CASE EN010110: MEDWORTH ENERGY FROM WASTE COMBINED HEAT AND POWER FACILITY

SUBMISSION PRIOR TO DEADLINE 1 – 10TH MARCH 2023

BY REGISTERED INTERESTED PARTY NICOLA SUTHERAN

UNIQUE REFERENCE No. 20032416 - RESIDENT

PROPOSED SITE LOCATION OF THE MVV INCINERATOR

It appears absolutely absurd that MVV have proposed Wisbech as a location, to site and operate a central incinerating operation. Wisbech is 28.5 miles away from the A1 and not at all central to the localities it has proposed to intake waste from at all, except for Norfolk itself.

Furthermore, there is also an existing operation available for use in Peterborough and other proposed incinerators pending approval, for example Boston in Lincolnshire which is only 45 minutes by road from Wisbech.

All incoming and outgoing MVV vehicle drivers that the company are responsible for or subcontracted to from outlying areas, are putting themselves at risk. By driving the quite unforgiving and hazardous terrain of the A47 especially in extreme weather conditions.

This is also regardless furthermore of increasing pollutant to prime farm land and impeding essential access to all currently existing residents, land owners, employees, school pupils, public bus transport and retail deliveries in and out of this East Anglian region via the A47. We all use the A47 daily and if we are cut off by road, the consequences are dire for the whole region. The A47 is our only main access road, in and out of the region,

The A47 in many places was not especially constructed for heavy vehicles or the capacity of incoming or outgoing vehicles, from or to the A1.

The A47 more importantly has many two way non-dual carriageway areas, many seriously dangerous chicanes, deep embankments and drainage ditches.

There are regular daily accidents by vehicle drivers misinterpreting the roads and causing long tailbacks in all directions. Due to vehicle recovery from accidents and emergency service vehicle attendance. The roads are also regularly closed on a daily basis through vehicle breakdown.

It is important to note, that the proposed vehicles coming to and from the proposed MVV incinerator, will be carrying hazardous or polluting waste materials. Should an

accident occur creating spillage of these materials on to the A47, the consequences to the A47's surrounding rural areas is extremely large and any clean up operation would be extremely costly.

The pure substance of the roads themselves, is also fragile and prone to damage, through underlying silt shift, cracking and rutting due to heavy vehicle tonnage weights. Which not only impedes and makes these roads even more hazardous, but affects all concerned in costs for repair, local residents in the council tax, businesses including MVV in their business tax and all outlying areas using the A47 in their taxes too.

The area is very heavily congested by incoming and outgoing traffic using the A47. All congestion on the A47, then automatically onwardly affects traffic movement in Wisbech itself and the neighbouring villages.

Stationery traffic, produces as much if not more pollutant as moving traffic. Currently Cambridge are looking to introduce ULEZ, in the near future to combat this pollution too. An action that could be adopted by future councils including Fenland or Wisbech.

These ULEZ zones, would then of course onwardly be passed on to all entering these zones, increasing the cost of transportation and travel, then again onwardly affecting the cost of operation to businesses, including MVV themselves and I wonder if this has been factored into their future transportation and operation costs.

POLLUTION PRODUCED BY THE PROPOSED MVV INCINERATOR

There have been a number of complaints made by the local residents and businesses via the press about Incinerators, including MVV's own sites and all these are available for public view in evidence. The complaints are of dust, noise, smell and fire.

Our world as a whole is in climate crisis, a very well-known fact. Every country is suffering from extreme temperature changes, both cold and hot and the UK is not exempt from this.

CASE EN010110: MEDWORTH ENERGY FROM WASTE COMBINED HEAT AND POWER FACILITY

SUBMISSION PRIOR TO DEADLINE 1 – 10TH MARCH 2023

BY REGISTERED INTERESTED PARTY NICOLA SUTHERAN

UNIQUE REFERENCE No. 20032416 - RESIDENT

Last summer in the East Anglian region had some the highest recorded temperatures in this country. It affected everything including distortion to our roads.

Bearing in mind these increased temperatures, it is imperative that residents and businesses within the area are able to gain adequate ventilation to cool their own properties as extreme heat poses health risks.

However no property owner within the town of Wisbech, will be afforded the privilege of this cooling air flow in the summer months at all. None will be unable to open their property widows due to dust, noise and smell pollution.

This affects not only quality of life, but more importantly health to all school pupils, residents and employees within the area through not being able to provide themselves the necessary ventilation to their properties.

The onward impact especially to local businesses and schools alone, could be completely catastrophic by way of cost implication. All because of maximum working temperatures and the guidance they must adhere to. Employees would be too unwell to attend work affecting business production and all students, in paid or unpaid education would experience school closure. At home all day residents, would be isolated to their own living accommodation.

This is on top of the already escaping carcinogenic properties of unfiltered micoparticles omitted from chimneys affecting all public health.

SCALE BY WAY OF HEIGHT OF THE PROPOSED MVV INCINERATOR SITE

Under the Rights to Light Act a landowner has the right to receive light through defined apertures (including windows) in buildings on his or her land.

The scale and height of the proposed site, will affect all future natural light to all land surrounding the proposed site, including private properties, business sites and educational establishments meaning that should their building be affected by the construction, they would have a right to claim compensation for the loss and its effects.

The proposed construction towers above all other land, meaning that receipt of incoming natural light by surrounding land owners, residents, business including growth of crops and educational establishments will be affected.

Lack of Vitamin D from natural light, has a major impact on the quality of life. It causes dreadful fatigue and lethargy. Therefore again this will pose a health risk to residents affecting their quality of life, school pupils affecting their essential education and a downtime business risk to companies due to the fatigue and lethargy of their employees meaning a need for increased sick leave.

The impact in reverse, by way of lawsuit representations made to MVV is immense also, due to the amount of compensation payable by the company if cases are filed, proven and awarded through the judicial system.

INDENTIFICATION OF MISS-ROUTING VEHICLES ACCESSING AND EXITING THE MVV SITE LOCATION

Mr. Carey in his feedback, stated that local residents were obliged to report to the company any vehicles that were using non specified routes to drive to and from the proposed MVV Incineration site.

This would be a completely impossible task for residents to undertake.

The vehicles attending the site from outlying areas would be unmarked and not bearing the MVV Logo on its livery. The vehicles entrancing and exiting the site would in the main be hired subcontracted vehicles as it is more cost effective than owning and running its own fleet of transport.

However due to the cost of these road vehicles, many, if not all, will be fitted with a vehicle tracker.

Therefore the onus should clearly be on MVV itself and its sub-contractors to monitor all vehicular routes and movements taken, via vehicle tracking data and not the residents at all.

Vehicles using not using pre-prescribed routes should be imposed a fine by MVV too and this money, should be returned to the Council Authorities or Highways to allow for repair and rectification of these misused highways. This would then prevent these vehicles in re-routing by all other roads other than those specified in their routing instructions.

NEGATIVE IMPACT ON LAND AND PROPERTY PRICES CREATED BY THE PROPOSED MVV INCINERATOR

We were verbally informed by Mr. Carey, that he initially sought interest of the site located in Algores Way by approaching the previous land owner in 2010.

He then later purchased the land in 2017, in the view of establishing such an Incinerator build by MVV.

Had his or MVV's intention to build an incineration plant on this site at the time of purchase of the land, been provided to Wisbech Town Council. It could have potentially been noted and any prospective property buyers would have been informed prior to purchase on their Land Registry searches, however it was not.

A study by Cranfield University (attached) shows that all Incinerators have a negative impact on land and property prices due to blight, within zones. This calculation of impact of blight has been made in a radius from Incinerator sites to outlying land and property. The lesser radius, the less land or property is of value.

The study by Cranfield University also shows that properties within the 1.7km radius would be worth zero in value.

As you can understand within the Wisbech area, this 1.7km range encompasses allot of privately owned and council land and property, including 2 brand new build houses developments, private housing, council housing and business properties. Meaning a lot of completely worthless land and property. This would mean that private, council, business and builders would make a huge loss unless the company purchased all properties within this 1.7km radius at its current market value in compensation to allow all parties to relocate.

CASE EN010110: MEDWORTH ENERGY FROM WASTE COMBINED HEAT AND POWER FACILITY

SUBMISSION PRIOR TO DEADLINE 1 – 10TH MARCH 2023

BY REGISTERED INTERESTED PARTY NICOLA SUTHERAN

UNIQUE REFERENCE No. 20032416 - RESIDENT

NEGATIVE IMPACT ON EMEGENCY SERVICES BY THE PROPOSED MVV INCINERATOR

a) Fire Service

The Fire Station based on Churchill Road, Wisbech operates two fire engines. One is a Scania rescue pump and the other a Scania water tender.

The first of which is crewed by firefighters seven days a week from 8am to 6pm and the second is then permanently crewed by on-call fire fighters two hours per week on a Thursday between 7pm and 9pm.

Therefore should this large site suffer and explosion or fire there are a number of issues.

1) The most obvious, there would not be a large enough capacity of Fire Engines to contain such a blaze or explosion. Nor would there be enough vehicles to attend any other fire or road traffic accident if required in the area, should an incident occur.

2) Should the MVV Incineration site suffer a fire or explosion where it is proposed to be located, it would cause a closure to the A47 and cause an exclusion zone within Wisbech itself. This would bring every vehicle to standstill within the area and beyond. Meaning that any emergency vehicle attending from outlying areas would be obstructed in their journey, causing their delay in attendance at such an incident.

3) The effect on vehicles on the A47, local business, property and residents would also be inexplicably impacted. There is a large risk of smoke inhalation to al, meaning that there could be a large number of casualties for local ambulance crew to attend to not only on the MVV Incineration site itself.

b) Ambulance Service – Road

The North Cambridgeshire Hospital does not have an A&E department. Anyone who needs to attend A&E between Wisbech and Kings Lynn, has to attend the Accident and Emergency Services at the Queen Elizabeth Hospital, located in

Gayton Road, Kings Lynn. Therefore all Ambulances are despatched from and to the Queen Elizabeth Hospital in Kings Lynn.

Their only direct access route by road is the A47. Therefore should this route be congested as it is daily, their journey is hampered by delay. With the additional vehicular movement on the A47 this delay will be further impacted, putting allot of lives already at risk in even higher risk.

c) Ambulance Service – Air

The Air Ambulance is in regular attendance in the local area when accidents not only occur on the A47 itself but locally, due to the distance to the Queen Elizabeth Hospital and other specialist hospitals further afield e.g., Addenbrookes.

Currently the Air Ambulance uses the area where the proposed MVV Incinerator is to be located as a turning circle. This enables the helicopter to be able to land on the neighbouring estate in Octavia Hill Ward which butts up to the Medworth Ward perimeter. The same location where the MVV Incinerator site is proposed to be built. This is done, as it is easier for them to land entrancing the area over lower level buildings, i.e. business premises and residential bungalows. The helicopter then lands on the grassed area located centrally to the Heron Road housing estate (off Weasenham Lane). Please see attached photo in evidence taken Thursday 24th March 2022 at 22:16 in evidence.

This location is chosen by the Air Ambulance, as it is within easy access of Weasenham Lane, the neighbouring housing estates and educational establishments.

The proposed MVV Incinerator will hamper the Air Ambulance turning circle and access to this location, not only through the height of its main building but also the extreme height of the proposed chimneys.

This will not only put residents, employees and students at increased risk, due to the air ambulance having to find a more accessible area for to land. But more importantly puts the lives at risk of the Air Ambulance crew should they try to fly around this area post the MVV Incinerator build.

Police

Wisbech Police Station is currently located in its town centre at Nene Parade. If there is an accident on the A47, the police service travel to attend from the town centre, However congestion on the A47 impedes their journey by clogging up the roads within Wisbech itself. Meaning that their journey in attending accidents and emergencies is also impeded by obstructing vehicles. Increased traffic movement on the A47 will further delay their attendance in an emergency.

Conclusion

Bearing in mind all the points raised not only by myself but all MPs, Councillors (Town, District and County), residents, employees and businesses within the Wisbech and outlying areas along the A47. I do not feel the locality of the proposed development by MVV to be a prudent one at all. It will effect so many lives.

I would very much like to thank the Planning Inspectorate for their time and consideration of all our views, it is extremely appreciated by us all.

Waste Management, Volume 61, March 2017, pp. 608-616
DOI:10.1016/j.wasman.2016.10.036

Monetising the impacts of waste incinerators sited on brownfield land using the hedonic pricing method

Monica Rivas Casado[a], Jan Serafini[a], John Glen[b] & Andrew Angus[b*]

[a]School of Energy, Environment and Agrifood, Cranfield University, Cranfield, MK43 0AL, United Kingdom

[b]School of Management, Cranfield University, Cranfield, MK43 0AL, United Kingdom

*Corresponding author: a.angus@cranfield.ac.uk, Tel.:01234750111 ext 4334

ABSTRACT

In England and Wales planning regulations require local governments to treat waste near its source. This policy principle alongside regional self-sufficiency and the logistical advantages of minimising distances for waste treatment mean that waste incinerators have been built close to, or even within urban conurbations. There is a clear policy need to balance the benefits of EfW against the negative externalities experienced by local residents in a European context. This study uses the Hedonic Pricing Method to estimate the monetary value of impacts associated with three incinerators. Once operational, the impact of the incinerators on local house prices ranged from approximately 0.4% to 1.3% of the mean house price for the respective areas. Each of the incinerators studied had been sited on previously industrialised land to minimise overall impact. To an extent this was achieved and results support the effectiveness of spatial planning strategies to reduce the impact on residents. However, negative impacts occurred in areas further afield from the incinerator, suggesting that more can be done to minimise the impacts of incinerators.

Keywords: hedonic pricing method; incinerator; willingness to pay; negative externalities

1. Introduction

The waste hierarchy is the rationale that underpins most European waste legislation, such as the European Waste Framework Directive 2008/98/EC (EU, 2008). The hierarchy is based on the principle that prevention of waste is the most desirable form of waste management and disposal of waste in landfill without energy recovery is the least. There are a range of other management options between these polar opposites, such as incineration with energy recovery, also known as Energy from Waste (EfW). When waste avoidance and recycling opportunities are unfeasible EfW is the next best alternative.

In England and Wales compliance with European legislation has driven significant investment in waste management facilities that offer alternatives to landfill (Defra, 2014). In addition to the 30 incinerators currently operating in England and Wales (Defra, 2013), over 100 new incinerators are in the proposal or planning stage (UKWIN, 2015). Two major guiding principles of waste management strategy in England and Wales are that facilities should be located such that: waste is managed or treated as close as possible to its source; and that the environmental or social impacts of a waste management facility should be minimised (DCLG, 2015). These two principles have the potential to conflict, given that those who create waste are those that must be protected from the impacts of waste management.

This conflict has given rise to notable public protests where incinerators have been proposed near residential areas (BBC, 2015; BBC, 2013; BBC, 2012). This opposition arises partly because of the nuisances and risks associated with waste incineration (COWI, 2000; Eshet *et al*., 2005; Rabl *et al*., 2008; Defra, 2013). Incinerators share many of the same negative externalities as landfills including noise, unpleasant odour, windblown litter, dust, vermin, presence of seagulls, flies, traffic, visual intrusion and enhanced perception of health risks among local residents (Havranek *et al*., 2009). Thus, while the decision to site an incinerator requires a technical and spatial assessment it also remains a highly sensitive issue for local residents.

Considering where to site EfW incinerators requires an analysis of all costs and benefits associated with waste incineration. While the benefits of incineration are largely tangible, such as the monetary value of electricity generated and number of jobs created, many of the disamenities are not. To date, the literature has typically used the Hedonic Pricing Method (HPM) to monetise the negative externalities of waste management. The HPM uses housing market data to estimate the price individuals are willing to pay for a non-marketed quality (Lancaster *et al*., 1996), such as distance from a waste management site.

Most studies that investigate the impact of incinerators on house prices have focused on US sites. These results are unsuitable for use in a European policy context (Havranek *et al*. 2009) because of differences in environmental policy and property markets. This leaves an important research gap. There is a clear policy need to balance the benefits of EfW against the negative

externalities experienced by local residents in a European context. Such analysis helps policy makers identify instances where EfW offers clear gains in net present value and others where EfW is unsuitable and alternative waste management options should be considered.

To meet this research need, this paper uses the HPM to quantify the impact of three EfW incinerators in England. In particular, the study focuses on the effect that these waste management sites have on property prices at three development stages: planning, construction and operational. The analysis processes over 55,000 transactions over a 20 year period. To the authors' knowledge this is the first European study on incinerator negative externalities that adopts a HPM approach using such a large volume of data. Although this study focuses on sites in England, the results have relevance to other countries with duties to comply with EU Waste Regulations. This study also has international relevance, offering another comparison measurement of the cost of the negative externalities of incinerators, as well as an analysis of whether spatial planning provides a useful option for waste management.

2. The impacts of EfW incinerators on house prices

Compared with research estimating the negative externalities landfill sites, the negative externalities of waste incineration have received less attention. The results of many existing studies that monetise the negative externalities of incineration, such as Kiel and McClain (1995a and 1995b) are based on outdated incinerator technology and hence resulting emissions have

outdated incinerator technology and hence resulting emissions have improved significantly over the intervening period (HPA, 2009). Several other studies (Kohlhase, 1991; Deaton and Hoehnb, 2004; Kiel and Williams, 2007) focus on hazardous waste sites, which, owing to the intrinsic toxic characteristics of the waste are expected to generate stronger negative impacts on local properties relative to municipal and/or industrial waste processing sites. This study focuses entirely on municipal waste sites, which are more common, and as such the impact of the disposal of toxic waste is outside the scope of this paper.

All European empirical studies that investigate the cost of externalities associated with proximity to incinerators focus on UK sites. Pragnell (2003) used the HPM to assess the monetary impact of proximity to 10 UK EfW incinerators. Their results show that incinerators had a negative effect on house prices up to 1.6km from the incinerator. Between 0.4km and 1.6km the impact on house prices declined with increasing distance from the incinerator, eventually reaching zero at 1.7km. The results from Pragnell (2003) must be treated with caution. Firstly, the study only considers housing transactions in the fourth quarter of 2002. This is opposed to Kiel and McClain (1995a and 1995b), who use a continuous time series. Furthermore, the study assumes neighbourhood characteristics are homogeneous across different sites. Thus, the research excludes other factors, such as quality of schools or crime rates, which could affect house prices. Finally, the study uses data from the UK Land Registry transaction dataset. This dataset excludes some critical housing characteristics, such as, number of bedrooms and bathrooms, property and garden size, access to parking and garage, which can explain approximately 60% of price variance (Cambridge Econometrics, 2003).

Havranek *et al*. (2009) focused on an EfW incinerator in Dudley, England. The study used a choice experiment to estimate the impacts of noise, odour, visual intrusion and traffic. The study found that participants had a low Willingness to Pay (WTP) to reduce the impact of the incinerator's disamenities. However, the authors argue that the very small size of the incinerator, the highly industrialised area in which it is sited and the fact that the facility has existed for over 70 years are all factors that might have significantly affected the results of the research. For all these reasons Havranek *et al*. (2009) concludes that the study offers limited inferences for other UK incinerators.

Phillips *et al*. (2014) provides the most recent research on the impact of UK EfW incinerators on property prices. They investigated three existing facilities that began operations between 2000 and 2004, organising data into five 1km radius bands from the centre of each site. The analysis adopted an approach similar to the repeat sales method (OECD, 2013), only considering houses that sold twice during the period: once before the facility was operational and once after. The results show that houses around two of three incinerators (Kirklees and Chineham plants) experienced an increase in price after the facility became operative. Property values within 1.2 km from Marchwood incinerator, the largest and most visually intrusive of the facilities examined by the study, were found to be lower after the facility became operative. However, none of these results were statistically significant (α=0.05). Thus, all three incinerators were found to have no effect on local house prices.

Again, these results must be treated with caution. The repeat sales approach has some limitations. Houses that sell twice during a given period could have some intrinsic characteristics that differentiate them from houses that were only sold once (for instance, for refurbishment), leading to a sample selection bias. Secondly, this technique significantly decreases the number of available observations, thus reducing the robustness of the analysis. The study researched house prices differentials associated with the proximity to an incinerator in the operative phases of the facility, and should not be interpreted as the overall impact of the facility on the local household prices. As demonstrated by Kiel and McClain (1995a), the construction stage, which usually last several years, has a significant impact on property values. Finally, each of the three EfW plants chosen for the study was on the sites of previous incinerators. Although each of these decommissioned facilities had been offline before the planning and construction of the new plant took place, a significant habituation effect (Havranek *et al*., 2009) might have affected the transaction prices and could explain why the study was unable to detect any impacts. Fourthly, as already noted, this study did not control for changes in neighbourhood characteristics and used the Land Registry dataset, which does not include several housing characteristics.

3. Methods

3.1. Site selection

157 Site selection involved the identification of a range of incinerator plants that were
158 representative of overall waste treatment activity in the UK and had suitable characteristics for
159 the implementation of the HPM. Incinerator plants managing municipal solid waste were
160 identified from an initial set of 134 facilities in England and Wales. Facilities located further than
161 0.8km from urban areas were excluded from the analysis as negative externalities are expected
162 only to be observed in close proximity to the source (Kiel and McClain, 1995a; Cambridge
163 Econometrics, 2003). Incinerators that burn waste from their own in-house processes were also
164 excluded. The remaining facilities were screened to exclude all sites with insufficient number of
165 housing transactions over the observed period (Havranek *et al*., 2009; Defra, 2013). Following
166 this filtering process, three incinerator facilities (Table 1 and Figure 1) were selected for
167 analysis.
168
169 **3.2. Data**
170 House price data were obtained from mortgage records between 1983 and 2014 held by Lloyds
171 Banking Group. The database holds records describing the transaction price and property
172 characteristics for over 6 million transactions. These were matched to annual ACORN (A
173 Classification Of Residential Neighbourhoods) geo-demographic segmentation records of the
174 UK population (CACI, 2006). To ensure the negative externalities of the incinerator were
175 quantified accurately, only houses within an 8km radius from the plant were included in line
176 with Kiel and Mclain (1995a) and Cambridge Econometrics (2003). House selection was plotted
177 within a Geographical Information System (GIS) environment (ArcGIS version 9.3; ESRI Inc.).

178 Selected transactions were divided into incinerator planning, construction and operational
179 phases (Table 1) to assess the negative externalities within each of these phases.
180
181 ### 3.3. Analytical framework
182
183 HPM models generally focus on five main house descriptors as defined by Malpezzi (2003): (i)
184 geographical location; (ii) neighbourhood characteristics; (iii) property structural characteristics;
185 (iv) contract arrangements and additional conditions affecting price; and (v) the date of the
186 transaction.
187
188 The basic statistical approach to HPM is a simple linear regression model (Eq. 1).
189
190 $$P = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon \quad \text{Eq. 1}$$
191
192 where ***P*** is the dependent variable price (i.e. house price), $\boldsymbol{X_i}$ are a set of independent variables
193 describing the price (e.g. house and incinerator characteristic), ***n*** is the total number of model
194 parameters, $\boldsymbol{\beta}$ are the regression coefficients and **ε** is the error term.
195
196 More complex but common functional forms for hedonic regression are nonlinear models such
197 as semi-log and log-log. Here, we used a log-linear based HP model as described by Eq. 2.
198
199 $$Log(P) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon \quad \text{Eq. 2}$$

The functional form was selected after comparing the objective functions of linear, log-linear, Box-Cox and quadratic models. For each site, models were independently fitted for the overall data set as well as for each of the construction phases beforehand mentioned. Within each phase, four regression models were fitted to test the negative externalities between 0-2km, 2-4km, 4-6km and 6-8km from the incinerator. All models were fitted using Ordinary Least Squares. To ease comparison between sites and ensure analytical consistency, all models were fitted with the same initial list of independent variables (Table 2). The validity of the model assumptions (i.e. multicolinearity, residual normality and homocedasticity) as well as presence of specification errors was checked via residual analysis.

The monetary impact (***I***) of incinerators on house prices per 100m distance from incinerator was quantified as follows:

$$I = \bar{P}_{2013} * \beta_d * 100 \qquad \text{Eq. 3}$$

where $\bar{P}_{2013}$ is the mean house price (2013 constant prices) calculated using the UK historic Consumer Price Index (CPI) data (ONS, 2014) and β_d is the regression coefficient for variable "distance to EfW" (D_EfW in Table 2).

3.4. Results

3.4.1 Newhaven

Newhaven is the model with the smallest sample of transactions (2,958), which might impact the overall reliability of the results of this particular model. The results indicate that during the planning and construction phase all the statistically significant coefficients were positively signed, suggesting that the incinerator had a positive impact on house prices (Table 3). Once the EfW incinerator became operational the model suggests there were negative impacts on the price of houses at 2-4km from the site, but positive impacts on houses at 6-8km. Houses in the 2-4km zone appear to be the only houses affected by negative impacts where the incinerator reduced house prices by an average of £2,277 per house.

3.4.2 Allington

The model results for Allington (Table 4) suggests that proximity to the incinerator had a negative impact on local house prices. During the planning phase there were negative impacts at 2-4km and 4-6km during construction there were negative impacts at 4-6km and 6-8km. Once operational there was a negative impact only at 6-8km. According to the literature, the strongest effect should be expected in close proximity to the incinerator. However, the nearest residential area is at least 380m from the incinerator. Hence the number of observations in the 0-2km model is significantly lower than the other zones. In monetary terms the negative impacts during the planning phase at 2-4km and 4-6km were on average £14,866 (the largest negative effect detected in this study) and £589 per house respectively, while the impacts at

construction at 4-6km and 6-8km were £562 and £1,405 per house respectively. Once operational the impact at 6-8km was £836 per house.

3.4.3 Marchwood

In all significant results (p-value<0.05) in the planning stages (Table 5), proximity to Marchwood EfW enhanced property prices, albeit by a relatively small margin. Furthermore, in the construction phase there was a slight increase in house price at a distance of 2-4km. However, model coefficients show that once operational the EfW site had a negative impact house prices at 0-2km of £2,422 per house.

3.4.4 Collected results and aggregate impacts

Table 6 shows that the incinerator at Allington had the largest and most consistent negative effect through the three stages of incinerator development and operation. The Newhaven and Marchwood models have a broadly similar negative effect per house. Table 6 aggregates the impact on price per house over the number of observed transactions to gauge the total impact of the incinerator. The negative impact (externalities) of the Allington incinerator aggregates to £22,651,116. This is followed by the Marchwood incinerator at £995,442 then the Newhaven incinerator with a negative impact of £195,822.

4 Discussion

With the exception of Allington the results show a number of significant positive coefficients, which suggests the planning, construction and/or operation of the incinerator increased the

value of houses within a specified distance of incinerators. There is nothing in our models that can explain why house prices would increase as a result of the construction of an incinerator. We can hypothesise that the increase in house prices could be associated with there being less impact than local people expected. Thus the housing market response is positive after construction or operation begins. However, it may also be possible that there are some explanatory variables missing from the models, such as impact on employment.

Phillips *et al*. (2014) also found that three UK incinerators had no significant impact on local house prices. The results from this current study in-part are supportive of Phillips *et al*. (2014), although some statistically significant negative impacts were also detected. This may indicate that the impacts of local incinerators on house prices are not necessarily negative under certain conditions, counter to much previous literature. However, it is unclear what conditions support positive, neutral or negative impacts. This is a current gap in the literature and provides a fruitful area of future research. Given that there is nothing in our models to account for positive impacts, henceforward we will only deal with the significant negative impacts.

The models of Allington, Newhaven and Marchwood show evidence of negative impacts from the incinerators. However, there is little commonality across the results, which may be because of the geographic differences between each incinerator and its surrounding area. All three incinerators have been built on brownfield sites, but with different previous uses:

- The Newhaven site is built in an industrial area on the banks of the tidal estuary of the River Ouse, over land formerly used as railway maintenance yard.
- The Marchwood incinerator is sited in an industrial area on the banks of Southampton Water, a tidal estuary characterised by areas of both residential and industrial development. In the proximity of the facility an incinerator was closed nine years before the current plant went online, but used as a waste transfer station for further ten years (Hampshire County Council, 2006) and demolished in 2012, further six years later (New Forest District Council, 2012).
- The Allington site was previously a stone quarry, with the incinerator being built within the quarry site and as such is mostly invisible from any residential structure. There is also a small industrial area, a reservoir and agricultural land in the proximity of the facility

The highest per house impact is found in Allington and aggregated over all transactions provides the largest negative impact from the three incinerators (Table 6). It is worth noting that the closest house to the incinerator at Allington is 380m distant, which may have mitigated some of the largest impacts. Allington is the only site selected which was not the site of a previous waste management facility.

The Marchwood incinerator had the second largest impact on local house prices. Marchwood has been the site of a previous waste management facility and some habituation effect is to be expected. Marchwood also has a series of other potential sources of current nuisance. It is host

to a large military port (built in 1943), a sewage treatment work (established in the 1960s), and a natural gas power station (established in 2009 and replacing a former power station from the 1960s) (New Forest District Council, 2004; Marchwood Power Limited, 2014). The sewage treatment works, whose odour emissions are a major complaint of local residents (Marchwood Parish Council, 2012) might have an important role in hiding any negative externalities caused by the incinerator. Given this range of potential nuisance sources it is notable that the incinerator still had an additional negative effect.

The Newhaven incinerator had the third largest impact per house, although it was very similar to the per house impact at Marchwood. Newhaven also had the third highest aggregate impact, although there was a relatively small sample of transactions. The negative value is in line with the opposition shown by local residents to the incinerator. Newhaven has 12,000 residents, yet there were more than 16,000 objections to the development of the incinerator (van der Zee and Jones, 2012).

It is useful to compare the results with the literature. In terms of studies that have estimated the negative impacts of incinerators, Pragnell (2003) found that in postcode sectors containing EfW incinerators average house prices are 18 percent lower than house prices at 2.8km from EfW sites. The results in this study show that the impacts are much lower than suggested by Pragnell (2003), although our model suggests that prices decreased in Allington by 10% in the planning phase at 2-4km), but greater than those estimated by Havranek *et al*. (2009), who found that households were willing to pay £3.69 for a 50% reduction in incinerator chimney

size, £2.12 for a 50% reduction in odour, £5.86 for a 50% reduction in traffic. Phillips *et al*. (2014) reported that the Marchwood EfW plant had no statistically significant impact on house prices within 5km of the incinerator, whereas this current study found that the Marchwood incinerator had reduced the average house price within 2km of the incinerator by 1.3%.

The figures from Table 6 are generally (with the exception of Allington) within the estimated costs of negative externalities of landfill sites. Cambridge Econometrics (2003) found that on average, across the UK, operational landfills reduce the price of houses within 0.25 miles by approximately £5,500 and about £1,600 for those between 0.25 and 0.5 miles. It is notable that the impact of incinerators is detected at a greater range than that suggested by Cambridge Econometrics (2003) and in line with other literature looking at the disamenties of incinerators.

The study by Cambridge Econometrics (2003) treated the impacts of landfill on the surrounding area as 'stock disamenities', meaning that these impacts occur from the very existence of the landfill and are independent of the size or type of waste facility. The results of this current study suggests that the impacts of incinerator vary by site, so the use of stock disamenity as an indicator of impact may be less useful for the analysis of the impacts of incinerators than it is for landfill.

UK planning regulations require incinerators to be sited near the source of waste, but also in a location that minimises the impacts of negative externalities. The incinerators studied were on brownfield sites, which are perceived to have lower impacts than incinerators on virgin sites.

The results show that despite this careful siting, there is a still a detectable impact in the operational phase of the incinerator. In Marchwood there is an impact in the immediate vicinity of the incinerator, despite the fact that there is likely to be a habituation effect from an older incinerator. The impacts at Newhaven were experienced at 2-4km from the incinerator and even further out at Allington (6-8km). For Allington there are very few houses to impact upon within 2-4km. The largest negative effect is experienced at 6-8km; again we can speculate that this may because negative impacts were unanticipated at this distance. In Newhaven the impact was again beyond the 0-2km range, suggesting that similarly to Allington, the impact of the incinerator has been largely mitigated at close proximity, but there have been unanticipated impacts further away.

Therefore, the findings broadly support the hypothesis that careful siting of incinerators minimises the social impacts (as indicated by house price changes), based on the evidence that (apart from Marchwood) there were no impacts in the immediate vicinity of the incinerator. However, it appears that there is a need for extra measures in terms of minimising nuisance beyond the immediate proximity (0-2km) of the incinerator. It should be noted that the largest effect was experienced in the planning phase of the Allington incinerator. Section 1 highlighted that there are usually large protests when a new incinerator is planned. As Allington had no previous history of waste management it can be speculated that residents had serious concerns about the potential impacts of the incinerator in the planning phase.

373 It should be noted that this study did not analyse the benefits of waste incineration, nor did it
374 assess the negative impacts of alternative sites that could have been used for the four
375 incinerators considered. In this way we have valued negative externalities, rather than
376 determine the net social costs of these incinerators.
377
378 The results of this study should be treated with caution. For instance, there is no consideration
379 of prevailing wind in these models, nor surface features. Many of the impacts associated with
380 incinerators depend on wind direction and also whether any natural barriers, such as
381 woodlands or mountains separate source and receptor. This may have played a part in our
382 results. It is possible for an incinerator to be in close proximity to dwellings, but have low
383 impact because of prevailing wind and intervening geographic features (such as hills). Indeed,
384 to our knowledge, the impact of geographical features and meteorological conditions has not
385 been considered. This is grounds for further research.
386
387 **Conclusions**
388 This paper uses the Hedonic Pricing Method, utilising 55,000 transactions over a 20 year period
389 to quantify the impact of four EfW incinerators in England, which have been sited on previously
390 industrialised land. Broadly the results show inconsistent impacts across the stage of
391 development (planning, construction or operation) and distance from incinerator. In this way
392 the impacts of incineration appear to be different from those of landfill, which is often treated
393 as a stock disamenity (Cambridge Econometrics, 2003), so that individual analysis of
394 incinerators should be undertaken individually rather than aggregated.

The results show a number of significant positive coefficients, which suggests some incinerators have increased the value of houses within a specified distance. There is nothing in our models that can explain why house prices would increase as a result of the construction of an incinerator and so this study focuses on the significant negative impact. The cause of the positive coefficients was hypothesised to be where impacts were less severe than expected, causing prices to increase. This represents grounds for further research.

Each of the incinerators studied was sited in previously industrialised land to minimise the impact on local residents. To an extent this was achieved. In two out of the three incinerators there were no significant negative impacts detected within 2km of the incinerator. This suggests that careful siting of incinerators reduced the impact on residents. However, negative impacts occurred in areas further afield, suggesting more can be done to minimise the impacts of incinerators. At the Marchwood incinerator there was a significant negative impact within 2km of the incinerator, despite this area previously hosting a now defunct incinerator. The largest negative impact was in the planning phase of the Allington incinerator, where the land was previously used for quarrying, unconnected to municipal waste management. It appears that the perceived impacts of an incinerator negatively impacted local property prices.

Once operational, the impact of the incinerators studied ranged from approximately 0.4% of the mean house price to 1.3%. These estimates fall in between the highest and lowest estimates from the literature. The highest impact (of an operational incinerator) per house is at

Marchwood (1.3% of the mean 2013 house price for the area). However, this differs from the results of Phillips *et al*. (2014), who using the repeated sales method found the incinerator had no significant negative impact on nearby households. Although the impact is a small proportion of total house sale value, the total negative impact of incinerators on their local communities to date have been estimated as £22,651,116 for Allington followed by the Marchwood incinerator at £995,442 then the Newhaven incinerator with a negative impact of £195,822.

The study of the economic impacts of waste management disamentities could be better understood by including environmental factors, such as local topography and prevailing wind direction. We also hypothesise that expected impacts relative to actual impacts could have a large influence on the results of a hedonic pricing study of incinerators.

Acknowledgements

We would like to thank Nitesh Patel at Lloyds Banking Group for kindly providing the data for this study and the Cranfield University IT service Unit for facilitating safe transfer and storage of the data following Information Commissioners Office's code of practice. We would also like to thank Phil Longhurst at Cranfield University for his helpful comments on the development of this paper.

References

BBC, 2012. Protest over Gloucester waste incinerator scheme. h[redacted]
[redacted](accessed 19/4/2015).

BBC, 2013. Barnfield incinerator public inquiry opens to protests [redacted] (accessed 19/4/2015).

BBC, 2015. Javelin Park waste incinerator: Hundreds attend protest march. [redacted] (accessed 19/4/2015).

CACI, 2006. The ACORN User Guide. [redacted] (accessed 19/4/2015).

Cambridge Econometrics, 2003. A study to estimate the disamenity costs of landfill in Great Britain. http://webarchive.nationalarchives.gov.uk/20130402151656/http:/archive.defra.gov.uk/environment/waste/strategy/legislation/landfill/documents/landfill_disamenity.pdf (accessed 19/4/2015).

COWI, 2000. A Study on the Economic Valuation of Environmental Externalities from Landfill Disposal and Incineration of Waste [redacted] (accessed 19/4/2015).

DCLG, 2015. Planning Policy Statement 10: Planning for Sustainable Waste Management. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/11443/1876202.pdf (accessed 19/4/2015).

Deaton, B., Hoehnb, J., 2004. Hedonic analysis of hazardous waste sites in the presence of other urban disamenities. Environ. Sci. Policy. 7 (6), 499-508.

Defra, 2013. Incineration of municipal solid waste.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221036/pb13889-incineration-municipal-waste.pdf (accessed 19/4/2016).

Defra, 2014. Energy from waste: A guide to the debate. HMSO, UK. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/284612/pb14130-energy-waste-201402.pdf (accessed 19/4/2015).

Eshet, T., Ayalon, O., Shechter, M., 2005. A critical review of economic valuation studies of externalities from incineration and landfilling. Waste Manage. Res. 23 (6), 487-504.

European Union, 2008. DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on waste and repealing certain Directives. [redacted] (accessed 19/4/2015).

Hampshire County Council, 2006. Minerals and waste sites in Hampshire 2003/2004. http://www3.hants.gov.uk/lpar_03-04_appendix_2.pdf (accessed 19/4/2015).

Havranek, M., Liston, S., Rabl, A., Scasny, M., Taylor, T., Walton, H., Xingshu, Z., Zoughaib, A., 2009. Final report on waste management externalities in EU25 and report on disamenity impacts in the UK. [redacted] (accessed 19/4/2015).

HPA, 2009. The Impact on Health of Emissions to Air from Municipal Waste Incinerators. [redacted] (accessed 19/4/2015).

Kiel, K., McClain, K., 1995a. House prices during siting decision stages: the case of an incinerator from rumor through operation. J. Environ. Econ. Manage. 28 (2), 241-255.

Kiel, K., McClain, K., 1995b. The Effect of an Incinerator Siting on Housing Appreciation Rates. J. Urban Econ. 37 (3), 311-323.

Kiel, K., Williams, M., 2007. The impact of Superfund sites on local property values: Are all sites the same? J. Urban Econ. 61 (1), 170-192.

Kohlhase, J., 1991. The impact of toxic waste sites on housing values. J. Urban Econ. 30 (1), 1-26.

Lancaster, K., 1966. A new approach to consumer theory. J. Polit. Econ. 74 (2), 132-157.

Malpezzi, S., 2003. Hedonic pricing models: a selective and applied review, in: O'Sullivan T., Gibb T., (Eds.), Housing Economics and Public Policy. Blackwell Science Ltd., London, pp. 67-89.

Marchwood Parish Council., 2012. Community Plan consultation responses. [redacted] (accessed 19/4/2015).

Marchwood Power Limited, 2014. Welcome to Marchwood Power. [redacted] (accessed 19/4/2015).

New Forest District Council, 2004. New Forest District Coastal Management Plan. http://www.newforest.gov.uk/media/adobe/1/1/CMPPartC11Zone11.pdf (accessed 19/4/2015).

New Forest District Council, 2012. Hampshire County Council. http://www3.hants.gov.uk/new_forest.pdf (accessed 19/4/2015).

OECD (2013). Repeat Sales Methods, in OECD, Handbook on Residential Property Price Indices. http://dx.doi.org/10.1787/9789264197183-8-en (accessed 19/4/2015).

505 ONS (2015). Consumer Price Indices. Available at:
506 http://ons.gov.uk/ons/taxonomy/index.html?nscl=Consumer+Price+Indices (accessed
507 19/4/2015).
508 Phillips, K., Longhurst, P., Wagland, S., (2014). Assessing the perception and reality of
509 arguments against thermal waste treatment plants in terms of property prices. Waste
510 Manage. 34 (1), 219–225.
511 Pragnell, M., 2003. The Economic Impact of an EfW Incinerator in Newhaven.
512 [redacted](accessed
513 19/4/2016).
514 Rabl, A., Spadaro, J., Zoughaib, A., 2008. Environmental Impacts and Costs of Solid Waste: A
515 Comparison of Landfill and Incineration. Waste Manage. Res. 26 (2), 147-162.
516 UKWIN, 2015. Table of Potential, Existing and Prevented Incinerators
517 [redacted](accessed 19/4/2016).
518 Van der Zee, B., Jones, G., 2012. This is the end for Newheaven'- controversial incinerator fires
519 up. The Guardian. 5th July.
520 [redacted]
521 (accessed 19/4/2016)
522

523 Tables

524

525 **Table 1. Summary description of the four incinerator facilities selected to assess the impact of negative externalities on**
526 **house prices. Permitted capacity (tn) and tonnage incinerated correspond to values obtained for 2012. AT, MW and NH stand**
527 **for Allington, Marchwood and Newhaven, respectively.**

Incinerator	Permitted capacity	Tonnage incinerated	Phase			Previous land use	Location
			Planning	Construction	Operational		
AT	500,000	419,402	1996-2002	2003-2008	2008-2014	Quarry	Maidstone
MW	210,000	206,700	1995-2001	2002-2004	2004-2014	Incinerator and industrial	Southampton
NV	240,000	224,730	2001-2007	2008-2011	2011-2014	Rail maintenance yard and brownfield	East Sussex

528

529 **Table 2. Independent variables considered for inclusion in the Hedonic Pricing Model. Variables have been grouped into five**

530 **categories based on Malpezzi (2003).**

Category	Variable	Description
Dependent Variable	Transaction price	Transaction price in £
Transaction time	Transaction date	Date when the transaction took place
	Pre 1919	Household sold before 1919 (dummy variable yes/no)
	1919-1945	Household sold between 1919 and 1945 (dummy variable yes/no)
	1945-1960	Household sold between 1945 and 196- (dummy variable yes/no)
	1960+	House sold after 1960 (dummy variable yes/no)
	Year#	Dummy variables for each year there are existing records of houses being sold
Contract arrangement	Tenure	Freehold or leasehold
Property structural characteristics	NW	New household (dummy variable yes/no)
	FT	Flat (dummy variable yes/no)
	BLW	Bungalow (dummy variable yes/no)
	DTC	Detached property (dummy variable yes/no)
	SDTC	Semi-detached property (dummy variable yes/no)
	TRC	Terraced property (dummy variable yes/no)
	LIV	Number of livingrooms
	BED	Number of bedrooms
	BTH	Number of bathrooms
	TLT	Number of toilets
	FCH	Full central heating (dummy variable (yes/no)
	PCH	Partial central heating (dummy variable yes/no)
	NCH	No central heating installed (dummy variable yes/no)

	NG	Number of garages
	NGS	The number of garage spaces
	GR	Garden (dummy yes/no).
	RCH	Road charge liable (dummy variable yes/no)
Neighbourhood characteristics	A	Property is in Acorn zone A- wealthy investors (dummy variable yes/no).
	B	Property is in Acorn zone B -prospering families (dummy variable yes/no).
	C	Property is in Acorn zone C - traditional money (dummy variable yes/no).
	D	Property is in Acorn zone - young urbanites (dummy variable yes/no).
	E, F, G	Property is in Acorn zone E/F/G - middle-aged families (comfortable), contented pensioners and families and individuals looking to settle down. Middle aged comfort €, contented pensioners (F) and settling down (G) (dummy variable yes/no).
	H	Property is in Acorn zone H - moderate living (dummy variable yes/no)
	I, K	Property is in Acorn zone I/K - meagre means and impoverished pensioners (dummy variable yes/no).
	J	Property is in Acorn zone J - inner city existence (low income singles and couples, multi ethnic young singles renting flats, high rise poverty dependent on welfare and poor young financially inactive (dummy variable yes/no).
Location within the market	House location	Postcode

Spatial	D_EfW	Linear distance to the incinerator

531

Table 3. Results obtained for the Hedonic Pricing Method (Lancaster *et al.*, 1996) for the case study area of Newhaven. I is the monetary impact of the incinerator on house prices estimated as in Eq. 3. (*) indicates statistically significant coefficients (p-value <0.05). $\overline{P}_{2013}$ is the mean house price in 2013 calculated using historic Consumer Price Index data (ONS, 2014). β_d is the regression coefficient as described in Eq. 3 and N is the number of records included in the regression model. The F-test for the overall model was statistically significant (p-value<0.05).

Phase	Distance (km)	N	β_d	$\overline{P}_{2013}$	*I*
Planning	0-2km	380	0.000062*	210247	1304
	2-4km	532	0.000021		
	4-6km	922	0.000035*	258307	904
	6-8km	352	0.00018*	392859	7071
Construction	0-2km	84	0.000098		
	2-4km	139	-0.000467		
	4-6km	191	0.000023		
	6-8km	54	0.000463*	336291	15570
Operational	0-2km	78	0.000045		
	2-4km	86	-0.000099*	230050	-2277
	4-6km	115	0.00004		
	6-8km	25	0.000221*	288800	6382

Table 4. Results obtained for the Hedonic Pricing Method (Lancaster *et al.*, 1996) for the case study area of Allington. I is the monetary impact of the incinerator on house prices estimated as in Eq. 3. (*) indicates statistically significant coefficients (p-value <0.05). $\overline{P}_{2013}$ is the mean house price in 2013 calculated using historic Consumer Price Index data (ONS, 2014). β_d is the regression coefficient as described in Eq. 3 and N is the number of records included in the regression model. The F-test for the overall model was statistically significant (p-value<0.05).

Phase	Distance (km)	N	β_d	$\overline{P}_{2013}$	*I*
Planning	0-2km	324	0.00001		
	2-4km	1162	-0.00101*	147190	-14866
	4-6km	1437	-0.00004*	147190	-589
	6-8km	1528	-0.00001		
Construction	0-2km	453	0		
	2-4km	2018	0.00001		
	4-6km	1915	-0.00002*	281088	-562
	6-8km	2089	-0.00005*	281088	-1405
Operational	0-2km	109	0.00003		
	2-4km	576	0.00001		
	4-6km	556	-0.00001		
	6-8km	621	-0.00004*	208876	-836

Table 5. Results obtained for the Hedonic Pricing Method (Lancaster *et al.*, 1996) for the case study area of Marchwood. I is the monetary impact of the incinerator on house prices estimated as in Eq. 3. (*) indicates statistically significant coefficients (p-value <0.05). $\bar{P}_{2013}$ is the mean house price in 2013 calculated using historic Cobsumer Price Index data (ONS, 2014). β_d is the regression coefficient as described in Eq. 3 and N is the number of records included in the regression model. The F-test for the overall model was statistically significant (p-value<0.05)

Phase	Distance (km)	N	β_d	$\bar{P}_{2013}$	*I*551
Planning	0-2km	327	0.000129*	98450	1270
	2-4km	1238	0		
	4-6km	2359	-0.00001		
	6-8km	135	0.00003*	106966	321
Construction	0-2km	148	-0.00004		
	2-4km	657	0.000052*	200254	1041
	4-6km	1040	-0.00001		
	6-8km	613	0.00001		
Operational	0-2km	411	-0.000133*	182141	-2422
	2-4km	1927	0.00001		
	4-6km	2992	0		
	6-8km	1843	0.000016		

552

553

554 **Table 6. Total monetary impact per incinerator. N stands for the number of transactions included in the overall Hedonic**

555 **Pricing Model.**

Phase	Distance (km)	Average economic impact per house (£)			N	Total impact on house prices(£)	Percentage of mean house price
		Newhaven	Allington	Marchwood			

							(%)
Planning	2-4km	N/A	-14866	N/A	1162	-17,274,513	10
	4-6km	N/A	-589	N/A	1437	-846,393	0.4
Construction	4-6km	N/A	-562	N/A	1915	-1,076,239	0.2
	6-8km	N/A	-1405	N/A	2089	-2,935,045	0.5
Operational	0-2km	N/A	N/A	-2422	411	-995,442	1.3
	2-4km	-2277	N/A	N/A	86	-195,822	1
	6-8km	N/A	-836	N/A	621	-519,156	0.4

556

557

Figures

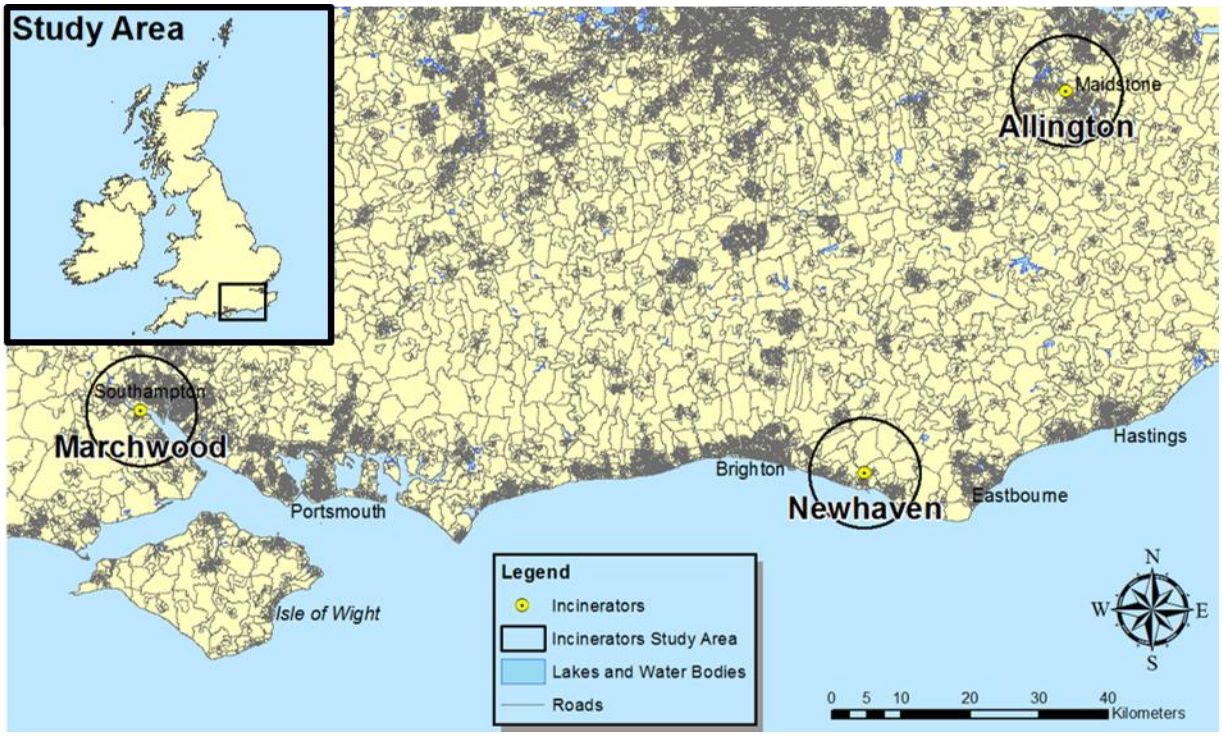
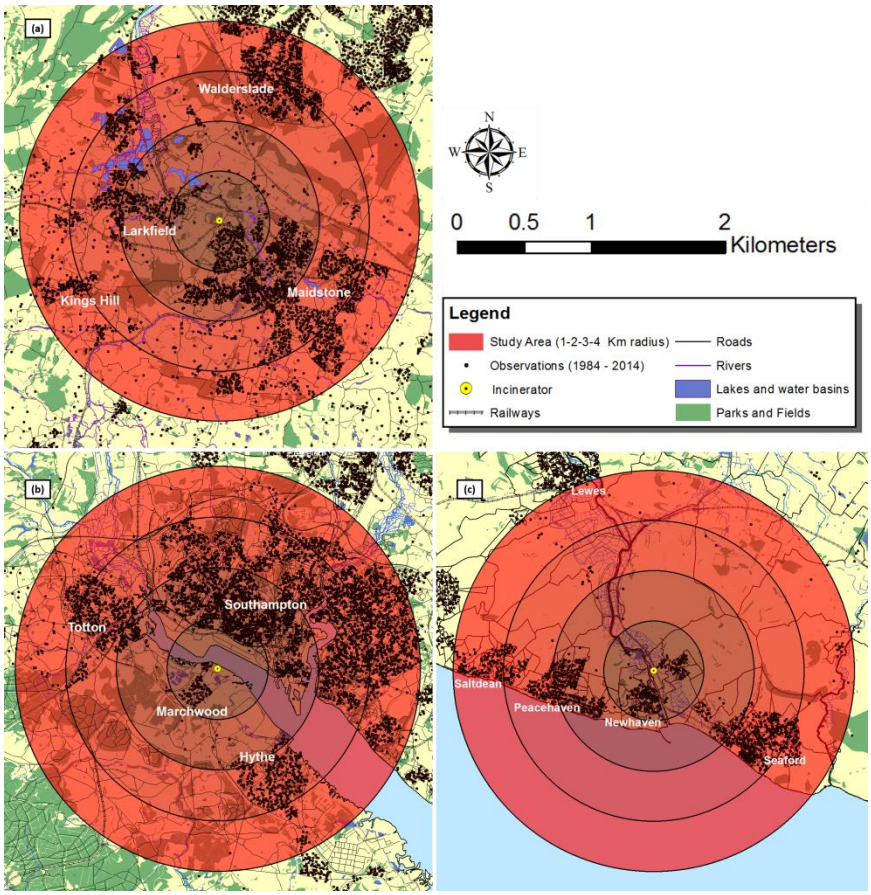


Figure 1: study areas selected for analysis.



561

562

Figure 2: Detailed map showing the houses selected for analysis falling within a 2km, 4km, 6km and 8km radius for the sites at (a) Allington, (c) Marchwood and (d) Newhaven.


GEMS