{-11}
123678 HxCDF	2.18×10^{-10}	1.99×10^{-10}
123789 HxCDF	7.83×10^{-11}	7.48×10^{-11}
234678 HpCDF	3.68×10^{-10}	3.51×10^{-10}
1234678 HpCDF	1.55 x 10-9	1.48×10^{-9}
1234789 HpCDF	2.09×10^{-10}	1.99×10^{-10}
OCDF	1.68×10^{-9}	1.60×10^{-9}

6. Conclusion :

Although there are a few isolated, apparently mostly transcription errors, in transferring the results from the computer modelling files to the relevant reports, there is no doubt that the composite soil sample at location 4a around the proposed site was the source of the input data for the modelling as reported in the EIS. Such differences that do appear (and already noted anomalies that have been carried through in the modelling) are of a minor magnitude and would not affect the significance of the level of risks as predicted. The reported modelling methodology is in accordance with best international practice in assessing environmental impact from such proposed installations.

Appendix : Data tables of reported site soil analyses and inputs to RISC HUMAN

References :

Modelling of PCDD/F intake for Ringaskiddy Resource Recovery Centre 2015, AWN Technical Report FC/14/8104SR02, AWN Consulting for Arup Consulting Engineers, pp21, 17 Dec. 2015 :

Attachment D : Baseline Intake Model Report

Attachment J : Model Output file for change in PCDD/F dose.

Sampling and analysis for soil and sediment sampling at various locations around Cork harbour, 'Dioxin in soil baseline report', Technical Report RH14/8104 SR01: AWN Consulting, dated 17th September 2015

Paul Johnston, September 2016