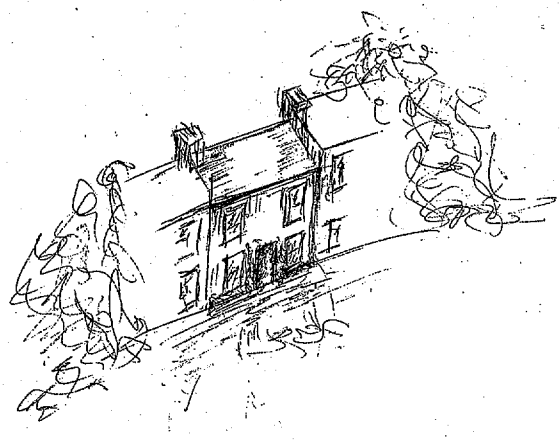
Sub(6) 186-1



4 Castle Terrace,
Monkstown,
Co. Cork,
Ireland.

Waste Licensing,
Environmental Protection Agency,
P.O. Box 3000,
Johnstown Castle Estate,
Co. Wexford.

2nd September, 2004.

RE: Waste Licence application 186-1 by Indaver Ireland

Dear Sir/Madam,

In April 2003, Indaver Ireland applied to the Environmental Protection Agency for a Waste Licence to operate two proposed incinerators at Ringaskiddy, Co. Cork. I object most strongly to the granting of any such licence to Indaver Ireland on behalf of both my constituents and environmental protection of Co. Cork.

This objection to the Indaver proposals for Ringaskiddy pertains regardless of whether one considers incineration to be Best Available Technology (BAT) for the waste management sector in Ireland or whether one considers the Indaver proposal for a hazardous waste incinerator to comply with the *National Hazardous Waste Management Plan*[1].

The site selection procedure undertaken by Indaver Ireland for these incinerators is entirely contrary to best practice, is in direct contravention of World Health Organisation (WHO) guidelines on site selection for hazardous waste incineration facilities[7], contravenes entirely the European Commission's advice on selection of such sites[2] and resulted in the purchase of a site prior to the undertaking of any environmental assessment as to the suitability of the area for mass-burn incineration.

Site selection procedure

Indaver's site selection procedure for this supposed national facility was, virtually in its entirety, a desk-based study. This study began at the end of 1999. Supported by its own knowledge of the pharmaceutical and chemical industry and by EPA statistics on national hazardous waste production, the study centred on Cork Harbour and its environs. Five potential locations around Cork Harbour were identified as being industrially zoned and therefore potentially suitable for

establishment of an incinerator. On contact with Cork County Council and the ESB, four of these five were ruled out. Only Ringaskiddy remained. Much of the Ringaskiddy land was found to be in the ownership of the IDA, which was unwilling to sell to Indaver. Of that land available, four potential sites were short-listed.

Having completed this first tranche of the desk-study, Indaver broadened its search to include industrially zoned lands in other areas of the county. However, all five zonings identified were close to sizeable towns and each was deemed to be unsuitable for the establishment of an incinerator for one reason or another. No detailed site investigation was undertaken in any of these five sites.

So Indaver returned to the four favoured sites in Ringaskiddy. An investigation of each site was undertaken with a view to applying a range of site selection criteria. These site selection criteria related to social, economic, transportation and environmental issues. This was the first time environmental criteria had been considered in the site selection process. Two of the four sites were in private ownership, while the other two belonged to Irish Ispat. One of these sites was further away from sensitive receptors than any of the other four, while the other was closer to sensitive receptors than any of the other four. However, that site which was furthest from sensitive receptors was believed to be potentially contaminated and to possibly involve considerable construction costs in piling.

In December 2000, Indaver purchased that site from Irish Ispat closest to sensitive receptors. In January 2001, after site purchase, Indaver commissioned a firm of Cork-based consultants to prepare an Environmental Impact Statement (EIS) for the chosen site.

As a consequence of its approach to site selection, the chosen Indaver site is one at sea level, at the bottom of a steep hill on the side of an eroding cliff and overlooking the only remaining beach for public amenity on this side of Cork Harbour. Some 36,000 people live within a 5 km radius of the site. Cobh, the largest town in the Lower Harbour, lies 2 km southwest of the proposed incinerators. Many of the town's residences will look down on the top of Indaver's proposed 60 m stack. The listed Ringaskiddy Martello Tower overlooks the Indaver site, while the Loughbeg nature reserve and proposed Natural Heritage Area nestles on the southern side of the peninsula. The site is at the end of a cul-de-sac in the very south of Ireland and can be accessed by only one, currently severely under-capacitied road. Across the road from the proposed entrance to the Indaver facility is the newly-constructed National Maritime College, anticipated to house 750 students, 75 teachers and to be Ireland's pride in the international nautical scene.

The proposed site within the Cork Harbour context

The best and most concise description of this part of the Cork Harbour valley is provided in Chapter 5 of the Indaver Environmental Impact Statement:

"*The site for the waste management facility is located on the northern side of the hill, at the eastern end of the Ringaskiddy peninsula, on the western shores of the lower part of Cork Harbour. The harbour is located in a broad, east-west trending valley between high ridges ... The high ridges to the north and south are intersected at right angles by deep, steep-sided valleys containing channels of Cork Harbour.*"

(EIS, Section 5, p. 1 of 22)

Anyone familiar with the area is very conscious of the vast range of localised meteorological conditions in the Cork Harbour valley. These include severe downdrafts, sea and land breezes, breeze circulations and local fogs. This is in part due to the marine environment, exacerbated by steep topographical changes and differing residential, industrial and agricultural land uses. All these characteristics create inhomogenities in the structure of the atmospheric boundary layer.

A further local consequence of the land-sea interaction in Cork Harbour is the occurrence of regular thermal inversions. On clear, cold nights, an inversion is created because the ground and the air immediately above the ground cool more rapidly than the sea. Any time warmer air overlies cooler air, the result is an extremely stable layer which resists vertical movement. Such extreme calms leading to thermal inversions are clearly evident to both inhabitants and users of the Harbour and, at the An Bord Pleanála Oral Hearing in September/October 2003, Cork County Council's Chief Fire Officer testified to thermal inversions occurring 5% of the time in Cork Harbour.

Because emissions within rising buoyant air may become trapped under conditions of thermal inversion, the WHO advises that areas experiencing regular thermal inversions should never be considered for establishment of a hazardous waste incinerator[7]. Indaver ignored this advice in its site selection procedure. Instead, it assessed the potential impact of air emissions from its proposed incinerators using comprehensive air dispersion modelling completed as part of its Environmental Impact Statement. Indaver concluded this modelling to prove no adverse effects either as a result of local meteorological conditions within Cork Harbour or during local thermal inversions.

Air dispersion modelling undertaken by Indaver

Indaver used three models for evaluating the impact of emissions from its proposed hazardous and non-hazardous incinerators. Additional models were used to evaluate the hazards associated with the proposed facility and the impact of the construction phase of the proposed project.

The three models in question – ISCST3, AERMOD and SCREEN3 – were all developed by the United States Environmental Protection Agency (USEPA) and have been exhaustively tested and trialled over many years of use. However the USEPA, while relatively confident of the performance of its dispersion modelling tools, cautions that:

"*A model applied improperly, or with inappropriate data, can lead to serious misjudgements regarding the source impact or the effectiveness of a control strategy.*"

(USEPA, 2000; USEPA 2003)

These misapplications described by the USEPA were the two fundamental errors made by Indaver in their air dispersion modelling. While the models used by Indaver are authentic and well-respected, they were:

1. applied improperly
2. applied with inappropriate data.

Improper model application

All three models used in the Indaver EIS are Gaussian plume based. While such models are well understood and easy to apply, it was noted at the 15th International Clean Air Conference 2000 that the use of Gaussian plume based models may often be without an objective scientific basis[3]. ISCST3 is a relatively simple Gaussian plume model. AERMOD is more refined, in that it superimposes several Gaussian plumes and uses a probability density function to more accurately characterise the non-Gaussian nature of the vertical pollutant distribution during convective conditions. Nonetheless, it is essentially Gaussian-based. The SCREEN3 model is a screening version of the ISC models and is based on the same steady-state Gaussian plume algorithms.

Meteorological complexity and topographical complexity are closely intertwined. Because they both introduce non steady-state atmospheric conditions, the USEPA cautions that they may lead to situations in which simple Gaussian-based models are unsuitable for evaluating source impacts[5,6]. The valley of Lower Cork Harbour is one such place where topographical and meteorological complexity combine to make highly localised conditions. The dramatic topographical character of the Lower Cork Harbour valley around Indaver's proposed site has been well described in Section 5 of the Indaver EIS:

"*Th-e site lies on the northern slope of the Ringaskiddy anticline. The site is located close to the northern edge of the anticline and rises from a level of approximately 3 mOD close to the road to approximately 40 mOD at the southern boundary of the site. South of the site, the land rises slightly to 43 mOD at the Martello Tower. To the north, beyond the Raffeen-Monkstown Creek syncline, the ground rises to a level of 130 mOD to the north of Monkstown and almost 100 mOD on Great Island. To the south of Ringaskiddy, the crest of the hill at Curraghbinny Wood rises to 74 mOD and the top of the ridge south of Crosshaven is at a level of almost 100 mOD.*"

(EIS, Section 5, p. 3 of 22)

Topographical changes of even a minor nature around any air discharge can significantly affect the pattern of dispersion of the discharge plume. Complex terrain, such as that described above, can produce wind channelling around or between hills, especially under stable atmospheric conditions. Hills or rough terrain can change wind speeds, directions and turbulence characteristics, while valleys can restrict horizontal movement and dispersion. Such complex wind conditions include those noted by the USEPA[5,6] as potentially needing special treatment through air dispersion modelling:

- land and sea breezes – arise because of a heating and cooling differential between land and sea
- mountain and valley winds – can often result in closed circulation patterns which can trap and/or recirculate pollutants in a mountain-valley system

Simple steady-state Gaussian plume models are not designed to deal with either complex terrain or meteorology. Models such as ISCST3 incorporate simple algorithms to account for the effects of terrain in only a very limited fashion. They are not recommended for use in complex terrain. The USEPA specifically cautions that ISCST3 can deal only with "*limited terrain adjustment*" and recommends its use only in "*flat or rolling terrain*"[5,6]. These models assume the atmosphere to be uniform across the entire modelling domain. ISCST3, for example, assumes that a constant, uniform wind blows across the top of an emitting stack each hour and that the emitted plume is transported in a straight line downwind for as far as the model extends. Vertical wind speed in ISCST3 is considered to be zero.

Not merely are steady-state Gaussian plume models incapable of dealing with complex atmospheric conditions, they are also unable to model dispersion during conditions of extreme calm. According to the USEPA[5,6], such conditions of calm include:

- inversion breakup fumigation – occurs when a plume is emitted into a stable layer of air which is subsequently mixed to the ground
- shoreline fumigation – important near shores
- stagnation – conditions of calm or very low wind speeds and variable wind directions.

Inversion conditions are particularly difficult to model with Gaussian plume algorithms because of their associated low wind speeds, the appearance of multiple layers of pollution and the difficulty of defining the mixing height[3]. ISCST3, the model principally relied on by Indaver, sets a minimum default wind speed of 1 $m.s^{-1}$. If the input hourly meteorological data records wind speeds below this minimum, ISCST3 ignores the hour in question, generally defaulting it to the minimum wind speed.

The Indaver EIS claims the ISCST3 model to be "*capable of modelling most meteorological conditions likely to be encountered in the [Lower Cork Harbour] region*" (EIS, Section 9, p. 9 of 117). This is clearly not the case. In Cork Harbour, wind circulations and turbulence are more regular than steady-state conditions and downdrafts and updrafts over the Cobh, Ringaskiddy and Monkstown hills are commonplace. Thermal inversions can be clearly evidenced on cold, clear, calm winter nights and when Cork City enjoys hot balmy summer sunshine, it is not unusual for Lower Cork Harbour to be enshrouded in thick fog.

The Indaver EIS attempts to cover up the inadequacies of ISCST3 in dealing with the steep contours of Lower Cork Harbour by describing the topography as having "*generally gentle changes in terrain*". Slopes such as those of the Cobh and Monkstown hills shown in the enclosed cross-sections through Cork Harbour could by no means be considered as gentle. Its own EIS's description of the "*steep-sided valleys*" of Cork Harbour belie the air modelling's attempt to belittle the topographical complexity of Cork Harbour.

AERMOD should have greater capability to deal with the Lower Cork Harbour conditions that its more unrefined ISCST3 predecessor. However, despite its more advanced algorithms, it is appropriate only for transport distances over which steady-state assumptions are appropriate[5]. In the case of Lower Cork Harbour, steady-state assumptions are frequently inappropriate even over the 1 km width of the channel between Haulbowline Island and Cobh.

Application of model with inappropriate data

Confidence in the AERMOD outputs would have been greater had Indaver's air dispersion modelling exercise heeded the USEPA's strong warnings for the model's proper use, particularly in complex terrain:

"*...Measured profiles of wind, temperature, vertical and lateral turbulence may be required [in complex terrain] to adequately represent the meteorology affecting plume transport and dispersion ... Data used as input ... should possess an adequate degree of representativeness to insure that the wind, temperature and turbulence profiles derived by AERMOD are both laterally and vertically representative of the source area ... The values for surface roughness, Bowen ratio, and albedo should reflect the surface characteristics in the vicinity of the meteorological tower and should be adequately representative of the modelling domain. Finally, the primary atmospheric input variables including wind speed and direction, ambient temperature, cloud cover and a morning upper air sounding should also be adequately representative of the source area.*"

(USEPA, 2000)

Meteorological data is probably the most important input into an air dispersion model. In particular, the representativeness of this data is dependent on:

- the proximity of the meteorological site to the area under consideration
- the complexity of the terrain
- the exposure of the meteorological monitoring site
- the period of time during which data are collected.

There is only one regularly monitored meteorological station close to Lower Cork Harbour. This station, Roches Point, is situated on the top of a cliff at the Harbour mouth. Conditions at the Roches Point station rarely reflect conditions in the inner valley of the Lower Harbour. Even were it representative of conditions at the proposed Indaver site, the Roches Point meteorological station was made automatic in the early 1990s and Met Eireann have been overcoming quality control problems with the resulting data ever since. Furthermore, no measurements of atmospheric stability are calculated for Roches Point. Atmospheric stability, expressed using the Pasquill Index, is a combined measure of sunshine hours, cloud cover and wind speed. The

Pasquill Index is a very important measure of the ability of the atmosphere to disperse any kind of emission to air. It prescribes a series of classes as follows:

A	Extremely unstable
B	Moderately unstable
C	Slightly unstable
D	Neutral
E	Slightly stable
F	Moderately stable
G	Extremely stable

Dispersion of any emission to air is best in classes A and B, while class G is used for clear, calm, cold nights in which there is virtually no effective dispersion. Class G generally represents conditions of thermal inversion.

The Pasquill Index of atmospheric stability is calculated for meteorological data gathered at the Met Eireann meteorological monitoring site at Cork Airport. Cork Airport is 12 miles (as the crow flies) from the proposed Indaver site. It is situated at the top of a hill, at approximately 100 m OD. By comparison, the Indaver site is virtually at sea level in the bottom of a valley. Cork Airport is surrounded by flat and rolling terrain, has little surface roughness comparativeness with the proposed Indaver site and rarely experiences the complex winds or extreme calms that characterise Lower Cork Harbour.

Yet the Indaver air dispersion modelling exercise used meteorological data gathered at Cork Airport as its primary input data. There is no way that this could be considered to be in any way representative of meteorological conditions in Lower Cork Harbour. Nor could it be considered to be in any way respectful of the USEPA's warnings for proper use of its air quality models. A comparison of weather data gathered at both the Cork Airport and Roches Point sites is presented and discussed in Section 9 of the EIS. Although weather conditions at neither station is appropriate input data for modelling of the site in question, Indaver must be aware of the inadequacies of its meteorological data.

"*As lower wind speeds are likely to lead to higher ground level concentrations under most scenarios, the use of Cork Airport data should not lead to a significant under-estimation of the ambient ground level concentrations from the site.*"

(Indaver EIS, Section 9, p.8 of 117)

Meteorological data gathered over a 30 year period is the international standard way of comparing data from two meteorological stations such as these. If such data is presented for both Roches Point and Cork Airport, it is clear that many of the most relevant weather phenomena are significantly different:

1961 – 1990	Roches Point	Cork Airport
Absolute daily max temp (°C)	27.5	28.7
Absolute daily min temp (°C)	-7.2	-8.6
Mean no. of days with air frost	7.0	24.0
Mean no. of days with ground frost	44.6	76.8
Mean monthly rainfall total (mm)	935.7	1194.4
Mean no. of days with >= 0.2 mm	184	204
Mean no. of days with >= 5.0 mm	63	75
Mean monthly wind speed (knots)	12.2	11.1
Maximum gust (knots)	86	94
Mean no. of days with gales	33.3	15.0
Mean no. of days with snow or sleet	8.7	16.4
Mean no. of days with fog	46.5	99.5

Data gathered over the standard 30 year period indicates that Cork Airport experiences considerably greater extremes of weather than Roches Point. Mean monthly data over this 30 years also shows that while mean wind speed is greater at Roches Point than at Cork Airport, gust speeds are higher at Cork Airport than at Roches Point. While it is again emphasised that neither meteorological monitoring station is representative of conditions in Lower Cork Harbour, it is essential to point out to the inaccuracy of the Indaver EIS statement: "*Cork Airport is the nearest suitable meteorological station to the site and thus the weather pattern experienced would be expected to be similar to the current site*" (EIS, Section 9, p. 8 of 117). This statement is neither logical nor scientifically correct – no such expectation follows.

Atmospheric stability as calculated by Met Eireann for Cork Airport is expressed over the seven Pasquill Index classes A – G. Pointing out the inability of ISCST3 to model dispersion under conditions of extreme atmospheric stability, Appendix 9.5 of the EIS uses SCREEN3 with the VALLEY screening algorithm to investigate dispersion from the proposed Indaver site. This two page assessment of some of the potentially poorest dispersion conditions assumes stability class F and a minimum wind speed of 2.5 $m.s^{-1}$ throughout. No mention is made of stability class G, despite the fact that it is the class G condition of extreme calm in which dispersion is least likely. It is also the class G condition of extreme calm in which night-time thermal inversions are most frequently evidenced in the Lower Harbour. The EIS makes no attempt to determine whether a wind speed of 2.5 $m.s^{-1}$ is even possible under such conditions of thermal inversion, particularly bearing in mind that the top of the proposed stack is lower than the surrounding topography. To further compound these errors, fumigation calculations undertaken ignore any potential effect of elevated terrain.

Please note that in its calculations of stability class G at Cork Airport, Met Eireann estimates speeds of less than 1 knot to have occurred 1.7% of the time over the international standard of 30 years. Although this is considerably lower than the Chief Fire Officer's estimate of 5% annual occurrence of thermal inversions in the Lower Harbour, it indicates that there is absolutely no excuse for Class G not having been at least mentioned by Indaver in its assessment of fumigation and shoreline fumigation.

Appropriate dispersion modelling of the Lower Cork Harbour area

Air dispersion modelling is the only way to make any sort of an accurate attempt at predicting the impact from the proposed Indaver incinerators on Cork Harbour and its surrounds. The air dispersion models used by Indaver and presented in the EIS are well tried, well regarded and commonly used worldwide. However, their application by Indaver in Cork Harbour is to a site in an area experiencing neither common conditions of meteorology nor topography. While the USEPA applauds consistency in the selection and application of models, it cautions that "*such consistency is not promoted at the expense of model and database accuracy*"[6]. It further cautions that, "*in all cases [of air dispersion modelling], the model applied to a given situation should be the one that provides the most accurate representation of atmospheric transport, dispersion and chemical transformations in the area of interest*"[6].

It is clear that the steady-state Gaussian plume models used by Indaver in this assessment are not those most suited to the Lower Cork Harbour situation. ISCST3 is suitable only for flat or rolling terrain. Neither ISCST3 nor AERMOD can deal with the calms and thermal inversions to which Cork Harbour is prone. Furthermore, both assume steady-state transport conditions of the emitted plume to receptor; simple observation of the wind and water patterns in the Lower Harbour channels tell clearly that such steady state conditions are an unusual rather than a usual occurrence in the Harbour. SCREEN3 and its VALLEY algorithm, both used to evaluate plume impacts under conditions of fumigation, are incapable of assessing conditions of atmospheric stability associated with extreme calms. Furthermore, VALLEY cannot account for the effects of elevated terrain, despite the fact that it is those living on the slopes of the Cork Harbour valley will be most exposed to the emitted plume during conditions of extreme calm.

There is a range of models recommended by the USEPA for regulatory application. Many of these are far better suited to the complex topographical and meteorological conditions in Lower Cork Harbour than those models used by Indaver. In particular, CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model that simulates the effects of time and space-varying meteorological conditions on pollutant transport, transformation and dispersion. It can deal with the near-field effects of such concern in the area around the Indaver site, including building downwash, transitional buoyant and momentum plume rise, partial plume penetration, subgrid scale terrain, the effects of coastal interactions and the effects of terrain impingement. CALPUFF sees hourly average winds below 0.5 $m.s^{-1}$ as calms and uses specific algorithms to deal with them as such. The USEPA specifically advises that CALPUFF should be used:

"*... to fully treat stagnation, wind reversals and time and space variations of meteorological effects on transport and dispersion [including inhomogeneous local winds, inversion breakup fumigation, shoreline fumigation and stagnation].*

(USEPA, 2000)

In a comparison between CALPUFF and ISC3, the USEPA explains the increased accuracy from CALPUFF in complex meteorological and topographical conditions to be due to the way in which emission transportation and dispersion is simulated. CALPUFF is capable of tracking the puff emitted before, during and after wind shifts and reversals. ISC3 models are concerned only with the current hour of plume transport. CALPUFF continues to disperse each puff even when the puffs are above an inversion layer. By comparison, ISC3 models determine the plume to remain above the inversion layer and to never be advected to the ground[4].

The Ministry for the Environment, New Zealand, also specifically recommends the use of CALPUFF in conditions virtually identical to those in Lower Cork Harbour:

"I*n very rugged hilly or mountainous terrain, along coastlines or near large land use variations, the characterisation of the winds is a balance of various forces such that the assumptions of steady-state straight-line transport both in time and space are inappropriate. In these special*

cases described, CALPUFF modelling system may be applied on a case-by-case basis for air quality estimates in such complex non-steady state meteorological conditions."

(Ministry for the Environment, New Zealand, 2004)

However, no model should be used without inappropriate and accurate input data. Regardless of its appropriateness to the Cork Harbour situation, it is essential that accurate meteorological data should be input into CALPUFF if the resulting output is to be representative of the impact of emissions from the proposed Indaver facility.

Meteorological data gathered from Cork Airport is not adequate for this purpose. The USEPA advises that site-specific meteorological data are "*critical for modelling in complex terrain*"[6]. The Ministry for the Environment, New Zealand, also advises that local meteorological monitoring is highly desirable, particularly when one of the conditions of greatest potential impact is low wind speeds[3]. In a telephone conversation with Met Eireann at Cork Airport, I was advised that Cork Airport meteorological data could not be considered to be representative of that in the Lower Harbour and that even conditions at Roches Point meteorological data would be quite different from those in the Inner Harbour. The climate specialist with whom I spoke advised that the only way accurate meteorological data on the Lower Harbour could be gleaned would be to erect an anemometer and other appropriate monitoring equipment on site.

The only way to accurately simulate transport and dispersion from the incinerators proposed by Indaver for Ringaskiddy is to gather at least one full year of site-specific meteorological data for input into a truly appropriate regulatory model such as CALPUFF. It is absolutely vital that this be undertaken if the real air quality impact of the proposed Indaver facility is to be evaluated. Furthermore, when this modelling is underway, the advice of the USEPA in relation to quality control should not be forgotten:

"*... It is increasingly important that [modelling is] directed by highly competent individuals with a broad range of experience and knowledge in air quality meteorology. Further, they should be co-ordinated closely with specialists in emissions characteristics, air monitoring and data processing. The judgement of experienced meteorologists and analysts is essential*".

(USEPA, 2003)

Conclusion

For the EPA to grant a Waste Licence to Indaver for its proposed waste management facility at Ringaskiddy, Co. Cork, would be a clear breach of its functions under Section 52 of this Act.

I, as an environmental engineer, am ashamed that members of my profession prepared and attempted to justify the air dispersion model presented by Indaver in its EIS for the proposed Ringaskiddy development. I am equally ashamed of the mockery such poor and unfounded science makes of Irish, European and international legislation and guidelines for protection of both human health and the environment.

Under Section 52 of the Environmental Protection Agency Act, 1992, the basic function of the Agency is environmental protection. In this regard, Section 4 of the Act clearly indicates protection of the environment to be:

- the prevention, limitation, abatement or reduction of environmental pollution, where such environmental pollution includes:
  - air pollution
  - the disposal of waste in a manner which would endanger human health or harm the environment and, in particular, create a risk to waters, the atmosphere, land, soil, plants or animals
- the preservation of the quality of the environment.

I trust that the EPA, being aware of current USEPA advice in relation to the use of its air quality models, will require a full reassessment of emissions to air from this proposed Indaver facility using an air quality model appropriate to the specific conditions of the Lower Cork Harbour valley to which authentic and accurate site specific meteorological data is input.

To grant a Waste Licence to Indaver for its proposed facility at Ringaskiddy based on the air dispersion modelling presented in the Indaver EIS would be a clear breach of the EPA's remit under Section 52 of the Environmental Protection Agency Act, 1992.

Yours faithfully,

Cllr. Marcia K. D'Alton, B.E., M.Eng.Sc., M.I.E.I.

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6. United States Environmental Protection Agency (2003). 40 CFR Chapter 1. Appendix W to Part 51 – *Guidelines on Air Quality Models.*

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B
A
PASSAGE WEST
An Pasáiste
River Lee
An Laoi
West Passage
Marino Pt
Marino
Knocknamullagh
Rathanker
Glenbrook
Maulbaun
Monkstown
Baile an Mhanaigh
Ballyfouloo
Strawhall
Raffeen
COBH
An Cóbh
Rushbrooke
Ringmeen
GREAT ISLAND
An tOileán Mór
Ballydaniel Beg
Currabally
Rosslague
Fanick
Ballydulea
Ballywilliam
Carrignafoy
Cuskinny
Cuskinny Bay
Ballymore
An Baile Mór
Spitbank Lighthouse
CORK HARBOUR
Cuan Chorcaí
Haulbowline Isd
Monkstown Creek
Ballybricken Pt
Ballintaggart
RINGASKIDDY
Rinn an Scidigh
Shanbally
Barnahely
Spike Island
Inis Pic
Long Point
Whitegate Bay
Corkbeg Island
Black Rock
Raheens
Loughbeg
Coolmore
Curraghbinny
Carlisle Fort
Corkbeg
Ballytigeen
Glanagow
Owenboy River
Frenchfurze
CROSSHAVEN
Bun an Tábhairne
Knocknagore
Hoddersfield
Aghamarta
Boycestown
Ram's Head
Grab-all Bay
White Bay
Trabolgan
Weaver's Point
Roches Point
Rinn na Róistigh
Poulnacalla Bay
Cow & Calf Rocks
Fahalea
Brownstown
Ballynaneening
Killeen
Gortnanoon
Ballinluska
Myrtleville
Baile an Chuainín
Kilmichael
Fountainstown
C
A
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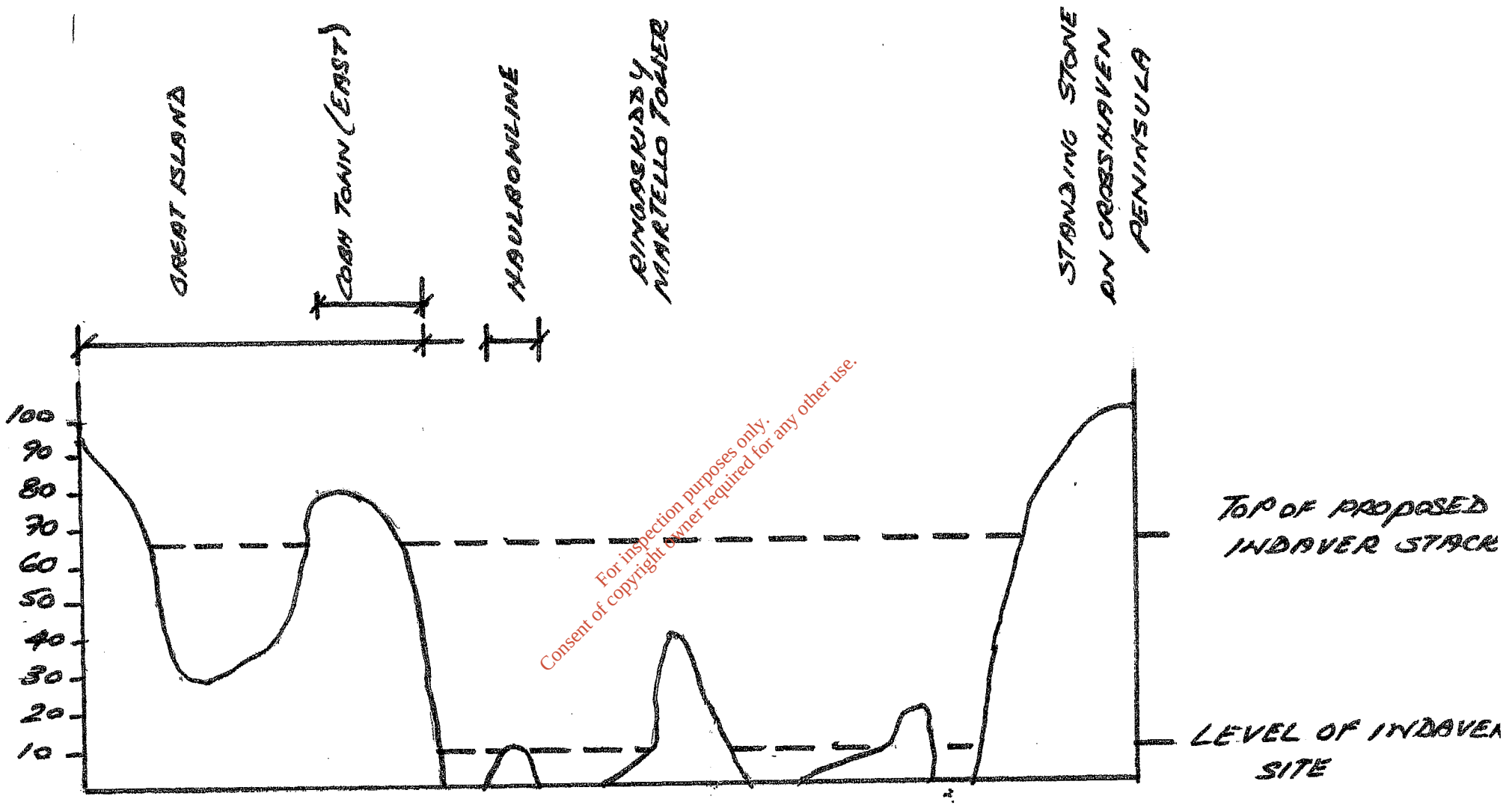
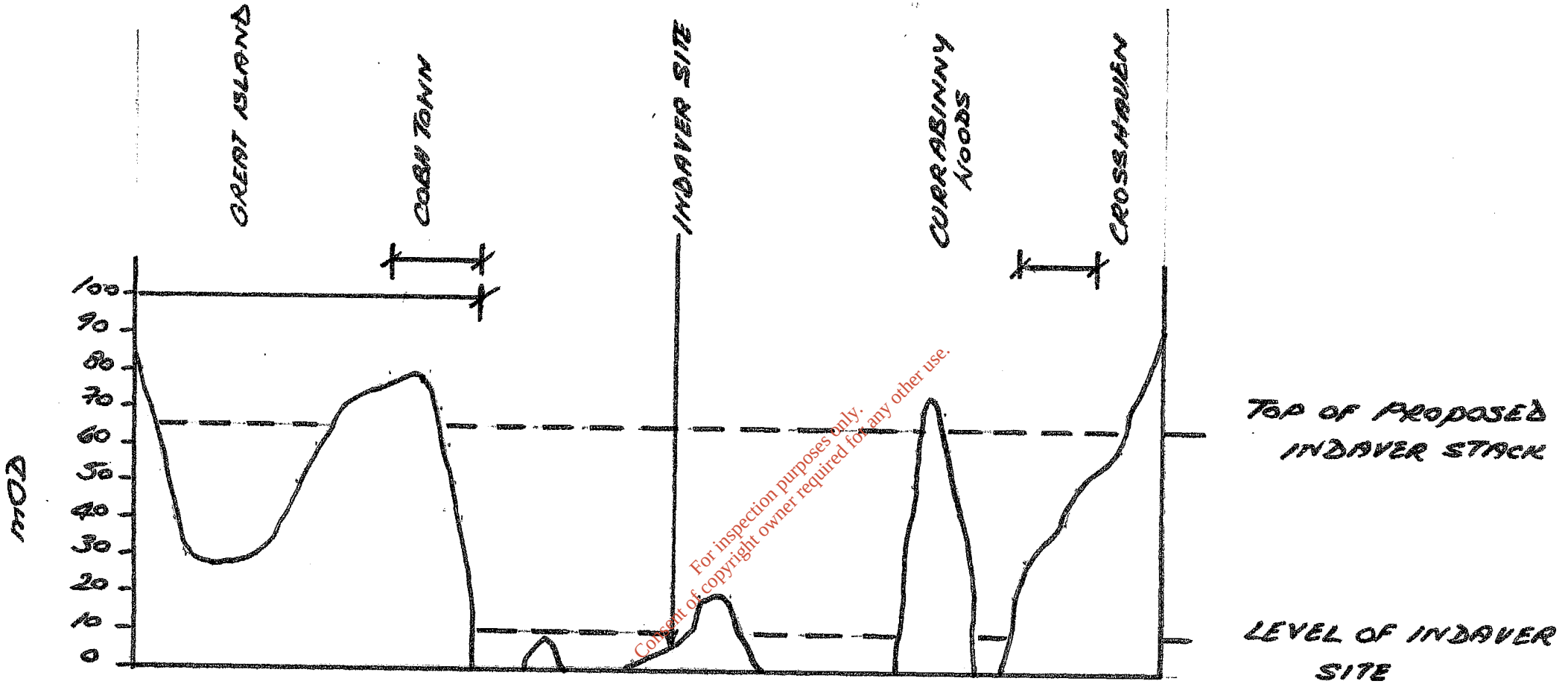
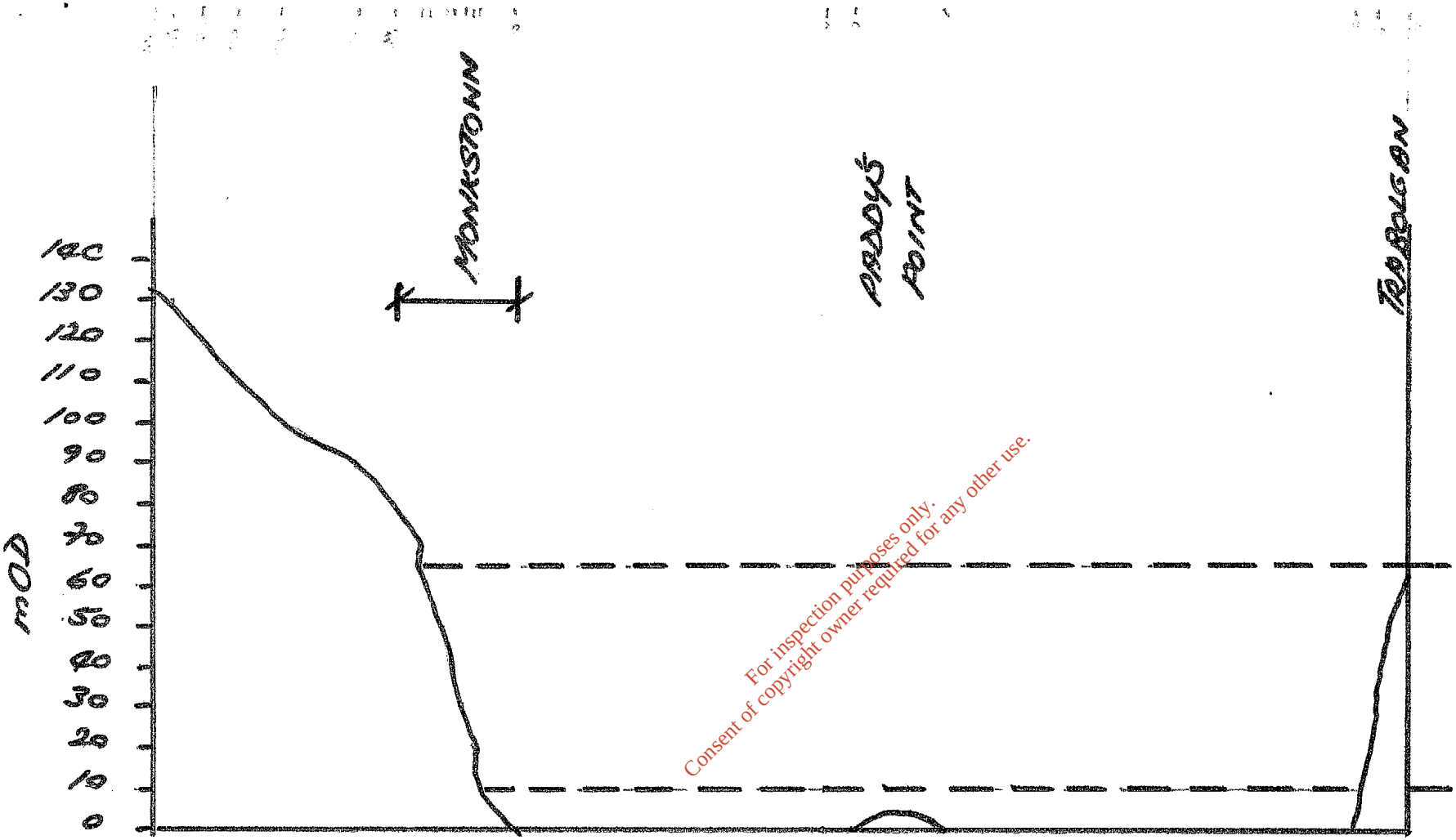
CROSS-SECTIONS THROUGH CORK HARBOUR.



SECTION A-A



SECTION B-B



SECTION C-C