M E M O R A N D U M

DATE: 22 March 1999

TO: Each Board Member

FROM: Tony Dolan

RE: Application for an Integrated Pollution Control Licence from The Great Northern Brewery, Carrick Road, Dundalk, Co. Louth.

Reg No: 440

Application Details	
Class of activity:	7.3; Commercial brewing in installations where the production capacity exceeds 100,000 tonnes per year.
Licence application received:	08/06/98
Notices under article 11(2)(b)(ii) issued:	06/08/98, 11/11/98
Information under article 11(2)(b)(ii) received:	09/09/98, 10/09/98, 21/09/98, 01/12/98, 04/02/99, 18/02/99
Section 97 notice sent:	20/08/98
Section 97 response received:	21/09/98
Article 10 compliance	18/02/99
Submission(s) received	06/08/98
Site visits	08/05/98, 16/02/99

Company Profile:

The GNB was established in 1897 and was purchased by Guinness as its lager brewing location in 1958. Harp was launched on the Irish market in 1960. As part of a group reconstruction in 1996 which involved the setting up of a single company within the group, the name was changed from Harp Ireland to the original name, The GNB, to reflect the diverse range of beer types produced on the site, such as Harp, Steiger, Satzenbrau, and Carlsberg. The original production capacity of 30,000 hectolitres/annum has increased in a series of expansion programmes since the early 1960's to bring the brewery to its present output level of 1.4 million hl/annum, which is expected to increase to 1.8 million hl/annum over the next few years.

The Great Northern Brewery (GNB) produces beer in keg and bulk beer for bottling and canning for both the domestic and export markets. The brewery operates a combination of three shifts per day in brewing, two shifts per day (6 a.m. to 2 p.m. and 2 p.m. to 10 p.m.) in Fermentation/Maturation, Filtration and Quality Assurance, and kegging on days (8 a.m. to 5 p.m.). The brewery operates on a five day week at present with occasional six or seven day working to meet peak requirements. There are 180 people employed at the site.

Process:

The cereals for brewing namely malt, maize and caramalt are delivered in bulk and transferred to designated silos in the brewhouse block. The malt is first milled and mixed in the mash tun in the appropriate proportion and at a specified temperature with maize and water. The purpose of mashing is to use the enzymes in the malt to convert the starch to fermentable sugars and to break down the proteins and other malt materials. The mash is then transferred to the lauter tun where the worts or clear extract is separated from the spent grains and then transferred to the copper wort kettle where it is boiled and the hops and hop extract added.

At the end of boiling, the worts are transferred to the whirlpool where the trub (solid material, e.g. grains, hops, protein precipitate from worts after mashing stage) is separated from the clear worts by centripedal action. The clear worts are then cooled to 9 - 11^{o}C and transferred to fermenting vessels and pitched en route with brewing yeast. At the end of fermentation the flocculated yeast is first removed and the beer transferred to a Storage Tank. The beer is then filtered, carbonated and nitrogenated as appropriate, and either kegged on site or filled into tankers for bottling or canning at other locations.

Air Emissions:

There are three boilers on site which are fuelled by natural gas, and one generator which is fuelled by gas oil. The three natural gas boilers emit negligible levels of SO_2, while levels of NO_x emitted are typically in the region of 70 - 80 mg/m^3. The Diesel Generator which burns gas oil with an average sulphur content of 0.15%, is used as back-up boiler during the maximum demand period from November to February. The main concern associated with this boiler is the high CO emissions which are in excess of 1000 mg/m^3 and would appear to indicate very poor combustion efficiency. The CO emissions from this boiler were modelled using the conservative screen model and fell well within the WHO 1 hour guideline value. The company are required to address the combustion efficiency of the Diesel Generator in the EMP.

The GNB produces large quantities of CO_2 during fermentation. The two largest sources are the impure gas vent (CO_2 containing > 40% air - this gas cannot be liquified) and the knock out pot on the CO_2 balloons. The upgrading of the CO_2 recovery plant in 1992 has led to large reductions in the emissions of CO_2 gas. In the event that the CO_2 recovery plant was not operational, all the CO_2 would be vented to atmosphere at VEP 314, which is on the knock out pot for the CO_2 collection balloons. The capacity of the CO_2 Recovery unit is 2 tonnes per hour. The quantity of CO_2 actually emitted from the site is in the region of 3,200 tonnes per annum, as compared with approximately 1.8 million tonnes emitted from Irish Industrial sources in 1995. According to the company, the current CO_2 liquifier enables the GNB to collect CO_2 gas as low as 60% purity which is 'state of the art' for CO_2 liquefaction plant and therefore, it is not possible to improve on current levels of CO_2 recovery.

Dust emissions from the Destoner cyclone (VEP 108) were sampled isokinetically. The results from four samples show particulate levels from 28 - 40 mg/m^3 and maximum mass flow of 0.25 kg/hr. Based on these results both the concentration and mass flow of dust from the Destoner are below the new plant BATNEEC limit values for Total Particulate Matter (50 mg/m^3 at a mass flow $\geq$ 0.5 kg/h). However the company are required to carry out annual dust monitoring on the emissions from this vent.

The dust emissions from the malt cleaning flat screens (VEP 107) and the malt intake dust filters (VEP 109) are significantly below the threshold limits at which new plant BATNEEC limits apply, and so the emissions from these vents are considered as minor. There is no requirement for monitoring from these vents.

Fugitive emissions: These occur during the filling of storage tanks (oil, spent grain silos), due to the displacement of what is essentially headspace gas. Emissions from these sources are small in quantity and their composition depends on the vessels

from which they originate. From time to time small leaks of ammonia will occur from the refrigeration system. However there is an ammonia detection system in place in the refrigeration plantroom. Leaks of CO_2 from the low pressure collection balloons give rise to fugitive emissions. This emission is minor and localised. Should the fugitive emission rise above a set level, the CO_2 detection system would automatically activate the balloon room extraction fans. Nevertheless the company are required to investigate the feasibility of reducing their fugitive emissions in the EMP.

Sewer Emissions:

The effluent discharge to sewer by the GNB comprises a number of waste streams, including weak worts, tank bottoms, decanted beer, CIP rinses and spent CIP solutions. Prior to exiting the site, the effluent from GNB passes through a pH neutralisation tank and then through a "Watering Can" system for measuring volume flow rate. The main characteristic of brewery effluent is its high BOD load. One of the main process waste streams discharged to sewer from GNB is a slurry of beer and yeast which arises primarily from the centrifugation of beer ex. fermenter vessels. The brewery is currently evaluating a cross-flow filtration technology as a means to separate the yeast and beer streams, to give two re-usable fractions. A feature of the current Trade Effluent Licence (TEL) for GNB is that the load contained in this licence applies to the load discharged by Guinness Ireland Group (GIG) from the GNB site, Carrick road, and from Dundalk Packaging (DP), Ardee road, i.e. the licensed load is a combined load for the two sites. In addition these two Guinness sites have secured the agreement of Dundalk UDC for higher interim limits for volume and COD load in order to enable the sites to operate within licence limits while the effluent management initiatives are being implemented.

The combined load was devised to provide considerable flexibility to both sites to balance their effluent discharges within the combined limits. The TEL issued on the 05/12/96 provides the basis for the commercial agreement entered into by the Guinness companies and Dundalk UDC on 02/09/97, for the installation of a new municipal WWTP for Dundalk. The WWTP is expected to come into operation in the year 2000. The capital contribution from the Guinness Companies and the scale of revenue charges agreed were determined on the basis that combined effluent discharge limits would apply to the two sites.

The concentration figures included in the Section 97 response from the UDC are almost double those contained in the existing TEL , while the loading figures are pretty similar. The variable nature of the effluent generated on site combined with the limited balancing associated with the pH neutralisation tank (18 m^3 capacity) on site, would suggest that the increased concentrations included in the Section 97 will allow for some degree of flexibility, as the company and the Agency have recorded a number of exceedences for some parameters in the TEL. The increased Section 97 concentration figures would also appear to be related back to the combined limits in the TEL which specifies eight hour composite samples, but the TEL is set out in such a way as to make it very difficult to interpret and enforce.

The applicant has pointed out that by continuously reducing water usage on site, the knock on effect is that the concentration values in the effluent have gradually increased. In addition they point out that the successful separation of the stormwater and foul sewer drainage system as specified in the PD, would also lead to an increase in the concentration limits in the final effluent. However if GNB commence with the immediate installation of the yeast recovery plant, then this should lead to a gradual reduction in the concentration and load for all the parameters specified. The reduction of the organic load to the pH neutralising tank is included in the objectives and targets. It is also considered appropriate to include a condition requiring investigation into the feasibility of installing a balancing tank in order to try to regulate the load being released to the sewer at any one time (see condition 6.5 of PD)

The Section 97 from the UDC did not specify any limits or include monitoring requirements for parameters such as total phosphorous, or ammonia. The results submitted by the company in the IPC application were very variable and so it is considered that the monitoring of these parameters on a quarterly basis would be appropriate as required under Schedule 2(iii) of the PD. In addition, the Section 97 response from the UDC specified that the monitoring of parameters such as BOD, COD, SS, and should be on the basis of eight hour composite samples, total nitrogen on the basis of 24 hour composite samples, and pH on the basis of two hour composite samples as set out in the TEL. However the standard 24 hour composite sampling criteria has been included in Schedule 2(iii), as the inclusion of the above mix of composite sampling requirements would have been extremely confusing.

GNB eventually submitted loading figures for their individual plant as requested by the Agency, and these are identical to the loading figures contained in the Section 97, but includes provision for a 25% load reduction by the end of May 2000 with the installation of yeast recovery. The discharge levels after start up of the WWTP reflect the current plans for brewing and kegging operations on the site over the next 3 - 5 years. They allow for:

* reductions in COD and SS loads as a result of yeast recovery.
* increase in production on site from 1.4 to 1.8 million hl/yr over the period.
* pro rata increase in decanting of returned keg beer.

For the GNB site, the effluent arising from the different production areas is collected together with stormwater into a common drain, and discharged at a single discharge point on the northern periphery of the site. Prior to 1985, the storm and foul drains at GNB were separate systems. However in 1985 at the request of Dundalk UDC, the storm and foul drainage systems were combined in order to rationalise discharges from the site into the Council's drainage system. With the new Dundalk UDC treatment plant coming on stream, the separation of the foul drains from the stormwater system is particularly relevant in order to reduce the hydraulic load to the WWTP. This requirement has been included in the EMP. While the drainage network for the separation of the stormwater and foul sewer drainage systems on site is already in place, the main problem is that the receiving water drain/canal off site is currently blocked up and overgrown, and according to the company there is a dispute between Dundalk UDC and CIE as to who is responsible for cleaning up this drain. Dundalk UDC were contacted in order to try to clarify this situation, and they stated that C.I.E. were responsible for cleaning out this drain and that they had been given an undertaking that this work would be carried out in the near future.

The Agency received an unsubstantiated allegation that the company had two emission points to sewer rather than the one discharge point as indicated in the IPC application. Nevertheless the Agency wrote to the company in order to clarify the annual water usage and process waste water discharged to sewer on site. The company provided figures for annual water usage (440,000 m^3) and the recorded effluent discharge (364,000 m^3). The balance of 76,000 m^3 was attributed to boil off, evaporation, and steam venting during the production process. The company confirmed that all trade, domestic, and the majority of the surface water run-off discharge from the site via discharge point SEP-101. The run-off from the roof of the garage is collected into a manhole and discharged to the UDC sewer.

Impact Assessment of the Brewery Discharge to the Estuary and Dundalk Bay:

The condition of the effluent as discharged from the brewery to the Council sewer is summarised in Table 1 below. Values given for the various parameters are average daily values based on analyses over the period July - December 1998, inclusive.

Table 1: Condition of Effluent as Discharged to Sewer

Parameter	Units	Ave. Daily Value
pH	-	6 - 10
Temperature	^{O}C	24
Volume Flow	m^3/d	1,100
BOD Load (estimated from COD)	kg/d	4,290
Nitrogen Load (Total N)	kg/d	132
Phosphate Load (Total P)	kg/d	30

In the table above, the BOD values are derived from measured COD values using a COD/BOD ratio of 1.75:1.

The effluent from the brewery enters the Council sewer and flows under gravity to one of the four pumping stations on the Dundalk main drainage system. The four pumping stations transfer industrial and urban waste water by rising mains to a common outfall at Soldier's point where the waste water is discharged untreated to the Estuary of the Castletown river. The most comprehensive data available on the discharge at Soldier's point are contained in the EIS prepared for Dundalk UDC on the proposed WWTP in 1994. The current effluent discharge load from the brewery is compared in Table 2 below, with the load from the brewery in 1992 and with the total Council load at the time (i.e. total industrial and urban wastewater).

Table 2: Comparison of Effluent Loads - 1992 & 1998

Parameter	Units	Total Council Load 1992	Average Brewery Load 1992	Average Brewery Load 1998
Dry Weather Flow	m^3/d	14,952	1,080	1,100
BOD	kg/d	9,753	3,540	4,290
Total Nitrogen	kg/d	483	101	132
Orthophosphate	kg/d	91	22	30

It can be seen from table 2 that the BOD load of the Brewery effluent has increased by ~ 21% since 1992 (due to a 32% increase in output over the same period). The increase in the total nitrogen and phosphate loads has been of a similar order over the period.

The EIS contains the results of five dispersion analyses carried out using a computer model of Dundalk bay. The modelling of the untreated effluent from the outfall at Soldier's point for the dispersal of BOD was of particular interest in the context of assessing the Brewery effluent. The predicted concentrations are shown in Table 3. Note; The predicted concentrations exclude background levels, i.e. the concentrations given represent only the impact of the BOD load discharged.

Table 3: Predicted BOD Concentrations (mg/l) in Dundalk Bay from EIS Dispersion Modelling (1992)

Location	Significance	Maximum	Minimum	Mean
Site 1	Limit of Giles Quay Bathing area	0.011	0.0083	0.0096
Site 2	Limit of Blackrock Bathing area	0.199	0.159	0.179
Site 3	Bird Sanctuary	1.557	0.555	1.056
Site 4	White Fish Nursery Grounds	0.385	0.038	0.211
Site 5	Area of Potential Mariculture	0.486	0.417	0.451
Site 6	Area of Potential Mariculture	0.009	0.0058	0.0075

In mathematical modelling of BOD dispersion in receiving waters, there is a direct proportional link between the input load to a particular scenario and the resultant concentrations predicted for that scenario. The impact of the current discharge from the brewery can be predicted by extrapolation. Table 4 below shows the predicted

contributions to BOD concentrations in the receiving waters arising from the current discharge from the brewery. These values are derived by multiplying the values in Table 3 by 0.4, which is the ratio between the current discharge load from the brewery (4,290 kg/d) and the discharge load modelled in the EIS (10,773 kg/d).

Table 4: Predicted Contributions to BOD Concentrations (mg/l) from Current Brewery Discharge

Location	Significance	Maximum	Minimum	Mean
Site 1	Limit of Giles Quay Bathing area	0.004	0.003	0.004
Site 2	Limit of Giles Quay Bathing area	0.08	0.064	0.072
Site 3	Bird Sanctuary	0.623	0.222	0.422
Site 4	White Fish Nursery Grounds	0.154	0.015	0.084
Site 5	Area of Potential Mariculture	0.194	0.167	0.180
Site 6	Area of Potential Mariculture	0.004	0.002	0.003

It can be seen from Table 4 that the highest predicted contribution to BOD levels attributable to brewery effluent, occurs at Site 3 which is adjacent to the point of discharge at Soldier's Point. The maximum predicted contribution to BOD levels is 0.623 mg/l, with a mean of 0.422 mg/l. In the Bay itself (Site 4), the predicted contribution to BOD levels reduces to a maximum of 0.154 mg/l, with a mean of 0.084 mg/l.

Impact on Beneficial Uses, Habitats, Flora & Fauna

The EIS states that the tidal mud flats and salt marshes of Dundalk bay are recognised as one of Ireland's most important coastal sites for ecological and ornithological reasons. The area is designated as a Special Protection Area and is proposed for a Natural Heritage Area. The EIS also notes that Castletown Estuary, Ballymascanlan Estuary, and Dundalk bay is of international importance for the number of wintering birds residing there.

The following is a summary of relevant conclusions (in the context of the impact of the brewery discharges) contained in the EIS.

- The consultants concluded that there is no evidence (1992) to show that the discharge from the Council into the Castletown Estuary are impairing the value of the Bay as a fishery or nursery ground, or the passage of migratory fish.

- The salt marsh and tidal flats support a large number of birds which may in part, be due to organic enrichment of the area supporting a huge benthic population. However, the effect of organic enrichment is not so severe as to endanger the welfare of the primary users of the resource. Fish do not seem to suffer unduly and migratory fish can easily pass up the river.

- The relative paucity of nitrate in the water (between the docks and Soldier's Point) has prevented any severe problems with eutrophication. Fortunately, from this point of view, nitrate is totally depleted during the spring bloom of algae and cannot sustain a nuisance bloom or feed an extensive growth of nuisance macro-algae.

- The accumulation of nutrients in the water of Dundalk Bay (which has a poor exchange with the Irish Sea) is leading to slow eutrophication.

The Oxygen Regime;

The conclusion drawn in the EIS was that there was no evidence of any significant sag in oxygen concentration at any depth along the length of the estuary (1992) or in the Estuary east of Soldier's Point (1981/1984 survey). The results of both sets of

surveys also suggested that nitrification did not play a significant role in oxygen depletion in the estuarine waters.

Conclusion;
Surveys of the water quality in the estuary and Dundalk bay, carried out by the EPA from 1992 - 1994 and published in 1996, noted that the inner bay was still in receipt of significant pollution loads while conditions in the outer bay continued to be generally satisfactory. The nature and content of the current discharge from the brewery are essentially unchanged from 1992, though the effluent load has increased by approximately 22%. It is considered that the current discharge from the Brewery does not have a significant environmental impact on the receiving waters, and the commissioning of the new WWTP should help to reverse the eutrophication of Dundalk Bay. As the loading limits specified in the PD are similar to those included in this EIA update, it would be expected that the environmental impact of such a discharge would not be significant.

Surface Water Emissions:
There are no direct emissions to surface water from this facility. The majority of the stormwater is combined with the foul drainage systems into a common drain and discharged from a single discharge point (SEP-101), which connects to the UDC sewer at manhole no. F27. The run-off from the roof of the garage at the south end of the site is collected in a manhole (M26) and discharged to the UDC sewer. The company are required to address the separation of the clean water from the foul sewer discharge under the EMP, as outlined earlier in this report .

Groundwater:
A leak of Heavy Fuel Oil (HFO) from one of the two oil storage tanks on site occurred in 1987. A residual amount of HFO leaked into the subsurface soils beneath the bunded tanks. A Soil Contamination Survey was carried out to determine the extent of any contamination that occurred. The conclusion from this survey was that if this residual slug of contaminated fill material were removed, then the remaining low levels of Diesel Range Hydrocarbons (DRO) in the fill and subsoils downgradient of the bund would gradually degrade. Even at their present levels, the concentrations of DRO in these outside areas do not present a significant risk.

The slug of contaminated material was excavated down to a depth of 3.5 metres. No evidence of staining or odours were identified within the boulder clay. Approximately 25 m^3 of fill material was removed during the excavation, of which 19 m^3 was deemed suitable for disposal at the local authority landfill in Dundalk. The remaining 6 m^3 of heavily contaminated material was transferred by MinChem Environmental Services to Germany for disposal. A copy of the Certificate of Disposal was forwarded to the Agency. Although the volume of groundwater in either formation is insufficient to sustain even a local groundwater supply, the consultant has recommended that the three bedrock groundwater wells BH-A, BH-B, BH-C (as outlined in attachment 15C of the application) be maintained for monitoring of groundwater quality beneath the site. Monitoring of the groundwater will allow an assessment of the effectiveness of the remediation programme.

The PD specifies a requirement for annual monitoring at the three wells, and the situation may be reviewed depending on the levels of contamination determined. There is an underground sump which is used to contain any spillage from the diesel generator on site. According to GNB, the tank design does not allow pressure testing, though the volume of oil discharges are very small, and the sump is emptied at least annually. An investigation of the integrity of the underground sump is included under Condition 9.4.2 of the PD.

Noise emissions:
According to the company the impact of the Brewery's operations on the noise levels at the boundary of the site and at noise sensitive locations is not significant. The

GNB have not received any complaints of noise nuisance in the past five years. Although the noise survey did not detect any specific impact from the electricity generator at the boundary of the site, the company is investigating installing attenuated louvers on the generator building in order to reduce the noise emissions from this source. This proposal has been included in the EMP.

Waste Management:
The main hazardous wastes generated on site include laboratory solvents (0.6 m^3/ann), waste oil (10 m^3/ann), and fluorescent tubes (300/yr). The other main waste is spent filter material (130 m^3/mth) which is generated during the filtration process.

Decanted beer generated on the GNB site is currently diverted to sewer . However the Guinness Ireland Group is examining the feasibility of consolidating the decanting of all returned keg beer on to a single site such as Dublin, Dundalk, or Kilkenny. Should the GNB site be selected, the plan would be to tanker the returned beer off site to a waste management facility such as the one being constructed by Greenfields Environment Ltd., in Fermoy, to process wastes into liquid fertiliser products. Provision has been made for GNB to be included as the main site for the decanting of beer from the Guinness Ireland Group (see Schedule 3(ii) of PD).

Environmental Improvements:
The Brewing industry generally is recognised as being one with high resource consumption. Resources used include energy, water and grist material (malted barley etc). Significant amounts of waste is currently used as animal feed and it may be possible to increase this further, or to transfer the trub to a waste management facility for recovery/re-use.

The trending of resource consumption is often used as an indication of overall process efficiency and the EMP requires this practice to be implemented on site. A hectolitre of beer is used as the defining quantity and resources are measured against this;

- Amount of malt used
- Amount of spent grains generated
- Water consumed
- Energy Consumption

The United Nations Environment Programme has published in a 1996 document - Environmental Management in the Brewing Industry, ranges of these ratios achievable in well run breweries and these can be used, through the EMP, to ensure continual improvement in brewery resource consumption.

Complaints:
The Agency has not received any complaints in relation to the activities carried out on site.

Submissions:
There was one submissions received from the Department of the Marine.

1. Department of the Marine

The submission stated that the Department would normally insist on maximum BOD/Suspended Solids levels of 20/30 for an effluent which will reach any surface water. They recommend that the most stringent requirements for the emissions of phosphorus be incorporated in the PD.

Response;
All trade effluent generated at this facility is discharged to the foul sewer drainage system which is under the control of Dundalk UDC. The Section 97 response from the UDC did not specify any limits or include monitoring requirements for parameters

such as total nitrogen, total phosphorous, or ammonia. The results submitted by the company for total phosphorus emissions in their IPC application varied from 9 - 75 mg/l. The monitoring of these parameters on a quarterly basis has been included under Schedule 2(iii) of the PD.

The assessment of the impact of the effluent discharge from the Guinness Group Breweries (GNB & DP) on the downstream receiving waters indicated that the current discharge from the brewery does not have a significant environmental impact on the receiving waters. The commissioning of the new WWTP facility for Dundalk which is scheduled for commissioning by June 2000, should ensure that the discharge from GNB will receive the necessary treatment to meet the relevant legislative requirements.

Recommendations:

That the Board approve the Proposed Determination as submitted.

Signed

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Tony Dolan