3. Alternatives

3.1 Introduction

This chapter provides a description of the reasonable alternatives studied by Indaver, which are relevant to the Ringaskiddy Resource Recovery Centre proposal and its specific characteristics, and an indication of the main reasons for the option chosen, including a comparison of environmental effects.

This chapter focuses on the site selection process and the main alternative waste management options and technologies considered with particular reference to best available techniques.

3.2 Methodology

3.2.1 Background

In relation to Alternatives, Annex 5(1) of Directive 2011/92/EU stated that an EIS must contain:

> *"an outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects".*

The 2014 amendment to the EIA Directive (Directive 2014/52/EU) also requires that the developer provides:

> "*a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

This chapter addresses both requirements, by outlining the main alternative sites, alternative technologies and alternative coastal and flood protection designs studied by Indaver. It also provided an indication of the main reasons for Indaver's choice, taking into account the environmental effects. Regard is had to project design, technology, location size and scale, the main reasons for selecting the chosen option, and having regard to reasonable alternatives, potential environmental effects are considered and compared.

3.2.2 Guidance

Regard has been given to the following guidance in the preparation of this chapter.

- European Commission (2017) Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report;
- Environmental Protection Agency (2022) Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Department of Housing, Planning, Community and Local Government (2017) Key Issues Consultation Paper on the Transposition of 2014 EIA Directive (2014/52/EU) in the Land Use Planning and EPA Licencing Systems.;
- Department of Housing, Planning, Community and Local Government (2017) Circular PL 1/2017 - Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive): Advice on the Administrative Provisions in Advance of Transposition;
- Department of Housing, Planning and Local Government (2018) Circular PL 05/2018 -Transposition into Planning Law of Directive 2014/52/EU amending Directive 2011/92/EU on the effects of certain public and private projects on the environment (the EIA Directive) and Revised Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment; and
- Government of Ireland (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).

3.2.3 Reasonable Alternatives and Environmental Considerations

The European Commission guidance (2017) notes that

> *"Reasonable Alternatives must be relevant to the proposed Project and its specific characteristics, and resources should only be spent assessing these Alternatives. In addition, the selection of Alternatives is limited in terms of feasibility. On the one hand, an Alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an Alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible Alternative…. Ultimately, Alternatives have to be able to accomplish the objectives of the Project in a satisfactory manner, and should also be feasible in terms of technical, economic, political and other relevant criteria."*

The same guidance also states that:

> *"The feasibility of the Alternatives proposed can be determined on a case-by-case basis. The final set of reasonable Alternatives identified will then undergo a detailed description and assessment in the EIA Report…. It should be noted that each Project and each EIA is different, and there can be no definitive list prescribing how Alternatives are to be identified and assessed… .In some cases, Alternatives will have been developed at the plan stage (e.g. a plan for the transport sector, a regional development plan, or a spatial plan) or by the Developer during the Project's initial design. In such cases, some Alternatives may have already been excluded, in which case, it would likely be unnecessary to consider them again".*

The EPA guidance (2022) notes the following in relation to the consideration of alternatives:

> *"The objective is for the developer to present a representative range of the practicable alternatives considered. The alternatives should be described with 'an indication of the main reasons for selecting the chosen option'. It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."*

3.3 Alternative Site Locations

3.3.1 Introduction and Background

This section examines alternative locations which may be regarded as "*reasonable*" to the existing site for the proposed development. In considering what may constitute as a "*reasonable alternative location*" in order to meet the current EIA legislation, it is important to first consider the history of the site selection process, and the site suitability assessments carried out by Indaver since 1999 and up to 2016 when Indaver launched a planning application for the current proposal for the site in Ringaskiddy. This history is set out below.

In summary, a site selection study was carried out during 1999-2000. The site selection criteria at the time also included an analysis of environmental factors. This study was carried out in three phases.

Initially, a preliminary investigation (Phase 1) of five areas around Cork Harbour (Ringaskiddy, Little Island, Carrigtwohill, Whitegate and Carrigaline) was carried out. The conclusion of that phase was that Ringaskiddy was the most suitable location for the development of a waste to energy facility.

Following this, it was decided to also assess five further possible areas in other parts of Cork County (Phase 2). These sites were Ballincollig, Macroom, Mallow, Mitchelstown and Charleville. The conclusion of that phase was that Ringaskiddy was the most suitable location for the development of a waste to energy facility.

Phase 3 considered four specific sites within Ringaskiddy. These sites would have been considered to be "*reasonable alternative*" locations at that time. A number of technical and social criteria were used to compare each site which included consideration of environmental factors such as landscape and visual, sensitive receptors, ecology etc. These criteria informed the decision-making process. Two of these were selected in early 2000 as preferred sites. One of these sites (Site 1) became available through a public auction in November 2000 and was purchased by Indaver. This is the site for the current proposed development. It is located at the eastern end of the Ringaskiddy Peninsula, surrounding the Hammond Lane Metal Co premises.

In 2015, the suitability of the Indaver owned site in Ringaskiddy for the development of a waste to energy facility was assessed. Indaver was aware at the time that changes may have occurred on the site or in its general vicinity. Further, Indaver was aware that the generally accepted technical requirements for a site for such a facility may also have changed. Consequently in 2015, Indaver commissioned Arup to undertake a technical review of the site and surroundings. Coakley O'Neill were commissioned to undertake an evaluation of the Indaver owned site in Ringaskiddy site with respect to planning policies at that time also. The conclusion of the 2015 site suitability assessment was that the Indaver-owned site was still suitable for the development of a waste to energy facility.

In 2015, Indaver reviewed the status of the sites considered during the 1999-2000 study (Phases 1,2 and 3). Environmental factors were considered in that assessment also. The conclusion of that review in 2015 was that Ringaskiddy was still the preferred location for the proposed development. In 2015, Indaver also considered other sites in Cork. Bottlehill, Kilbarry and Gortadroma. The conclusion of that assessment was that the Indaver owned Ringaskiddy site was still the preferred site.

As part of an application to the Environmental Protection Agency for an Industrial Emissions Licence for the proposed development in 2019, the assessment was completed again and concluded that the Indaver-owned site in Ringaskiddy was still the preferred site.

This assessment has been updated as part of this EIS and is presented in **Section 3.3.2** below.

3.3.2 Assessment of Alternative Locations

A full review of the 2019 assessment was completed in 2025 under the headings outlined below.

3.3.2.1 National and Regional Context

The evaluation of alternatives to the site was first commenced from a national perspective in order to review alternative areas nationally for the proposed development. To this end, the National Waste Management Plan for a Circular Economy 2024 - 2030 (NWMP), was reviewed in the first instance. The Plan provides the framework for the prevention and management of waste in an environmentally safe and sustainable manner and informs waste planning for each constituent region in Ireland.

The NWMP identifies the national requirement for 300,000 tonnes of thermal recovery capacity for the treatment of residual municipal waste. In terms of the management of hazardous waste capable of being treated by the proposed facility, the Plans also supports the development of additional capacity for the treatment of hazardous waste in accordance with the National Hazardous Waste Management Plan to ensure there is adequate active treatment capacity.

The National Hazardous Waste Management Plan (NHWMP) 2021-2027 also highlights the need for increased self-sufficiency in the management of hazardous waste and the need to minimise hazardous waste export.

Presently, existing thermal treatment facilities are located predominantly in the Eastern Midlands region. Two waste to energy facilities are located in this region in Dublin and Meath, as are cement facilities which are located in Kinnegad and Platin. One cement plant is located in the Connacht-Ulster Region. A further cement facility is located in the Southern region in Mungret, County Limerick.

However, no dedicated waste to energy recovery capacity currently exists in the Southern region (only 2% of consented national thermal recovery capacity is located in the Southern Waste Region despite it representing 33% of the national population).

Dedicated waste-to-energy plants are designed to primarily treat residual MSW, run continuously, and are a stable and reliable form of waste treatment. During the COVID-19 pandemic restrictions on construction activity negatively impacted cement plant operations in Ireland resulting in reduced treatment capacity which caused waste supply chain disruption. By prioritising dedicated thermal treatment plants, it reduces reliance on vulnerable waste treatment options such as co-processing at cement kilns which is linked to demand for a manufactured product and exposed to potential shocks to the market.

As shown in **Table 3.1** below, CSO figures showed that it had the largest population outside the Eastern midlands region. In addition, no other dedicated hazardous waste recovery capacity exists or is otherwise proposed in the Southern Region.

Table 3.1 Population Figures by Waste Region (CSO 2022)

Waste region	Population
Eastern Midlands	2,540,307
Southern	1,703,393
Connaught-Ulster	905,439
Total	**5,149,439**

Figure 3.1 of Volume 3 *Figures* of this EIS illustrates this regional spatial imbalance in clear terms. The distribution of facilities reflects a Regionally unbalanced distribution of facilities in the national context, as currently the Southern region does not have any dedicated waste to energy recovery capacity and only has limited thermal capacity in a cement kiln.

The National Waste Management Plan (NWMP) also specifically highlights that the Eastern-Midlands Region is the only region in the country to have dedicated thermal recovery treatment available at two waste-to-energy facilities, with a total of 4 active facilities authorised and a further 65,000 tonnes of MSW capacity pending.

Moreover, the National Planning Framework (NPF) set out that securing balanced regional development by maximising the potential of the regions and supporting proper planning and sustainable development as a key objective of this statutory national planning policy document.

The NPF's National Strategic Outcome 9 – Sustainable Management of Water and other Environmental Resources, expressly provides that in terms of planning for waste treatment requirements to 2040, this will require:

'Waste to energy facilities which treat the residual waste that cannot be recycled in a sustainable way delivering benefits such as electricity and heat production'.

With the foregoing in mind and in terms of considering whether there are any "*reasonable alternative areas*" nationally for the development of the proposed waste to energy facility, the Southern Region appears to be the most appropriate when alternatives are considered on a national scale. This selection would address the regional imbalance in thermal recovery capacity that currently exists in the Southern Region. This also adheres to stated policy positions at European and national level as the location of the proposed development in the Southern Region would accord with the principles of proximity and self-sufficiency as laid down in the Waste Framework Directive (WFD).

This consideration of alternatives at the national level led conclusively to the Southern Region and thereafter, it was considered necessary to also evaluate the population of this region. In this regard, the ten local authority areas of Carlow, Clare, Cork County, Cork City, Limerick City & County, Kerry, Kilkenny, Tipperary, Waterford City & County and Wexford which comprise the Southern Waste Region were also assessed in terms of population.

In 2022, the Central Statistics Office (CS0) figures showed the population for the Cork region (Cork City and County) to be 584,156 (see **Table 3.2** below). Having the largest population in the Southern Region, the location of the proposed facility in this county would appear to be the most suitable given that no dedicated waste to energy treatment capacity exists in the county.

Table 3.2 Southern Waste Region Population Figures

County	Population
Cork	584,156
Limerick	209,536
Tipperary	167,895
Wexford	163,919

County	Population
Kerry	156,458
Clare	127,938
Waterford	127,363
Kilkenny	104,160
Carlow	61,968

It should also be noted that Cork is projected to become one of the fastest growing locations in the Southern region.

Project Ireland 2040, the overarching policy and planning framework for the social, economic and cultural development to apply in Ireland to 2040 (and which constitutes the National Planning Framework (NPF)). It envisages the population of Cork City and Suburbs to grow by between 105,000 - 125,000 people by 2040.

In light of these population figures, projected future growth and the aforementioned regional spatial imbalance in terms of the lack of thermal recovery capacity in the national context and having completed this evaluation at regional level, Cork County was considered to be the only feasible location for a site for a thermal recovery facility.

3.3.2.2 Cork County Development Plan Review

An examination of the Cork County Development Plan 2022 was undertaken in order to ascertain if the selection of a suitable site within the Southern region may be said to be compatible with the zoning and land use policies of the Plan.

In the County Metropolitan Area, the Plan identifies Ringaskiddy as one of five Strategic Employment Locations in the County, the others being Carrigtwohill, Kilbarry, Little Island, and Whitegate. It is the objective to promote the development of Strategic Employment Locations suitable for large scale developments at these areas, where such development is compatible with relevant environment, nature and landscape protection policies as they apply around Cork Harbour. The areas are also recognised by the Cork Metropolitan Area Strategic Plan (MASP), in particular the potential for foreign direct investment and development by indigenous enterprises.

Accordingly, the Plan sets out Objective EC: 8-3 Strategic Employment Locations

a) Promote the development of Strategic Employment Locations suitable for large scale industrial developments at Carrigtwohill, Little Island, Ringaskiddy, and Whitegate where any such development must be sensitively designed and planned to provide for the protection of any designated sites. Any development must be compatible with relevant environment, nature and landscape protection policies as they apply around Cork Harbour and the protection of residential amenity.

b) Protect lands in these areas from inappropriate development which may undermine their suitability as Strategic Employment locations.

In relation to Industrial Areas, zoned 'I', as is the case in this instance, policy objective ZU 18-16 states that:

The provision of strategic large scale waste treatment facilities including waste to energy recovery facilities will be considered in 'Industrial Areas' designated as Strategic Employment Locations in this Plan subject to the requirements of National Policy, future Regional Waste Management Plans and the objectives set out in this Plan.

The five Strategic Employment Areas are Industrial Areas where the provision of strategic large scale waste treatment facilities including waste to energy recovery facilities will be considered.

An additional site, that of Bottlehill (which is not listed as a Strategic Employment Location) was also examined as policy objective BE 15-15b) in relation to Waste Prevention and Management of Waste Facilities seeks to:

> *b) Support the sustainable development of the Bottlehill facility for specialised and appropriate uses primarily associated with achieving the aims of the circular waste economy.*

Refer to **Figure 3.2** of **Volume 3** ***Figures*** of this EIS for a map of the five strategic employment areas and Bottlehill.

3.3.2.3 Locational Context – Individual Site Appraisals

With the foregoing in mind, the next required step in identifying suitable locations for the proposed development must necessarily encompass one within an industrial area designated as a Strategic Employment Location, in which large scale waste facilities will be considered, and which are in accordance with zoning objective ZU 3-7(b) of the Plan or the Bottlehill area.

The locations identified in the Cork County Development Plan 2022 were therefore assessed individually as was the site of Bottlehill as referred to above in order to determine whether these could be regarded as "*reasonable alternatives*" when compared to the existing development site.

In addition, the proposed development site should also be capable of contributing to a diversity in energy generation in line with policy ED 1-1 of the Development Plan.

As such, the following five areas were identified as possible areas for siting a large scale waste facility, as they comprise Strategic Employment Locations, including:

- Carrigtwohill
- Kilbarry
- Little Island
- Ringaskiddy; and
- Whitegate

In addition to these areas, the Bottlehill area was also examined. All six areas may also be said to be compatible with locating the proposed facility in a location that minimises the amount of road transport required to deliver waste to the proposed facility as all of these sites are within the environs of Cork City, with Bottlehill and Whitegate being the most distant.

After the foregoing review was carried out, a planning expert was subsequently engaged in order to assess these areas from a planning perspective as to their suitability for large scale waste facilities.

The areas were screened in relation to their size and zoning (refer to **Section 3.13** of **Appendix 3.1**) in order to evaluate as to whether areas could be regarded as "*reasonable alternatives*" in planning terms to the proposed development site. This report from Coakley O'Neill entitled, "*Planning Report, In Relation to Industrial Lands Within Metropolitan Cork"* is presented in **Appendix 3.1** to this EIS.

After reviewing the Cork County Development Plan and zoning applicable to large scale developments, this planning report concluded that there were a number of sites in Ringaskiddy, Little Island, Carrigtwohill and one in Bottlehill that could be considered reasonable alternatives

3.3.2.4 Comparison of Environmental Effects for Reasonable Alternative Sites

These sites were then compared having regard to the potential environmental effects of developing a resource recovery centre on each site. The documents reviewed for this process are the strategic environmental assessment (SEA) of the Cork County Development Plan 2022-2028, the Cork County Development Plan 2022-2028, and also publicly available information on baseline air quality at the identified sites from the Environmental Protection Agency's website, epa.ie. These sources of information provide relevant, up-to-date and comparable information on environmental constraints at each site.

Additional detail on this comparison of environmental effects for the reasonable alternative sites is included in **Appendix 3.3** and summarised in **Table 3.3**. A matrix of environmental effects using a colour code system is provided for each of the options considered. This system provides an indication of the potential environmental effects; the green ratings indicate a lower potential for negative environmental effects; the grey ratings represent neutral potential for negative environmental effects, and the amber ratings represent higher potential for negative environmental effects. The proposed development is located across the two sites identified with a bold outline. The analysis focuses on the potential for negative effects, as these are the greatest potential environmental constraints to development.

Table 3.3 Comparison of Environmental Effects

Option	Air Quality	Biodiversity	Hydrology (Flood Risk)	Cultural Heritage	Roads and Traffic	Population and Human Health	Material Assets	Landscape and Visual	Major Accidents and Disasters
Little Island									
Option 1 (LI-I-01)									
Option 2 (LI-I-05)									
Carrigtwohill									
Option 1 (CT-I-01)									
Option 2 (CT-I-02)									
Option 3 (CT-I-03)									
Ringaskiddy									
Option 1 (RY-I-01)									
Option 2 (RY-I-02)									
Option 3 (RY-I-03)									
Option 4 (RY-I-04)									
Option 5 (RY-I-05)									
Option 6 (RY-I-06)									
Option 7 (RY-I-08)									
Option 8 (RY-I-09)									
Option 9 (RY-I-10)									
Option 10 (RY-I-11)									

Option	Air Quality	Biodiversity	Hydrology (Flood Risk)	Cultural Heritage	Roads and Traffic	Population and Human Health	Material Assets	Landscape and Visual	Major Accidents and Disasters
Option 11 (RY-I-13)									
Option 12 (RY-I-14)									
Option 13 (RY-I-15)									
Option 14 (RY-I-16)									
Option 15 (RY-I-18)									
Bottlehill									
Option 1 (Bottlehill)									

3.3.2.5 Locational Context – Heat Feasibility

In parallel with the above planning review, a further expert was consulted with a view to assessing the areas from a heat feasibility perspective as to their suitability for the development of a district heating/heat network system in conjunction with the proposed development. This report from Fichtner entitled, "*Heat Network Feasibility Study, Review of the Potential for District Heating in 6 areas of County Cork",* is presented in **Appendix 3.2** to this EIS.

The heat study examined the above six areas, taking into consideration the planning report, in order to assess the potential for the recovery of heat energy from the proposed development. In doing so, regard was had to stated policy positions at local and national level which promote the development of district heating networks.

The Energy Efficiency Directive (Directive 2012/27/EU), promotes the use of cogeneration, district heating and cooling, and waste industrial heat recovery and is given effect in national law though the European Union (Energy Efficiency) Regulations 2014. The directive requires a cost-benefit analysis in order to assess the potential for using cogeneration when building a heat or electrical installation with a total thermal input exceeding 20MW. The proposed development has a heat input of over 70MW.

The BAT document for Waste Incineration 2019 also identifies techniques for the optimisation of overall energy efficiency and recovery in Section 4.4.1 therein describes that:

- '*Securing of long-term base load heat/steam supply contracts with large heat/steam users so that a more regular demand for the recovered energy exists and therefore a larger proportion of the energy value of the incinerated waste may be used;*
- *Location of new installations so that the use of the heat and/or steam generated in the boiler can be maximised through any combination of:*
    - *a. electricity generation with heat or steam supply for use (i.e. CHP)*
    - *b. the supply of heat or steam for use in district heating distribution networks*
    - *c. the supply of process steam for various, mainly industrial, uses'*

After taking into account the above national and European policy positions and conducting a comprehensive technical assessment of the Strategic Employment Locations and Bottlehill, the heat network feasibility study established that a heat network could be feasible in Little Island or Ringaskiddy, but that with a larger number of customers in Ringaskiddy and with a larger average heat load, Ringaskiddy would be the most suitable of the 6 areas considered.

This determination was reached after evaluating each of the six areas from a technical perspective in order to establish which, if any, could be regarded as a "*reasonable alternative*" to the proposed development site and in terms of proximity to heat users, Ringaskiddy was found to be the most suitable site in real terms.

3.3.3 Conclusion on the existence of "*Reasonable Alternative Locations*"

The 2025 evaluation process has identified that the Southern Region and specifically Cork is the most suitable location for the provision of the required thermal treatment capacity identified in the NWMP. The provision of the facility in Cork would address the national capacity deficit and the Regional imbalance identified in the NWMP.

Following the detailed assessment of suitable sites in Cork, a number of reasonable alternative sites were identified in the Ringaskiddy, Carrigtwohill, Little Island and in Bottlehill. Having reviewed this, Indaver still consider the Indaver-owned site an appropriate site for the proposed development, given that it is already owned by Indaver with good potential for connection to a heat network serving the industrial sector in Ringaskiddy.

3.4 Additional Project Alternatives Considered

3.4.1 Alternative Waste Management Options

This section deals with the alternative treatment options that were considered by Indaver that would meet the identified need for thermal recovery in the National Waste Management Plan (NWMP) as outlined in **Chapter 2** ***Planning & Policy Framework and Need for the Scheme*** of this EIS.

When examining the types of technology that would be most appropriate for the Ringaskiddy Resource Recovery Centre, Indaver considered the characteristics of the Irish waste market.

The policy as outlined in **Chapter 2** ***Planning and Policy Framework and Need for the Scheme*** of this EIS identified a need for 300,000 tpa capacity MSW thermal recovery. While a standalone MSW incinerator is possible in need terms, this did not fulfil policy or market needs in the area.

As outlined in **Chapter 2** ***Planning and Policy Framework and Need for the Scheme*** of this EIS, the NWMP also describes a need for thermal treatment of hazardous waste and an unspecified amount of industrial waste. Indaver provides an Industrial Waste Service to the chemical and pharmaceutical market. Waste from this market forms part of the hazardous waste arising within Ireland that requires thermal treatment. In addition, the same industries produce industrial sludge and industrial non-hazardous waste.

Though Indaver considered the possibility of treating only hazardous industrial waste, this is generated in such quantities that running a dedicated incinerator for this waste would not be economically viable.

Therefore, waste streams considered for this project include household, commercial, industrial, hazardous and non-hazardous waste. In this way the facility would be optimised both from an economic and technology perspective in line with policy and environmental benefits. This determined the requirement for a proven technology to treat a broad range of waste streams.

The Irish market for waste disposal is relatively small by international standards and is also varied in its composition. Because of this, Indaver determined that the design of the waste-to-energy facility, and of the technology to be chosen, must be robust and also flexible enough to be able to adapt to changing waste streams and market conditions that may arise in the future.

Alternative technologies are considered in more detail in **Section 3.5** of this chapter.

3.4.2 Export for Energy Recovery

An established practice in Ireland within the waste market at present is the export of residual municipal waste for recovery in waste-to-energy facilities in other Member States of the EU. This option has enabled Ireland to continue to reduce the amount of waste consigned to landfill even in the absence of development of any further recovery capacity, at a low cost to the consumer.

However, the new National Waste Management Plan is clear in highlighting the risk of relying on export outlets for residual waste treatment as outlined in **Section 2.2.2.3** of **Chapter 2** ***Planning and Policy Framework and Need for the Scheme*** of this EIS. In particular, it leaves Ireland exposed to market shocks, price increases and potential enhanced regulatory controls tied to destination countries. It also means Ireland cannot achieve self-sufficiency in residual waste treatment, a key objective in European waste policy. Finally, the export of waste represents a loss in revenue to the economy which is compounded by the loss in the valuable energy resource in the waste.

Accordingly, the preference of local authorities in all regions is to support self-sufficiency and the development of indigenous infrastructure for energy recovery from residual municipal waste. The proposed resource recovery centre at Ringaskiddy will enable the authorities to achieve this by delivering local energy recovery capacity.

In 2024, Ireland exported 246,528 tonnes of residual municipal solid waste for thermal treatment abroad which represents the current national deficit in waste treatment capacity and supports the call within the National Waste Management Plan for the provision of further thermal treatment capacity.

The Ringaskiddy Resource Recovery Centre would eliminate the need for this export. Any impacts of additional traffic on the local Ringaskiddy infrastructure is outweighed by the environmental advantages of developing badly needed waste management infrastructure. Significant improvements to the local road infrastructure are either already under construction, or have been recently completed as described in **Chapter 7 *Roads and Traffic*** of this EIS, and with the completion of these works, this chapter documents that the impact of the proposed development on traffic will not be significant. As outlined in **Chapter 2 *Planning and Policy Framework and Need for the Scheme*** of this EIS, the provision of this waste-to-energy capacity supports diversion from landfill, climate change mitigation and renewable energy targets.

3.4.3 Waste Transfer Station Option

The provision of a waste transfer station, as a separate piece of infrastructure, was considered but ultimately not included, for the following reasons:

A transfer station is not required for the operation of the proposed development, as is evidenced by the Meath waste-to-energy facility, which does not have a transfer station and accepts the same waste streams as the proposed development.

There are already transfer stations operating in Dublin, Shannon, Cork and Portlaoise.

Due to the advancement of waste management practices on industrial sites generating industrial waste, the provision of such a facility is not justified.

3.4.4 Alternatives for Upgrading the L2545 Road and Providing Flood Protection

The flood risk appraisal undertaken on behalf of the applicant has concluded that the L2545 road is at risk of flooding. The road level, in the vicinity of the Indaver site is below the 1 in 200-year design tidal flood level.

Two options were considered for upgrading the L2545 road. The first option was to raise the level of the road along part of the frontage to the Indaver site, to above the 1 in 200 year design tidal flood level plus an allowance for climate change, and to upgrade the road drainage. The second option was to construct a flood wall or embankment on the eastern side of the car park and to upgrade the road drainage.

The first option was chosen as it would give a high level of flood protection to the road. This was also the preferred option of the Cork County Council roads engineers, who were consulted. The second option would require a ramp to allow access to the beach. Reinstating the road at the lower level of flood protection was not preferred.

3.4.5 Coastal Erosion Protection

The coastline along the eastern boundary of the Indaver site consists of a glacial till face adjoining Gobby Beach. The glacial till face is very shallow near the public car park to the north and steepens to the south to a maximum of 10-12m high. Issues in relation to coastal erosion were raised by An Bord Pleanála during the course of the 2008 planning application process. In response to the issues raised by the Board, a coastal study was carried out by Arup in order to better understand the coastal processes in the vicinity of the site, the rate of erosion of the glacial till face and the specific coastal protection measures required. The coastal erosion study undertaken included an evaluation of the retreat rate of glacial till face based on historical information and surveys. Numerical wave modelling, a wave run-up assessment and beach sediment transport assessment were carried out.

The study found that the proposed development would not increase the current rate of erosion of the glacial till face.

As part of the study, a very conservative rate of erosion over a 40-year period was applied to the site in order to assess whether the proposed development could be impacted. The study found that there is a low risk of an impact on a small section of the proposed development after 40 years however this would be confined only to the amenity walkway and proposed viewing platform. The waste-to-energy facility would not be impacted by coastal erosion during the duration of the planning permission.

Coastal protection mitigation measures are not required for the waste-to-energy facility element of the development. However, given the concerns raised by An Bord Pleanála and given the low risk that the amenity walkway and a section of the diverted gas pipeline could be impacted in 40 years' time, coastal protection measures have been included in this planning application as a precautionary measure so as to reduce the rate of erosion of the glacial till face.

A total of ten options were considered for the protection of the glacial till face from erosion. Refer to **Table 3.4** below. The relevant environmental effects taken into account during the options assessment included issues such as visual intrusion, erosion/deposition of material, ecology, risks to navigation, small craft users and swimmers.

The preferred option was the placing of sacrificial beach material (shingle) at the toe of the glacial till face on Gobby Beach. This will be a 'soft' solution, which will:

- Reduce erosion rates by increasing beach levels i.e. reducing near shore water depth and wave heights.
- Protect the glacial till face from breaking waves
- Comprise a very natural way of slowing coastal erosion
- Require less material than conventional beach nourishment
- Located within the Indaver site boundary
- Not affect the current state of the glacial till face (no need for re-shaping)
- Not have any negative impact on the existing structures in the vicinity and adjoining areas (glacial till face and beaches).
- Protect the site and also the adjoining areas to it, so it is beneficial for the entire coastline
- Enhance the amenity and recreational aspects of the area, providing additional beach area at high tide.
- Enhance the visual appearance of the beach
- Provide an adaptive approach to the erosion and retreat issues of the coastline while working with nature.
- Promote the growth (accretion) of the beach as material is free to move in the coastal cell (bay).
- Protect the beach clay layer from further erosion

Further details on the coastal protection measures are provided in **Chapter 13** ***Soils, Geology, Hydrogeology, Hydrology and Coastal Recession*** of this EIS and its associated appendices.

Table 3.4 Coastal Engineer Solutions Considered

	Technique	Advantages	Disadvantages
Detached Breakwaters	Intermittent structures made of a loose material core which is covered with a resistant outer skin composed of rocks or concrete units. It is constructed in the wave breaking zone.	Dissipate wave energy further seaward than under natural conditions. Encourage beach build-up at the shoreline in the lee of the structure.	May pose as a hazard to vessels navigating the waters, however, it is envisaged the breakwaters would not be a hazard to ships in this case.
Sills	Un-segmented, structures parallel to the shore, always or occasionally submerged, usually built of rock and designed to hold beach material on their landward side.	They alter the cross shore sediment transport, preventing offshore loss of sediment resulting in a perched beach behind the sill. They also absorb some of the wave energy reaching the glacial till face.	Risk to small craft users and swimmers due to submerged structure. May trap sand that would have deposited at other beaches. May cause some scour of the beach immediately to the seaward.
Groynes	Narrow structures built usually at right angles to the shoreline which can be made of timber piles, rock, sheet pilling and concrete. They extend across the beach but rarely below the low water mark	Hold back sediment that would otherwise move along the beach under the action of waves and long-shore currents. Results in the accumulation of sand on the updrift side of the groyne to protect the coastline	Can increase the erosion along the down drift shoreline.
Revetment	Revetments are a means of protecting soft glacial till face and slopes from wave impact forces. The most common methods are with rock armour or gabions.	Reduce wave impact energy on the glacial till face or coastal slope.	Visually intrusive and may be hazardous to beach users if the rocks are very large. Requires beach access for construction.
Sea Walls	Vertical or near vertical walls, usually built at the high water mark between the shore and the land from concrete or stone.	They can reflect or absorb the wave impact energy and prevent erosion.	Visually intrusive and may prevent access to the beach or sea. Prevent normal development of the shoreline and may hamper strand line flora and fauna.
Bulkheads	Vertical retaining walls with either cantilevered or anchored sheet piles or gravity structures.	Reduce land erosion and loss to the sea by preventing soil from sliding seaward.	They commonly cause a change to the beach profile, normally resulting in sediment deposits along the shore where the bulkheads end.
Glacial till face Strengthening	Applied above the tidal zone for soft rock or exposed glacial till faces, techniques include the provision of drainage lines within the glacial till face to minimize moisture or planting suitable vegetation on the exposed face of the glacial till.	Reduce mass failure of glacial till face by increasing the material strength or decreasing the strain forces put on them.	Can have an impact on the ecology or land use at the top of the glacial till face (not expected for Indaver site). Can have an impact on shoreline sediment budgets. However, considering the short length of the exposed glacial till face at the Indaver site this would only be minor.

	Technique	Advantages	Disadvantages
Beach Nourishment	Artificially adding material to the beach in order to overcome a deficit in the sediment budget.	Protects the glacial till face from breaking waves. Regarded as a very natural way of combating coastal erosion.	Long-term maintenance effort usually required. Cause of the erosion is not eliminated as beach material is sacrificed with time.
Sacrificial beach material (shingle) at the toe of the glacial till face	Artificially adding material to the beach above the foreshore in order to protect the toe of the glacial till face from wave action	Protects the glacial till face from breaking waves. Regarded as a very natural way of combating coastal erosion. Less material than conventional beach nourishment needed	Long-term maintenance effort usually required. Cause of the erosion is not eliminated as beach material is sacrificed with time.
Planting	On the glacial till face, grass, bushes and trees protect the glacial fill against surface erosion by rain and melt-water.	Landslides on the glacial till slope are reduced by the presence of planting.	In isolation they are generally not sufficiently effective. Vegetation may fail due to environmental conditions May be successful in low energy environment but not for example on the open coast.

3.4.6 Construction Phasing

3.4.6.1 General

The main construction phasing options that were considered were the timing of the road upgrade works, the re-grading and earthworks on the eastern area of the site, raising the level of the western field, and the placing of the sacrificial beach material. Relevant environmental effects (such as traffic, minimising export of materials) were considered in the decision-making process as necessary.

3.4.6.2 Earthworks and construction of the retaining structures

The proposed layout of the waste-to-energy facility requires the eastern area of the site to be re-graded to form a series of terraces. A number of soil and rock retaining structures will be constructed as part of the terraces. The earthworks and construction of the retaining structures could happen at the same time as the construction of the waste-to-energy facility. However, this would involve a considerable number of different operations, undertaken by different contractors, happening at the same time. Also, there would be a significant amount of truck movements associated with the earthworks.

Accordingly, it is proposed that the earthworks and the construction of the retaining structures should be undertaken prior to the construction of the waste-to-energy facility. This will reduce the number of concurrent site operations and avoid the potential cumulative traffic impacts associated with the simultaneous phasing of earthworks with the construction of the waste-to-energy facility.

3.4.6.3 Road upgrade works

There were a number options considered in relation to the phasing of the road upgrade works, which could be undertaken before, during or after the earthworks on the eastern area of the site, or before, during or after the construction of the waste-to-energy facility. It will be necessary to construct a temporary road on the Indaver site to the south of the existing road, on which to divert traffic, for the duration of the road upgrade works. The temporary road would be a major constraint on the earthworks and on the construction of the waste-to-energy facility. Also, the earthworks will have to tie into the new road level. This would be facilitated if the new road is constructed in advance of the earthworks.

For these reasons it is proposed that the road upgrade works be undertaken as the first construction activity.

3.4.6.4 Raising the level of the western field

Again, raising the level of the western field could be undertaken before, during or after the earthworks on the eastern area of the site, and before, during or after the construction of the waste-to-energy facility. It is proposed that the western field would be used for the construction compound and for construction laydown and parking.

To minimise the quantity of imported fill, it is also proposed that material, excavated from the eastern area during the earthworks phase, would be reused, if suitable, to raise the levels in the western field. To achieve this reuse, if raising the level of the western field is undertaken after the earthworks, it would be necessary to stockpile the suitable material. The stockpiles would constrain the earthworks and the construction of the waste-to-energy facility.

Consequently, it is proposed that raising the level of the western field is undertaken at the same time as the earthworks.

3.4.6.5 Placing of the sacrificial beach material

The placing of the sacrificial beach material would not impact directly on or constrain any of the construction activities discussed above. The road upgrade works would constrain the placing of the sacrificial beach material, and it would be preferable if those two elements of the works did not coincide. The initial placement will be of 1,100m^3 of material which will result in approximately 100 truck movements.

Consequently, it is proposed that the placing of the sacrificial beach material will be undertaken towards the end of the construction of the waste-to-energy facility, when truck movements associated with the proposed development have substantially reduced.

3.5 Alternative Thermal Treatment Technologies

Alternative thermal treatment technologies were considered by Indaver. The key elements of these technologies, together with their respective merits and demerits are set out below, under the following headings:

- Pyrolysis and Gasification
- Waste combustion with energy recovery

It should be noted that only technologies that are in accordance with the requirements of EU Industrial Emissions Directive were considered by Indaver.

3.5.1 Pyrolysis and Gasification

Two technological alternatives for thermal treatment of municipal solid waste are the advanced thermal conversion technologies of pyrolysis and gasification.

Pyrolysis is the thermal degradation of a material in the complete absence of an oxidising agent (typically air). The by-products, char, pyrolysis oil and pyrolysis ash can be used as a fuel for energy production. Gasification is the conversion of a solid or liquid feedstock into combustible gas by partial oxidation under the application of heat and water. The gas can be used as fuel in boilers, combustion engines or gas turbines.

There is still only very limited operational data available for the gasification or pyrolysis of residual municipal waste. The BREF on Waste Incineration does not include any BAT for either technology. In the absence of any standards or data, it is difficult to compare this technology with conventional thermal treatment technology.

However, indications are that advanced thermal conversion technologies have the potential to produce lower environmental emissions, have a smaller footprint and can offer a range of different types of energy products from municipal wastes.

Facilities for gasification or pyrolysis of residual municipal waste typically require waste pre-treatment (shredder and iron removal). This requires additional handling and energy input into the waste prior to treatment.

Some of the advantages of pyrolysis include a lower volume of flue gas because of a lower excess oxygen rate with the combustion of pyrolysis products. Energy can be stored for later use in the form of oils or char. There is a reduction in the formation of dioxins or furans at the early stages however the overall levels are similar to conventional incineration. Pyrolysis also leads to the production of gas with lower calorific value which may be combusted with a short retention time and low emissions. Furthermore, pyrolysis can lead to better retention of heavy metals in the char than in ash from conventional combustion.

However, a significant disadvantage of pyrolysis is the lack of long term operating experience from large scale facilities. The technology has proved to be more suited to single, homogeneous waste streams rather than residual MSW. Residual MSW would require extensive pre-treatment via shredding and homogenisation prior to entering pyrolysis unit. This also means that combining hazardous waste to the inputs would not be possible with this technology. The char and oils contain heavy metals and other components and require further treatment (as waste) in a solid fuel boiler or gasifier. These energy products require pre-scrubbing or extensive flue gas cleaning depending on the final use as gas for gas engines or gas for chemical synthesis. Thus, the energy recovery efficiency may be lower than in a grate furnace.

Some of the advantages of gasification include less CO_2 production because of potentially better energy yield compared to traditional waste incineration. There can be less flue gas (quantity) than from grate furnace technology because of lower excess oxygen in the final oxidation of the gasification products. The energy product (e.g. syngas) can be stored for later use. If the solid fraction is vitrified there is better retention of heavy metals in the ash. Gasification also produces gas with lower calorific value which may be combusted with a short retention time and low emissions.

However, again a significant disadvantage of gasification includes the lack of long term operating experience from large scale facilities. It is more useful for single, homogeneous waste streams rather than mixed MSW which would require extensive pre-treatment via shredding and other mechanical treatment prior to entering gasifier unit. This would also rule out the possibility of treating hazardous waste in combination with municipal solid wastes and other non-hazardous wastes.

A part of the oxygen needed for gasification is supplied by means of pure oxygen, which is expensive and energy intensive to produce. Gasifiers need support energy, especially when the energy content of the waste is low. This energy is supplied by coke or by electric torches. Gasification technology involves more complicated emergency stop procedures (more combustible/ explosive/toxic gases in the system in the event of an emergency stop) which can reduce long term reliability. The energy recovery efficiency may be lower than grate furnace. The gas remains classified as a waste and must be treated in line with the Industrial Emissions Directive. Aluminium cannot be recovered from the metal melt as it is bound within the slag, unlike ash from grate furnace technology. Finally, the syngas produced requires pre-scrubbing before it can be used in gas engines for electricity production.

Finally, indications are that gasification and pyrolysis technologies are more difficult to maintain under stable operating conditions with a variable fuel like waste.

Overall, due to the range of residual waste streams to be handled at the Ringaskiddy Resource Recovery Centre, the absence of any reference plant operating to the scale required for the waste streams required, the robustness of the technology and the focus on energy recovery, pyrolysis and gasification technology were not considered as reasonable or practical alternatives to proven waste combustion technology.

3.5.2 Waste Combustion with Energy Recovery

Waste combustion involves the reduction of municipal waste-to-approximately 5-10% of its original volume. The thermal energy generated is recovered as steam which can be used to generate electricity, directly in heat applications or in a combination of heat and power facility. The process leads to the production of flue gas cleaning residues which either require further treatment or deposition in a controlled landfill.

The principal technologies used for waste combustion are grate combustion, fluidised bed and rotary kiln systems. Liquid injection systems can be used for liquid wastes. These are discussed below.

3.5.2.1 Grate Combustion

Moving grate furnaces operate in a similar fashion to an escalator, pushing waste from the top of the furnace to the bottom to ensure complete combustion. The moving grate mechanism transports the waste slowly from the feed point at the top of the furnace to the ash discharge at the bottom of the furnace. The residence time for waste in a grate furnace is typically approximately one hour.

Grate combustion is the chosen technology and is discussed in detail in **Chapter 4 *Description of the Proposed Development*** of this EIS.

The advantages of grate incineration include its proven reliability and its ability to handle all types of municipal and industrial waste and a wide variety of suitable liquid and solid hazardous wastes (as demonstrated by the Indaver Meath waste-to-energy facility). The total volume of waste is reduced to approximately 5-10%. The energy recovery efficiency is over 80% (transferred to steam from the boiler). The ferrous and non-ferrous metals within the ash can be recovered and recycled. However, the combustion process produces gases and dust which require an extensive flue gas cleaning system. Moreover, the energy output cannot be easily stored as it is in the form of steam. Finally, the flue gas cleaning residues require treatment at a facility suitable for hazardous wastes.

3.5.2.2 Rotary Kiln

A rotary kiln is an alternative waste combustion technology. The rotary kiln process consists of a refractory lined incinerator rotating very slowly (5-15 rev/hr). The cylinder is mounted at a slight incline so that solid materials introduced to the furnace will move from one end to be discharged at the other. A burner is located at the same end of the kiln as the waste feed and can be fired with gas, oil or waste solvents.

The main advantage of the rotary kiln design is the ability to treat a variety of waste streams such as solid wastes of varying sizes, liquid wastes using atomising burners, and wastes with high moisture contents. Rotary kilns are also efficient in the destruction of organic compounds.

The relatively high capital and operating cost of a rotary kiln incinerator and the kiln size limit of about 60,000 tonnes/annum means that a larger capacity unit is required to be economically viable. They are also not suitable for the treatment of sludge-like wastes or municipal solid wastes if no other types of waste are added.

Indaver NV successfully operates this type of incinerator technology at its facility in Antwerp.

3.5.2.3 Liquid Injection Systems

Liquid injection systems are an alternative technology for the combustion of liquid wastes. This type of incinerator is most commonly used for the combustion of chemical wastes such as oils and solvents (including chlorinated wastes), but it can also be used for the incineration of gases and sewage sludge. Liquid wastes are injected by means of an atomiser at one end of a refractory lined cylinder, where the waste is thoroughly mixed with the combustion air. The combustion temperature reaches 1,100ºC (the temperature required for treatment of highly chlorinated waste), with a residence time of 1.5 to 2 seconds. The design may incorporate just one combustion chamber with a number of zones or multiple chambers.

Liquid wastes that are highly combustible are fired in the first zone/chamber along with waste gases, while incombustible liquids containing some solids such as sewage sludge can be introduced into the following zones/chambers where the liquid fraction evaporates off and solid content burns. A liquid injection system can be installed after a rotary kiln or fluidised bed or directly into a grate incinerator. Indaver successfully operates a liquid injection system (for aqueous waste liquids) at the Meath waste-to-energy facility.

As the majority of the waste requiring treatment is solid and not liquid, then this technology on its own does not address the primary need for the proposed scheme.

3.5.2.4 Fluidised Bed System

A fluidised bed system is an alternative waste combustion technology. In a fluidised bed system, the waste is mechanically pre-treated, usually by shredding and metals removal, with the resulting particulates being introduced into a fluidised sand bed and suspended in an upward airflow in the combustion chamber.

This ensures uniform combustion conditions and is particularly suitable for efficient combustion of low grade fuels. An example is peat or sewage sludge combustion, where it is now the industry standard.

Fluidised bed systems require a uniform waste feedstock (up to 150mm in size) meaning that the waste must be shredded/pre-treated prior to feeding. Fluidised beds work better when processing wet material, e.g. sludge. In short, the benefits of a fluidised bed system do not outweigh the additional financial investment required, when only a small proportion of the total waste feed is sludge.

3.6 Rationale for Technology Selection

3.6.1 Influencing Factors in the Technology Selection

When examining the types of technology that would be most appropriate for the Ringaskiddy Resource Recovery Centre, Indaver considered a number of factors, which are set out below.

3.6.1.1 Characteristics of the Irish Waste Market

The Irish market for waste disposal is relatively small by international standards and is also varied in its composition. Because of this, the design of the waste-to-energy facility, and of the technology to be chosen, must be sustainable, with sufficient robustness and flexibility to adapt to changing waste streams and market conditions that may arise in the future.

3.6.1.2 Exclusion of Certain Waste Combustion Technologies

Indaver considered the numerous types of waste combustion technology available as outlined in **Section 3.5.2** above. However, a number of those technologies are not suitable for treating all of the types of waste streams required for the Irish market and identified for this project. For example, it is a fact that rotary kilns are best suited for the treatment of hazardous waste, but hazardous waste only represents 10% of the total waste throughput. Hence, it is neither practical or reasonable to propose an alternative that is more expensive, and which is not suited to the main feedstock of municipal solid waste.

Similarly, fluidised bed technology is best suited to sludge (and other wet wastes) treatment but these waste types represent less than 10% of the total waste throughput for this project. The amount of additional investment to pre-treat the main solid waste feedstock to make it suitable for this technology type is also neither practical or reasonable.

3.6.1.3 Explanation for the Chosen Waste Combustion Technologies

The Ringaskiddy Resource Recovery Centre will include a moving grate furnace for the treatment of municipal and industrial solid waste.

Indaver believes that this technology is the most appropriate for the range of materials to be accepted for recovery. Grate furnaces provide for the safe and efficient thermal treatment of wastes that are not suitable for reuse or recycling, while allowing flexibility in handling a wide range of waste types and in responding to changes in market conditions and waste streams generated in the future. There is also no technical impediment to operating the facility significantly below its nominal design capacity.

An additional advantage is that the existing grate technology can accommodate liquid incineration, so there is no need for a separate liquid injection and incineration installation. Indaver has demonstrated the capacity to treat liquid waste in this way at its facility in Meath.

Furthermore, grate furnace technology can provide for a high degree of energy efficiency, and therefore will meet the R1 recovery criteria with either electricity or heat exports or both.

The chosen furnace type is explained in more detail in **Chapter 4** ***Description of the Proposed Development*** of this EIS.

3.7 Alternative Energy Recovery and Gas Cleaning Systems

Indaver considered a range of energy recovery and flue gas cleaning technologies for the Ringaskiddy Resource Recovery Centre, with a view to optimising energy recovery and choosing technologies that would be well proven, robust and easy to operate.

3.7.1 Heat Recovery and Use

The following energy recovery alternatives to electricity generation are discussed below:

- No heat recovery
- Hot water generation for export via a heating network / use onsite
- Steam generation for export via a heating network / use onsite.

No Heat Recovery

Incineration without heat recovery has not been considered as an alternative, as incineration without heat recovery is not considered to be a Best Available Technique (BAT).

Hot Water/Steam Generation

The boiler chosen for the Ringaskiddy Resource Recovery Centre provides steam at a pressure of 53 bar and a temperature of 420°C, which is considered BAT. This will be used to generate electricity but could alternatively be used to supply a high pressure steam pipeline if this were available. However, generally industrial or domestic heat demand would be for much lower temperatures and pressures (e.g. 80 – 120^{o}C) and therefore, the steam would have to be stepped down prior to distribution to steam or hot water end users. This can be achieved by designing the steam turbine to operate in combined heat and power (CHP) mode, where steam is used to generate some electricity and is extracted at lower pressures and temperatures.

The location of the resource recovery centre on the Ringaskiddy Peninsula provides an opportunity to ultimately supply steam/hot water to large-scale industrial facilities, such as pharmaceutical and chemical facilities, and the large educational facilities located within 5 km of the site. Initial studies in this regard indicate that such a project could be feasible in Ringaskiddy, as documented in **Appendix 3.2 *Heat Network Feasibility Study***.

However, there are a number of regulatory uncertainties and funding issues to resolve prior to the development of a heat distribution network. Therefore, it is envisaged that the facility will be developed only to produce electricity from the steam generated. For clarity, heat exports and district heating are not part of the current proposal, but it will be considered by Indaver in the future. In order to achieve sustainability, full flexibility has been built into the design to facilitate its operation as a CHP facility if and when it is possible to progress with a heating supply network.

3.7.2 Dust Removal System

Dust removal can be achieved using a variety of technologies in order to meet the requirements of Industrial Emissions Directive, such as:

- Cyclone
- Electrofilter
- baghouse filter

The most suitable option is dependent on process conditions and emission limits standards.

Cyclones can be used at temperatures up to 900°C. The efficiency is dependent on the particle size and density. Efficiencies of over 90% can be achieved for sand. However, for fly ash it is unlikely to have a separation efficiency of more than 60%.

Electrofilters can be used at temperatures up to 400°C. The efficiency is dependent on the number of "*electrical fields*" installed. An efficiency of 95 % is common. However, achieving dust emissions below 3 mg/Nm^3 has proven difficult.

Baghouse filters can be used at temperatures up to 200°C with high efficiency. Such filters achieve typical dust emissions of 2 mg/Nm^3 which compares favourably with the Industrial Emissions Directive which sets the limit at 10 mg/Nm^3. Due to the creation of a cake on the filter cloth it is possible to consider a baghouse filter as a reactor also for the removal of acid gases and further removal of dioxins and heavy metals.

The outlet temperature from the cooling section is between 140 and 180°C, therefore this is an optimal location for a baghouse filter in the process.

Fly ash separation (dust removal prior to gas cleaning) has not been considered due to the very low volume generated from the grate furnace technology proposed. The advantage of separation would be the recovery or disposal of fly ash to a non-hazardous treatment facility and without pre-treatment prior, however, this would be dependent on prior knowledge of the concentration of metals in the waste.

For the reasons outlined above it is therefore proposed to use a baghouse filter (which is considered BAT) for the removal of dust after the cooling section as the outlet temperature is optimal and this option gives the best and most reliable environmental performance. It will also be much easier for this technology to achieve the more stringent BAT-associated emission levels (BAT-AEL's) set out in the revised BREF on Waste Incineration which was published in December 2019.

3.7.3 DeNO$_x$

DeNO$_x$ can be achieved by either Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR). Both technologies are considered BAT and the differing environmental performance of both is recognised in the new draft of the BREF on Waste Incineration by the BAT-AEL ranges set for new and existing plants.

SCR is more complicated to operate than SNCR. Ammonia is used as a reagent in the SCR process. SCR must be used downstream of the flue gas cleaning system to avoid blocking and poisoning of the catalyst bed. As the flue gases are relatively cold (< 200°C) in this part, it requires energy input to re-heat the flue gases, which has a negative effect on the overall energy balance of the facility. The SCR system is more prone to technical difficulties and frequent, unscheduled, shutdown time. Advantages include an option to combine DeNO$_x$ with dioxin removal (using the catalyst bed), efficient NO_x removal and less raw material (ammonia) usage.

SNCR is a far less complicated system and is, therefore, more reliable and not as prone to technical difficulties and frequent, unscheduled, shutdown time. However, it does require a higher consumption of ammonia. Modern SNCR systems can also achieve low NO_x emission limits. SNCR does not require any additional energy input.

Two reagents can be used in such a DeNO$_x$ system: ammonia or urea. Urea is a chemical that decomposes to ammonia and carbon monoxide. It is safer to handle than ammonia. In an SNCR system, the carbon monoxide will be further oxidised to carbon dioxide because it is applied at temperatures in excess of 900°C. Urea allows a larger temperature range in which to react with NO_x.

It is proposed to use SNCR with urea or ammonia injection as it is more reliable, more flexible, better availability and consumes less energy and therefore does not have a negative effect on the overall energy balance of the facility. This option is also considered BAT under the new BREF on waste incineration which was published in December 2019.

3.7.4 Flue Gas Cleaning Options

The choice of the flue gas cleaning equipment depends on the feasibility of a liquid purge from the site and on the pollutant load in the flue gases.

A liquid purge from the site would allow the removal of the salts from the reaction of the flue gas pollutants (HCl and SO_2) with a neutralising agent (lime) by means of a scrubber purge. The scrubber purge would require treatment in a chemical water purification system before leaving the site as an effluent.

The by-product of the chemical water purification would be a solid cake containing gypsum and heavy metals, which would be landfilled. The technology options would then focus on absorption of the flue gas pollutants (HCl and SO_2) in wet scrubbers. In case of low pollutant load, as is expected with the grate furnace, a single scrubber would be able to absorb the flue gas pollutants. In case of higher flue gas pollutants there would be a need for two scrubbers.

The main advantages of the effluent option are:

- no overconsumption of neutralising agents
- landfill capacity is not taken up with harmless salt coming from the reaction of HCl and SO_2 with lime; and
- lower stack emissions

If a liquid purge is not feasible then the salts from the reaction of the flue gas pollutants (HCl and SO_2) with the neutralising agent (lime) would need to be removed in solid form as flue gas cleaning residue. This residue must be disposed of in a suitable facility. This means that the adsorption and reaction need to be done in the semi-wet or semi-dry flue gas cleaning system. Semi-wet or semi-dry flue gas cleaning is able to absorb the flue gas pollutants. Semi-wet or semi-dry flue gas cleaning includes recirculation of the solid flue gas cleaning residue in order to improve the lime utilisation.

The main advantages of the effluent free option are:

- No effluent to be controlled on emission parameters
- Lower capital cost
- Better energy recovery rate

Indaver considered Best Available Techniques (BAT) when assessing the potential technologies for the proposed facility. This necessitated the consideration of a flue gas cleaning treatment system which resulted in a liquid purge effluent discharge. Raw material usage and economics are taken into account when assessing a technology against BAT guidelines. In this regard, the large volumes of water required for the flue gas cleaning with an effluent discharge was considered not viable in terms of raw material use and economics (ie paying to purchase the water and then paying to discharge it). Other BAT options for flue gas cleaning which were also considered by Indaver do not include an effluent.

Options that do not include an effluent are semi-wet and semi-dry systems.

In semi-dry conditions, neutralizing agents in dry form together with a separately temperature-controlled amount of water are used in unsaturated flue gas conditions.

In semi-wet flue gas cleaning, overall energy recovery is lower. In semi-wet conditions, neutralizing agents suspended in water are used in unsaturated flue gas conditions. The temperature at the outlet of the boiler is set at 160°C – 180°C to achieve maximum energy recovery. However, for semi-wet cleaning which relies on the injection and evaporation of water to provide cooling of flue gases, this temperature is not high enough to drive evaporation and cooling to the operating temperature of the flue gas cleaning system (145°C). The amount of water needed to suspend the lime for acid gas treatment is larger than the amount of water that can be evaporated to cool the flue gas to 145°C. Hence not enough lime could be injected to treat the acid gases as required while also achieving the cooling effect. The flue gas temperature would need to be higher to close out this water balance.

Dry flue gas cleaning was considered. In dry flue gas systems, neutralizing agents in dry form are used in unsaturated flue gas conditions. Similar to semi-dry flue gas cleaning, dry systems favour more heat recovery.

It is proposed to use a semi-dry system followed by a bag filter for the treatment of the flue gases to give better energy recovery and an effluent-free process. Again, this option is considered BAT.

3.7.5 Removal of Dioxins, Trace Organics and Heavy Metals

Options for dioxin removal are the injection of a premix of activated carbon or activated clay and lime before the bag house filter. Activated clay is a blend of treated clay and activated carbon. The treated clay is an alternative to activated carbon for dioxin adsorption. Some activated carbon however is still needed for the adsorption of mercury. Activated clay is in this context understood as a blend of ca 90% clay and 10% activated carbon.

Activated carbon or activated clay injection before the bag house filter is an efficient dioxin removal system and is considered BAT. Activated clay can also be injected for dioxin control before the bag house filter. It is the most favourable option due to its operational simplicity and the fact that a bag house filter has also been proposed for dust removal from the proposed facility.

Alternatively, activated carbon or activated clay can be injected as a premixed blend with hydrated lime. However, it is not possible to alter the activated carbon or activated clay /lime ratio when they are dosed together. As the lime need is variable in function of the pollutants in the waste and the dioxin sorbent dosing is a fixed amount separate injection of lime and dioxin sorbent is preferred.

An SCR system is another alternative option. An additional catalyst bed and higher catalyst operating temperature would be required, and the risk of catalyst fouling is too high to consider it as an alternative in the earlier stages of the flue gas cleaning system.

It is proposed that a fixed amount of activated carbon or a carbon/clay mixture will be injected in two places. The first will be into the flue gases in the cooling stage and the second into the flue gas either in the dry reactor or just after it. Again, this option is considered BAT.

3.8 Conclusion

3.8.1 Alternative Locations

A site selection study was carried out during 1999-2000. The site selection criteria at the time also included an analysis of environmental factors. Following on from this study, Indaver purchased a site in November 2000. This is the site for the current proposed development. It is located at the eastern end of the Ringaskiddy Peninsula, surrounding the Hammond Lane Metal Co premises.

In 2015, the suitability of the Indaver owned site in Ringaskiddy for the development of a waste to energy facility was assessed. The conclusion of the 2015 site suitability assessment was that the Indaver-owned site was still suitable for the development of a waste to energy facility.

As described in **Section 3.3.2** above, this exercise was updated for this EIS to consider the relevant changes since the 2016 application such as the new Cork County Development Plan 2022 and the new National Waste Management Plan for a Circular Economy 2024 – 2030 (NWMP).

The Southern Waste Region does not have any dedicated waste to energy recovery capacity and only has limited thermal capacity in a cement kiln. The NWMP specifically highlights that the Eastern-Midlands Region is the only region in the country to have dedicated thermal recovery treatment available at two waste-to-energy facilities, with a total of 4 active facilities authorised and a further 65,000 tonnes of MSW capacity pending.

Therefore the Southern Region appears to be the most appropriate when alternatives are considered on a national scale. This selection would address the regional imbalance in thermal recovery capacity that currently exists in the Southern Region. This also adheres to stated policy positions at European and national level as the location of the proposed development in the Southern Region would accord with the principles of proximity and self-sufficiency as laid down in the Waste Framework Directive (WFD).

Within the Southern Region, the largest population centre is Cork, which means this is the area where the largest concentration of residual MSW is produced. In addition to this, Cork is a hub for the pharmaceutical industry. Little Island and Ringaskiddy itself are home to a cluster of multinational pharmaceutical companies, the producers of the hazardous and non-hazardous industrial waste streams which the proposed waste-to-energy facility would treat. The proximity principle underpins the choice of a site in Ringaskiddy, located near the sources of household, industrial, and commercial, hazardous and non-hazardous wastes which the proposed facility would treat.

As described in **Section 3.3** above, and analysed in detail in **Appendix 3.1** and **3.3,** there is potentially suitable land zoned for industrial use in Ringaskiddy and at other locations close to Cork City, including the site purchased by Indaver in 2000. The 2025 evaluation process considered a range of reasonable alternative locations, and included a comparison of the potential environmental effects of these reasonable alternatives.

Having reviewed this, Indaver still consider the Indaver-owned site an appropriate site for the proposed development, given that it is already owned by Indaver, with good potential for connection to a heat network serving the industrial sector in Ringaskiddy.

3.8.2 Alternative Thermal Treatment Technologies

The Irish market for waste disposal is relatively small by international standards and is also varied in its composition. Because of this, Indaver believed that the design of the waste-to-energy facility, and of the technology to be chosen, must be sustainable by being robust and flexible enough to be able to adapt to changing waste streams and market conditions that may arise in the future.

The significant lack of large scale and proven examples of alternative technologies remain. Therefore, Indaver maintains that grate technology is the most appropriate for the range of materials to be accepted for recovery. Grate furnaces provide for the safe and efficient thermal treatment of wastes that are not suitable for reuse or recycling, while allowing flexibility in handling a wide range of waste types and in responding to changes in market conditions and waste streams generated in the future.

The design of the facility has been optimised in line with policy and environmental benefits to treat household, commercial, industrial, hazardous and non-hazardous waste.

3.9 References

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