BILTON-IN-AINSTY WITH BICKERTON PARISH COUNCIL

PROPOSED TOCKWITH ENERGY FROM WASTE FACILITY

REVIEW OF AIR QUALITY AND HUMAN HEALTH IMPACTS

REFERENCE: C44-P01-R01

JULY 2009

CONTENTS

1 INTRODUCTION

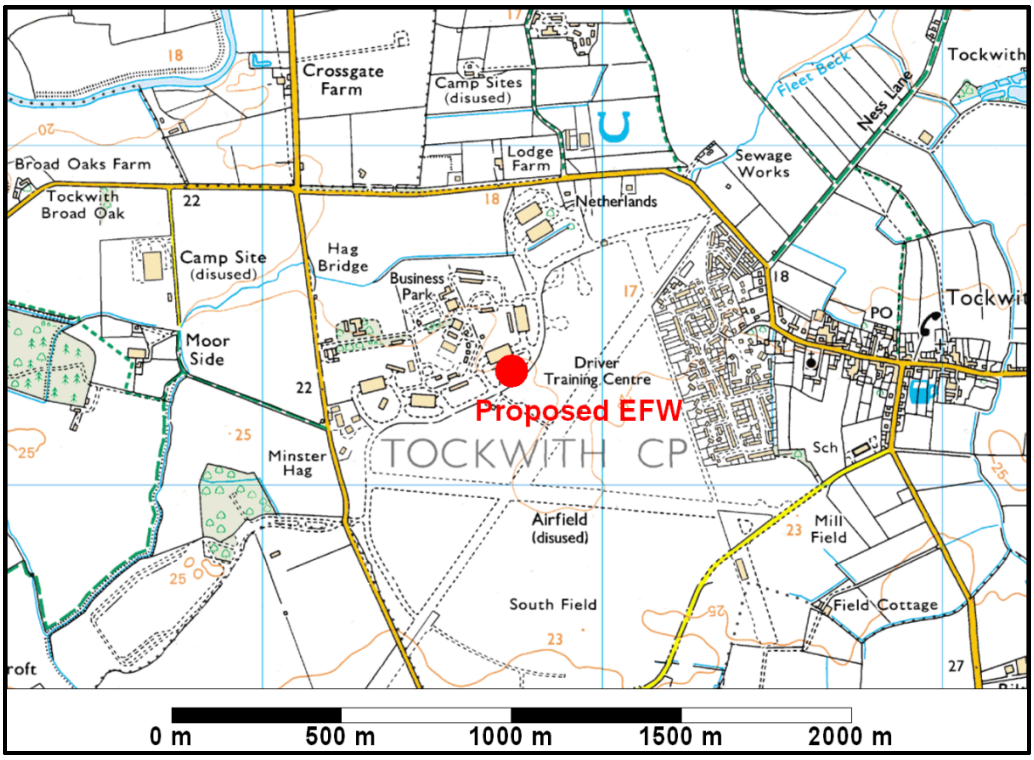
1.1 PURPOSE OF THE REPORT

Gair Consulting Ltd has been requested by Bilton-in-Ansty with Bickerton Parish Council (the Council) to provide a review of air quality and public health impacts arising from a proposed Energy from Waste (EFW) facility. A planning application for the proposed development has been submitted to North Yorkshire County Council (NYCC) by the proposed developer BCB Environmental Management Ltd (BCB). It is understood that BCB currently operate a transfer station for hazardous waste at an adjacent site and that at present this waste leaves the facility for further treatment elsewhere. The proposed EFW would treat this hazardous waste on-site in a mixed waste thermal treatment facility including hazardous, municipal, commercial and industrial wastes.

1.2 BACKGROUND

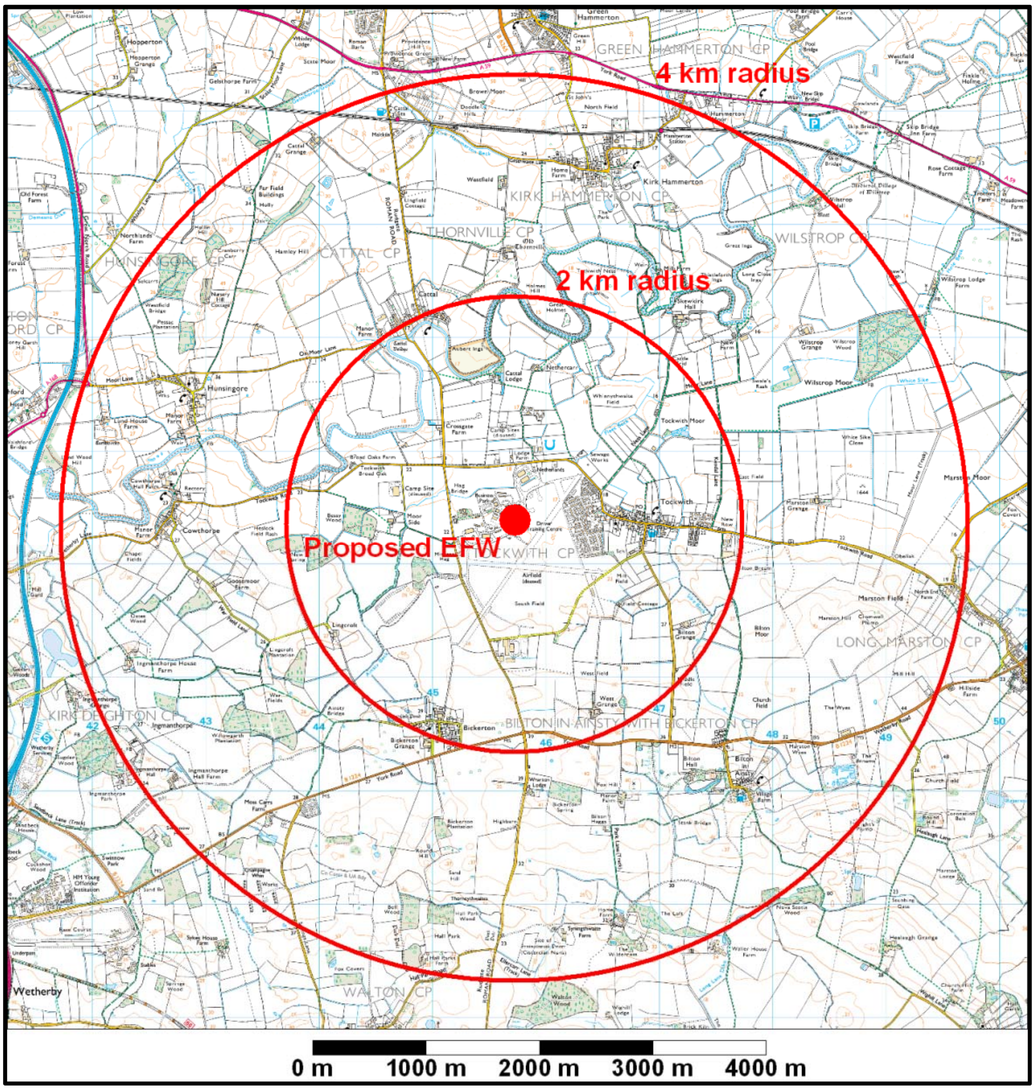
BCB propose to locate the mixed waste EFW plant at Marston Business Park immediately to the west of the village of Tockwith (refer *Figure 1.1*).

FIGURE 1.1 LOCATION OF THE PROPOSED EFW FACILITY



The facility would be located in the southeast corner of the Marston Business Park. At its nearest point the facility boundary is approximately 400 m from the edge of the village of Tockwith. The area surrounding the facility is generally rural. The village of Tockwith is the nearest settlement to the proposed facility. Other settlements with the potential to be affected by emissions from the facility include, but are not limited to, Bickerton (1.8 km to the south-southwest), Cattal (2 km north-northwest), Bilton-in-Ansty (2.7 km southeast) and Hunsingore (3 km west-northwest). The area surrounding the EFW plant is presented in *Figure 1.2* with circles indicating the 2 km and 4 km radii around the proposed plant.

FIGURE 1.2 AREA SURROUNDING THE PROPOSED EFW FACILITY



Furthermore, given the rural nature of the surroundings and the agricultural activities that take place there are a number of farms, as well as isolated residential properties within the area likely to be influenced by emissions from the proposed facility.

It is proposed that the mixed waste EFW facility will treat 60,000 tonnes per annum of waste. It is anticipated that up to 50% of the waste will comprise hazardous waste from the adjacent transfer station. Waste will be treated using gasification and six gasification chambers are proposed. A secondary thermal treatment process will treat the gas generated and emissions from this will be treated in an air pollution abatement plant prior to release via a 31 m stack. However, it is understood that following consultation with the Environment Agency it is proposed that the stack height be increased to 40 m.

An Environment Statement (ES) has been prepared for the proposed development and a review of this has been undertaken with respect to air quality impacts and public health impacts. It should be noted that the review has been undertaken of the ES for the facility (dated April 2009) and does not take into account any benefits that may arise from an increase in stack height. However, the likely acceptability of a 40 m stack height is discussed.

2 REVIEW OF THE ENVIRONMENTAL ASSESSMENT

2.1 INTRODUCTION

A review of the air quality assessment provided in the ES for the development has been carried out. Principally, this has included a review of Section 10 and Appendix 10.1 of the ES.

2.2 OVERVIEW OF THE ATMOSPHERIC DISPERSION MODELLING STUDY

2.2.1 Dispersion Model Utilised

The assessment undertaken is stated as utilising the Atmospheric Dispersion Modelling System (ADMS) model. This model is appropriate for the dispersion modelling of emissions of this type. However, the version of the model utilised is not stated. Data provided in Table 1 and Table 2 of Appendix 10.1 appears to be consistent.

2.2.2 Assessment Criteria

Table 10.3 provides Air Quality Objectives (AQO's) for a range of pollutants. However, there is no discussion relating to air quality guidelines or assessment criteria for other pollutants (e.g. trace metals). The EU provides target values for arsenic, cadmium and nickel (annual mean concentration in the PM_{10} fraction). Assessment criteria in the form of Environmental Assessment Levels (EALs) for trace metals are also provided by the Environment Agency [1]. The World Health Organization (WHO) also provides guidelines for the concentration of some trace metals in air. A summary of the appropriate criteria for the trace metals considered is presented in *Table 2.1*.

It should be noted that the most stringent annual mean concentration for total metals should be 0.006 $\mu g\ m^{-3}$ (6 $ng\ m^{-3}$) and not 0.2 $\mu g\ m^{-3}$ as used in the assessment provided by BCB (refer Table 10.11). This is based on the fourth Daughter Directive under the EU Directive on Air Quality Management and Assessment. This Directive sets target values for arsenic and other contaminants with Member States required to 'take all necessary measures, not entailing disproportionate cost' to meet the target values by 31 December 2012. Therefore, the assessment undertaken by BCB will substantially underestimate the impact of airborne emissions on health as it does not take into account these future EU target values.

1 Environmental Permitting Regulations – H1, Environmental Risk Assessment, Environment Agency Horizontal Guidance (March 2008)

TABLE 2.1 **ENVIRONMENTAL ASSESSMENT LEVELS FOR TRACE METALS**

Contaminant	Environmental Assessment Level (µg m-3) Long-term	Short-term	EU Directive Target Values (µg m-3)	WHO Guideline (µg m-3)
Antimony (Sb)	5 (a)	150 (b)		
Arsenic (As)	0.2 (a)	15 (b)	0.006 (g)	
Cadmium (Cd)	0.005 (c)	1.5 (b)	0.005 (g)	0.005 (g)
Chromium (Cr)				
CrIII	5 (a)	150 (b)		
CrVI	0.1 (a)	3 (b)		
Cobalt (Co)	0.2 (a)	6 (b)		
Copper (Cu)	10 (a)(d)	200 (e)		
Manganese (Mn)	150 (a)	1,500 (b)		0.15 (g)
Mercury (Hg)	0.25 (a)	7.5 (b)		1 (g)
Nickel (Ni)	1 (a)	30 (e)	0.020 (g)	
Thallium (Tl)	1 (a)	30 (b)		
Vanadium (V)	5 (a)	1 (c)(f)		1 (h)

(a) Derived from the long-term occupational exposure limits
(b) Derived from the long-term occupation exposure limit as no short-term limit exists
(c) WHO guideline value
(d) Copper as dusts and mists
(e) Derived from short-term occupational exposure limits
(f) Derived from 24 hour reference period
(g) Annual mean
(h) 24 hour mean

No assessment criteria are provided for hydrogen chloride (HCl) or hydrogen fluoride (HF) although it is noted that these are indicated in the various tables in Appendix 10.1.

The Expert Panel on Air Quality Standards (EPAQS) has published a report on halogen and hydrogen halides in ambient air [2]. A summary of the EPAQS guideline and EAL's [1] for HF and HCl is presented in *Table 2.2* for HF and *Table 2.3* for HCl.

TABLE 2.2 **ASSESSMENT CRITERIA FOR HYDROGEN FLUORIDE**

Averaging Period	Concentration (µg m-3)	Averaging Period
Environmental Assessment Levels		
Short-term EAL	250	1-hour mean
Proposed EPAQS Guideline	160	1-hour mean

2 Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects, EPAQS (January 2006)

TABLE 2.3 ASSESSMENT CRITERIA FOR HYDROGEN CHLORIDE

Criteria	Concentration ($\mu g\ m^{-3}$)	Averaging Period
Environmental Assessment Levels		
Long-term EAL	20	annual mean
Short-term EAL	800	1-hour mean
Proposed EPAQS Guideline	750	1-hour mean

2.2.3 Assessment Criterion for Dioxins and Furans

There are no assessment criteria provided for airborne exposure to dioxins and furans. The reason for the absence of an air quality guideline is that direct exposure to dioxins and furans (e.g. via inhalation) is a minor exposure pathway. More significant exposure occurs via indirect exposure routes (e.g. deposition on to soils and uptake via the food chain). Consequently, exposure criteria for dioxins and furans are generally expressed as a total Tolerable Daily Intake (TDI). The WHO recommends a TDI for dioxins/furans of 1 to 4 pg I-TEQ kg-BW^{-1} d^{-1} (picogrammes as the International Toxic Equivalent per kilogram bodyweight per day) [3]. The UK Committee on Toxicity (COT) TDI also recommends a TDI of 2 pg I-TEQ kg-BW^{-1}.

As no assessment criterion is proposed by BCB or used within the assessment to assess the impact of dioxin/furan emissions on public health then the air quality and health impact assessment is deficient and incomplete. It is not possible to conclude that the facility does not have an impact on air quality or public health if no comparison is provided between the predicted magnitude of the release and an appropriate assessment criterion.

2.3 PRELIMINARY STACK HEIGHT SCREENING ASSESSMENT

For this purpose, a D1 stack height calculation was performed which resulted in a stack height of 23 m. Subsequently, dispersion modelling of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) was carried out to determine a suitable stack height for the facility.

The D1 stack height methodology [4] was published by the former HMIP in 1993. It utilises a methodology that assesses the significance of a release (pollution index) based on the magnitude of the release, background air quality and the relevant air quality standard for the pollutant(s) considered. As the methodology was published over 16 years ago, some aspects of it are out of date. Therefore, it needs to be used with caution particularly with

3 Assessment of the Health Risk of Dioxins: Re-evaluation of the Tolerable Daily Intake (TD), WHO Consultation, May 25-29 1998, Geneva, Switzerland

4 Technical Guidance Note D1, Guidelines on Discharge Stack Heights for Polluting Emissions, Her Majesty's Inspectorate of Pollution (June 1993)

regard to the air quality limit values used (those specified in the method have since been replaced by more stringent levels) and the background air quality assumed.

With regard to the D1 stack height assessment presented in Appendix 10.1 of the ES we would comment as follows:

- The calculations utilise old air quality limit values which are no longer applicable. Therefore, the calculation would provide a minimum stack height which would not result in safe exposure by today's standards.
- It would appear that the discharge rate (D) has been derived from actual conditions and not normalised conditions. The discharge rates that should have been used are those presented in Table 2 of Appendix 10.1.
- A mixture of reference periods have been used for the discharge rate (daily values are used), background concentrations (annual concentrations are used) and the guideline concentration (e.g. for NO_2 a short-term guideline is used which is no longer applicable). In order for the calculations to be meaningful, consistent values should be used (e.g. either all long-term or all short-term values).

As a consequence of the above points, the Pollution Index (Pi) derived is substantially lower than it would be if correct or consistent inputs had been used. For example, for NO_2 which has the highest Pi derived from the developer's calculations we would estimate a Pi of 211,935 would be more appropriate (a factor of 6.8 times higher). This is derived from a long term discharge rate of 6.5 g s^{-1}, a long-term guideline concentration of 40 µg m^{-3} and a long-term background concentration of 9 µg m^{-3}. On the basis of this and the other input parameters used this would result in a minimum stack height of 30 m and not 23 m as calculated by the developer.

In addition to the stack height calculations, BCB provide a dispersion modelling assessment for various stack heights. A standard approach has been adopted for this purpose, where only emissions of NO_2 and SO_2 have been considered. It is stated that '*these are the two pollutants that have the highest environmental impact*'. However, for a development of this type, which has a range of polluting emissions some of which are known to have acute health impacts and others which have chronic health impacts, this may not result in an appropriate stack height. No consideration of a suitable stack height for other pollutants (e.g. toxic organics or trace metals has been considered). In relation to chronic health affects, these pollutants will be of greater importance and the stack height required to protect public health will need to take into account emissions of these pollutants.

Therefore, we would conclude that the stack height assessment provided is inadequate and does not demonstrate that any of the proposed stack heights (e.g. up to and including 40 m) are acceptable for the protection of public health. This is evident in the assessment provided of the chosen stack height of 40 m since predicted concentrations of arsenic comprise a very large proportion of the EU target value (refer *Section 2.7*).

2.4 ADOPTION OF A WORST-CASE SCENARIO

In paragraph 10.10 of the ES it is stated that a worst-case scenario approach has been adopted. We would not agree with some of the comments made with regard to this and, in particular, we would comment as follows.

- Bag filters will be employed to reduce the level of particles released from the air pollution control equipment. Bag filters are more efficient at removing larger particles. Therefore, the residual particles released via the stack are more likely to be the small fraction (e.g. PM_{10} and $PM_{2.5}$). Therefore, the assumption that all of the particles released are $PM_{2.5}$ and PM_{10} is not unrealistic.
- The assumption that 50% of the oxides of nitrogen are converted to NO_2 is not an unrealistic assumption. A worst-case approach would have been to assume 100% conversion.
- Given the nature of the waste being treated and the uncertainty relating to its composition, it is not possible to assess the actual composition of the Group 3 metals. Therefore, it is necessary to assume that 100% of the Group 3 metals may comprise of arsenic or some other metal in order to assessment potential impact on local air quality and public health.
- Operation at reduced loads may affect the temperature of the release and the volume flow of air from the stack. This would reduce the thermal buoyancy and momentum of the plume potentially resulting in an increase in predicted concentrations. Therefore, the assumption of continuous, full-load operation does not necessarily represent worst-case conditions.

2.5 POLLUTANTS CONSIDERED

The pollutants considered in the assessment include only those for which Waste Incineration Directive (WID) emission limits are provided.

In our experience, the gasification and thermal treatment of a mix of hazardous and other wastes is not widespread throughout the UK. No information is provided by BCB in relation to examples of similar plants operating in the UK and in Europe. Furthermore, it is understood that no information has been provided on the technology proposed or the provider of this technology. Consequently, it is not clear how it can be demonstrated that the plant will meet with the requirements of the Waste Incineration Directive without this information and evidence of operational plant utilising similar waste. In particular, we would have concerns relating to other toxic organic micro pollutants (TOMPs) which could potentially be emitted during the treatment process either from the stack or from fugitive releases during the handling and treatment of hazardous waste in particular. These could include polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs). Fugitive releases may arise from the transfer of waste from the adjacent transfer station or handling of this waste within the EFW plant building. Although this should not be a problem if the building is maintained at a negative pressure, there will be times (e.g. delivery of waste) that doors will be opened.

Emissions of other TOMPs will depend on the hazardous waste being treated and is likely to be very site/waste type specific. However, no consideration appears to have been given to characterising emissions of these or of assessing their impact on human health.

Given the novel technology being used and the mix of waste proposed more information should be provided by BCB regarding the characteristics of the emission and the release, or otherwise, of other toxic organic micro pollutants based on information of similar plant operating elsewhere.

2.6 BACKGROUND AIR QUALITY

The presentation of the background air quality is weak. Background air quality for PM_{10}, $PM_{2.5}$, SO_2, CO, NO_2 and benzene has been obtained from background air quality maps. However, very little information has been provided on how these have been calculated or to what year they have been derived, etc. For trace metals and dioxins/furans data are used from one year of monitoring at a very remote site in Scotland (Eskdalemuir) for trace metals and for a remote site at High Muffles for dioxins and furans. The Eskdalemuir site in particular is very unlikely to be representative of air quality in rural North Yorkshire. For example, for arsenic the annual mean concentration at Eskdalemuir for 2007 was 0.31 ng m^{-3} (0.00031 $\mu g\ m^{-3}$); as used in the assessment by BCB. However, consideration of data for the rural metals network (ten sites throughout the UK) indicates concentrations in 2004 and 2005 ranged between 0.24 and 1.13 ng m^{-3} as an annual mean. The aim of rural metals network is to measure the background concentrations and deposition of heavy metals. The sites in the network were specifically chosen as they are rural locations which are not influenced by nearby emission sources such as industrial plants or major roads. Therefore, these are more likely to be characteristic of rural background concentration throughout the UK rather than remote Scotland. The network does not have a monitoring location in North Yorkshire, the nearest sites are Cockley Beck in Cumbria and Beacon Hill in Leicestershire. To properly characterise air quality with respect to trace metal concentrations around the proposed EFW facility site it would be necessary to carry out local monitoring.

2.7 ASSESSMENT OF AIR QUALITY IMPACTS

We consider that the air quality assessment undertaken does not demonstrate that the facility would not have a significant impact on local air quality and public health.

Firstly, no assessment is provided in relation to emissions of dioxins and furans. These are a group of chemicals which are known to be emitted from incineration processes. They are highly toxic at very low concentrations and are one of the major concerns relating to EFW processes. Therefore, the lack of comparison for dioxin/furans completely invalidates the assessment undertaken. Without the consideration of dioxins/furans it is not possible to demonstrate whether or not the proposed facility would have an impact on local air quality or public health.

Secondly, an incorrect air quality target value was used by BCB for the consideration of the air quality impacts of arsenic. An annual mean AQS of 0.2 $\mu g\ m^{-3}$ (200 $ng\ m^{-3}$) was used whereas the EU target value for arsenic in air is 0.006 $\mu g\ m^{-3}$ (6 $ng\ m^{-3}$) which is a factor of more than 30 lower than the value used by BCB. Therefore, the assessment of impacts provided will be substantially underestimated.

Maximum ground level concentrations of arsenic of 0.0077 $\mu g\ m^{-3}$ (7.7 $ng\ m^{-3}$) were predicted by BCB (see Table 12 of Appendix 10.1). Therefore, the contribution from the facility alone is in excess of the AQS at 6 $ng\ m^{-3}$. It is understood, that on the basis of this exceedance the Environment Agency has indicated that a 40 m stack height should be adopted. However, we would have concerns as to whether this is sufficient to reduce predicted levels to an acceptable level, particularly when background concentrations are included.

On the basis of the stack height predictions provided by BCB, increasing the stack height from 31 m to 40 m would result in the maximum arsenic concentration being reduced from 7.7 to 4.3 $ng\ m^{-3}$; this is still a substantial proportion of the annual mean AQS (72%). The inclusion of a background concentration of up to 1.13 $ng\ m^{-3}$ (refer *Section 2.6*) would result in a predicted environmental concentration of 5.4 $ng\ m^{-3}$ which is 90% of the AQS.

Based on examples provided in the former National Society for Clean Air's Development Control guidance [5] (now Environmental Protection UK), an annual mean increase or decrease of >25% of the AQS is considered to be a 'Very Large Magnitude of Change'. It should be noted that predicted annual mean concentrations of arsenic are 72% of the annual mean AQS. Furthermore, examples of descriptors for impact significance would suggest that on the basis that with the facility concentrations of arsenic would be

5 Development Control: Planning for Air Quality, NSCA Guidance, 2006 Update September 2006)

described as 'below the AQS but not well below' then the facility would be described as having a 'Substantial Adverse' impact.

2.8 ASSESSMENT OF HUMAN HEALTH IMPACTS

Section 11.0 of the ES documents the health impact assessment undertaken for the proposed facility. In Paragraph 11.7, it is stated that:

> *'The assessment has included the consideration of the direct risk associated with the inhalation of chemical substances as well as the potential indirect effects though ingestion of potentially contaminated, locally grown food.'*

Given the rural nature of the surroundings and the agricultural activities taking place in very close proximity to the site, the consideration of indirect health impacts is very important. However, given the statement in Paragraph 11.7, no assessment of indirect health effects is provided. The assessment focuses on a comparison of predicted concentrations with ambient air quality guidelines and the total intake (i.e. from inhalation and ingestion) is not considered at all.

The emissions from the proposed facility would contain a number of substances that cannot be evaluated in terms of their effects on human health simply by reference to ambient air quality standards. Health effects could occur through exposure routes other than purely inhalation. As such, an assessment needs to be made of the overall human *exposure* to the substances by the local population and then the *risk* that this exposure causes. Therefore, the principal focus of the human health impact assessment should have been to assess risks to health from alternative exposure routes other than inhalation (direct as well as indirect). This is particularly important for dioxins/furans and trace metals which (unlike substances such as nitrogen dioxide that have short term, acute effects on the respiratory system) have the potential to cause effects through long term, cumulative exposure. Furthermore, there are no air quality guidelines available for assessing the impact of dioxins/furans on human health as inhalation exposure represents only a small proportion of total exposure. The largest contribution arises from other exposure routes (e.g. ingestion). Therefore, without the consideration of these other exposure pathways, it is not possible to assess the impact of the facility on human health.

Therefore, it is concluded that the human health impact assessment provided by BCB is inadequate.

3 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

A review of the ES for the proposed mixed waste EFW plant proposed by BCB has been undertaken with respect to the potential impact on air quality and human health. This has principally included a review of Section 10 and Appendix 10.1 of the ES. It is noted that since the submission of the planning application, the Environment Agency has recommended an increase in stack height from 31 m to 40 m. Consequently, the assessment provided in the ES will no longer be valid. However, in reviewing the information provided we have taken into account the stack height increase and also made comments as to the acceptability of this new stack height.

Our principal comments on the air quality and human health assessments provided to support the planning application are as follows:

- The assessment provided by BCB did not use EU Directive target values for trace metals which Member States are required to 'take all necessary measures, not entailing disproportionate cost' to meet by 31 December 2012. Therefore, incorrect air quality standards have been used for arsenic and will result in a substantial (factor of 33) underestimate of the impact of arsenic emissions on local air quality and human health.
- No assessment criteria are used for the emissions of dioxins/furans. Therefore, the air quality and public health assessments provided are incomplete. Furthermore, it is not possible to conclude that the facility does not have an impact on air quality or public health if no comparison is provided between the predicted magnitude of the release and an appropriate assessment criterion. There are other methods of assessing the impact of these emissions (see below) against widely used, robust assessment critieria set by the WHO and the UK Committee on Toxicity.
- There are errors and inconsistencies in the D1 stack height calculation carried out by BCB. Furthermore, the more detailed modelling study carried out considers only emissions of NO_2 and SO_2 whereas it is the emissions of pollutants with long term air quality standards (e.g. arsenic) which influence the stack height requirement. Therefore, we would conclude that the stack height assessment provided does not demonstrate that any of the proposed stack heights (e.g. up to and including 40 m) are acceptable for the protection of air quality or public health.
- The assessment carried out by BCB is stated as being worst-case. However, as detailed in *Section 2.4*, we would disagree that the assessment undertaken was necessarily worst-case and provides a realistic estimate of potential impacts.

- Given the novel technology proposed and the treatment of hazardous waste, no consideration has been given to the provision of information on other toxic organic micro pollutants (e.g. PCBs, PAHs) that may be emitted either from the stack or from fugitive releases. Information on the technology, the plant supplier and examples of operational plant are not provided. Therefore, it is not possible to determine whether or not the technology can meet with the requirements of the Waste Incineration Directive particularly with regard to the formation and control of dioxin emissions.
- Information provided on estimated background air quality is poorly presented and it is considered background concentrations of trace metals are likely to be underestimated.
- Consideration of arsenic as an example and the proposed new stack height of 40 m would result in the facility being described as having a 'Substantial Adverse' impact based on current development control guidance.
- For the human health assessment, despite comments to the contrary there is no assessment of impacts on health from pathways other than inhalation. Given the rural nature of the surroundings and the prevalent agricultural activity, it is concluded that the human health impact assessment provided by BCB is inadequate.

3.2 RECOMMENDATIONS

It is considered that substantial additional work is necessary in order to demonstrate that emissions to air from the proposed facility would not have an unacceptable impact on human health. In particular, this requires a more detailed and more thorough analysis of a suitable stack height and a detailed assessment of exposure via other pathways (e.g. ingestion of local produce). This would require detailed food chain modelling of trace metals and dioxins/furans as a minimum. In addition, the release of other toxic organic micro pollutants would need to be included in the human health assessment, if the developer is unable to demonstrate that the release of these from the facility would not arise. The onus for this additional work should be placed on the developer.

The local planning authority and the Environment Agency should be made aware of the findings of this report. Therefore, it is recommended that both are provided with a copy of this report for their consideration.

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