Appendix 3. Description of the Development

3.1. Residuals Management Plan

Residuals Management Plan

Great Island Generating Station

INTEGRATED PREVENTION POLLUTION CONTROL

LICENCE REGISTER NUMBER: P0606-02

LICENSEE: ENDESA

Report P04E318A – R1

Revised April 2009

TMS Consultancy Ltd.

Table of Contents

1. Introduction

1.1 Background

Environmental management at Endesa's Great Island Generating Station is regulated by the conditions of Integrated Pollution Control Licence (IPPC Licence) Reg. N° P0606-02 issued as Licence number 715 in January 2005 by the Environmental Protection Agency (EPA).

Clause 14 of IPPC Licence Reg. N° P0606-02 requires the preparation and submission to the Agency of a Residuals Management Plan (RMP). The specific requirements are laid down in Condition 14, as follows:

14.1 Following termination, or planned cessation for a period greater than twelve months, of use or involvement of all or part of the site in the licensed activity, the licensee shall, to the satisfaction of the Agency, decommission, render safe or remove for disposal/recovery, any soil, subsoils, buildings, plant or equipment, or any waste, materials or substances or other matter contained therein or thereon, that may result in environmental pollution.

14.2 Residuals Management Plan:

14.2.1 The licensee shall prepare, to the satisfaction of the Agency, a fully detailed and costed plan for the decommissioning or closure of the site or part thereof. This plan shall be submitted to the Agency for agreement within six months of the date of grant of this licence.

14.2.2 The plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement as part of the AER. No amendments may be implemented without the written agreement of the Agency.

14.3 The Residuals Management Plan shall include as a minimum, the following:

14.3.1 A scope statement for the plan.

14.3.2 The criteria which define the successful decommissioning of the activity or part thereof, which ensures minimum impact to the environment

14.3.3 A programme to achieve the stated criteria.

14.3.4 Where relevant, a test programme to demonstrate the successful implementation of the decommissioning plan.

14.3.5 Details of costings for the plan and a statement as to how these costs will be underwritten.

14.4 A final validation report to include a certificate of completion for the residuals management plan, for all or part of the site as necessary, shall be submitted to the Agency within three months of execution of any part of the plan. The licensee shall carry out such tests, investigations or submit certification, as requested by the Agency, to confirm that there is no continuing risk to the environment.

This Report is prepared to address the above requirements.

1.2 Basis of RMP

The basis of the RMP is as follows:

- A review of the activities carried out at the station, including processes and services.

- Identification of existing and potential hazards, including evaluation of materials consumed and wastes generated.
- Consideration of historic environmental incidents and remediation works undertaken.
- Identification of items of plant and other materials that may be decommissioned, rendered safe or removed from the site for disposal or recovery in the event of closure.
- Identification of locations where cleaning, decontamination or remediation works may be required in the event of decommissioning to prevent environmental pollution.

1.3 Station Features

Great Island Generating Station is located in south-west Co. Wexford near Campile at the confluence of the River Suir with the River Barrow estuary.

The station's generating capacity stands at 240 MW and it was developed in two stages, comprising three generating units. The initial development consisted of two 60 MW units that were commissioned in 1967 and 1968. Each unit comprises a VKW boiler and a Parsons turbo-alternator. The follow-on development consisted of a single 120 MW unit that was commissioned in 1972. It comprises a Fives boiler and Parsons turbo-alternator.

The station was constructed on lands that were formerly in agricultural use and some lands were reclaimed from the estuary during development of the site. The total area of the site is approximately 65 hectares (ha).

The main features of the station include:

- Station main building housing three boiler and turbo-alternator units.
- Jetty for unloading marine oil tankers having a capacity to accept vessels up to 20,000 dwt. The cooling water intake is incorporated into the unloading jetty.
- Five tanks for storing heavy fuel oil (HFO) with a total capacity to 85,000 t.
- Minor HFO tanks including transfer tank, test tank and oil stripping tank for use in oil unloading.
- Diesel oil tank and minor vehicle refuelling tanks.
- Waste oils storage tanks.
- Cooling water system comprising pumphouse, inlet and outlet culverts, and discharge channel.
- Service reservoir and tanks for storage of incoming and treated water.
- Water treatment plant for processing of water prior to its use in the boilers.
- Neutralisation plant for treating boiler washing effluents and water treatment plant effluent.
- Generator transformers and high voltage switchgear.
- Unit and house transformers.
- Two reinforced concrete chimneys, one each serving the two 60 MW units and the 120 MW unit respectively.
- Administrative offices and canteen.

Please note that the 110 kV and 220 kV transmission compounds were removed from the scope of the IPPC Licence P0606-02 in Technical Amendment C, December 2008. URS completed an

Environmental Site Assessment on the Switching Yards and concluded that "the subject areas are suitable for the continued industrial land use. No remedial action is considered necessary within the subject areas under a continued industrial land use scenario"

- Supporting facilities including the following:
  - fire protection pumphouse
  - fuel oil pumphouse
  - diesel generators
  - chemicals storage tanks
  - chemical laboratory
  - workshop and stores

Bedrock underlying the site comprises volcanic rocks of the Campile Formation. This consists of zones of siliceous volcanic ash and crystalline felsite. There is an overburden of glacial till and alluvial silt.

The site closed and verified an on site landfill area comprising two cells, cell 1 and cell2. Cell 1 is 22,500 m2 and cell2 is 13,500 m2. The design of the closure was based on a URS report (October 2003) and the technical specification for the closure and capping was based on that report. URS also conducted an Environmental Risk Assessment on the waste disposal areas and concluded that there was an associated low environmental risk. The cells were capped and closed in conjunction with a Quality Assurance assessment of the closure by URS ("Closure of Landfill at Great Island Power Generating Station – Construction Quality Assurance Report" 2008). The latter report concluded that "construction of the landfill cap was completed in general accordance with the specifications and drawings."

The residuals management plan thus reflects the remaining areas of the site within the scope of the IPPCL.

2. Scope of RMP

2.1 Application of RMP

Endesa has no current plans to decommission all or part of the plant, outside of the exclusions and closures outlined in Section 1.3 above. The scope of this RMP addresses the key issues that would occur in the orderly shut-down of all of the station activities.

Condition 14.1 of IPPC Licence Reg. N° P0606-02 refers to planned cessation of operations for a period of greater than twelve months. The role that Great Island Generating Station will play in the Irish electricity industry close to the time of its decommissioning will be determined by a complex array of issues and cannot be foreseen at this point in time. While a section of the plant or all of it may be unused or not in operation for a period of twelve months, circumstances could dictate that it be maintained until such time as production resumes. While this has not happened at Great Island, similar long-term storage of plant has occurred in the past at other power stations where units were mothballed for a number of years and subsequently became available again for commercial operation. In such an event the RMP will not be implemented.

There are no direct references in this RMP to partial closure. While some ancillary and support facilities at Great Island are unit related, most are not. Additionally, there are significant practical constrains involved in safely segregating working from non-working station plant.

Under a scenario involving discontinued use of one or two of the station's three units, most ancillary and support facilities would remain operational and the station would continue to operate under the conditions of IPPC Licence Reg. N° P0606-02.

2.2 Areas Addressed

General

The scope of the RMP will be the decommissioning of the site activities related to the electricity generation process and disposal of residuals arising therefrom.

This will involve decommissioning of:

- Production facilities
- Ancillary / support facilities
- Storage areas

It will also include the disposal of all residuals arising from the decommissioning itself. Here the term "residuals" is deemed to include any materials remaining on site following process decommissioning. This includes materials and wastes.

Key Issues

The principal issues to be considered in the RMP for Great Island are identified as follows:

- Liquid fuel (HFO and diesel) removal / cleaning from pipelines and tankage.
- Residual chemicals and chemical storage tank cleaning.
- Boiler cleaning.
- Drainage line cleaning.

Materials

The station stores holds approximately 3,000 coded items with an equivalent annual turnover of stock. Station purchases run to in excess of 2,500 orders annually. Most items are used in operations and maintenance activities and are of no environmental significance.

A list of the environmentally significant materials used at the station and to be disposed of during decommissioning, derived from Section 10 of the station's application for its IPPC Licence, is presented in Appendix I. The list contains details of the maximum quantities of these materials stored on site. The actual quantities remaining at shut-down would likely be much less due to scaling down of activities prior to closure, allowing a staged reduction in inventory.

Wastes

Site operations generate hazardous and other wastes. The types of waste generated are outlined in Schedule 3 of IPPC Licence Reg. N° P0606-02 and are presented as Appendix II. The list contains details of the quantities of these wastes arising annually, as indicated in the station's application for its IPPC Licence.

The amount of wastes generated will increase significantly during implementation of the RMP with the following being of particular note:

- Batteries.
- Waste lubricating oils.
- Waste transformer oils.

Additional hazardous wastes that may arise during decommissioning are as follows:

- Smoke detectors.
- Chemical paints and additives.
- Refractory brick from station chimneys.

Wastes arising during decommissioning will be managed in accordance with Condition 7 of IPPC Licence Reg. N° P0606-02.

Asbestos

Asbestos was used widely in construction of Units 1 & 2 at Great Island but very little was used in the construction of Unit 3.

In 1990 a decision was taken to remove all remaining asbestos material from Great Island and a survey of the plant was undertaken to identify where it was present. The asbestos was removed and was stored on site until 1992 when all asbestos waste, including that excavated from a designated on-site asbestos burial site, was exported to a licensed disposal site in Finland.

Small amounts of asbestos may still be incorporated in certain small items such as gaskets and gland packing. However, large-scale removal from the plant of asbestos insulation and lagging will not arise during decommissioning.

Environmental Incidents

The principal accidents or incidents of environmental significance that have occurred at Great Island were as follows:

- An oil spill in the 1970s resulted in oil being leaked from the stripping tank to the estuary during oil unloading.
- In 1985 interference with equipment in the oil storage bund led to quantity of oil being lost from one of the tanks. All oil was retained within the concrete bund.

Neither of the above lead to contamination of station lands.

Other Conditions of IPPC Licence Reg. N° P0606-02

Certain obligations may arise as a result of compliance with Condition 9.2.4 and of IPPC Licence Reg. N° P0606-02 as follows:

> 9.2.4 The licensee shall implement the groundwater programme as approved by the Agency in correspondence of 16/09/03, for removal of on-site contamination and remediation of groundwater

It is envisaged that discharge of any obligations arising from the above will predate decommissioning of the station. No significant aftercare management is predicted.

Should the opposite be the case with station closure and decommissioning occurring sooner than anticipated, works within the scope of the RMP will be completion of outstanding actions on foot of any obligations arising from the above.

Long-term Liabilities

An underground tank that was previously used for storing petrol was decommissioned some years ago.

There has been no recorded spillage of chemicals at Great Island.

The environmental monitoring programme conducted at Great Island is in accordance with the requirements of Condition 11.1 of IPPC Licence Reg. N° P0606-02. Monitoring in accordance with Schedules 1(ii), 1(iii), 2(ii), 2(iii), 4(i) and 4(ii) is designed to identify any impacts associated with operation of the station so as to allow effective remedial action or minimise environmental pollution.

Given the current knowledge concerning the long-term environmental liability associated with the site and that full compliance with IPPC Licence Reg. N° P0606-02 will ensure that additional liability will be avoided, a significant soil and groundwater programme at station decommissioning is not anticipated.

2.3 Annual Review

The RMP will be reviewed annually.

The annual review of the RMP will address all developments at Great Island. The review will also evaluate the scope of the RMP in the context of any environmental incidents at the station.

The RMP will be updated as necessary.

2.4 Exclusions

The RMP applies to the entire site, except as follows:

- Successful decommissioning is determined as being completed when all buildings, equipment, wastes or any other materials that could result in environmental pollution are removed from the site and recycled, recovered or disposed of in accordance with all regulations in force at that time. The RMP will result in a decommissioned and decontaminated site suitable for future industrial use. All buildings and some site services, whilst emptied and cleaned as part of the RMP, will remain in place following decommissioning.
- The structural form of station buildings is conventional structural steel supported on reinforced concrete foundations. Gantries and walkways for access to plant and equipment are constructed of stainless/galvanised steel open grating type flooring. These are supported on steel beams and columns. External walls comprise profiled metal cladding and roofs are constructed of profiled metal decking on purlins spanning between rafters. The materials used do not pose any environmental threat in the event of station closure, whether they are demolished or remain in place.
- Certain station areas will continue to operate or remain operational. These include facilities such as the following:
  - Diesel supply to back-up engine in the fire protection pumphouse.
- All equipment and plant at Great Island is the property of the station, other than cylinders in which bottled gas is delivered and a pressure vessel (bullet) of 1,500 l capacity in which propane gas is stored. The latter is owned by the supplier who is responsible for maintenance. The supplier will be responsible for removing any remaining propane and bringing the bullet to a safe state.

- Services that are performed by contractors on an ongoing basis include the following:
  - Unloading of marine oil tankers
  - Landscaping of station grounds
  - Rodent control
  - Hygiene services
  - Window cleaning
  - General building work

  The above activities have no implication for the RMP.

3. Criteria for Successful Decommissioning

The criteria for successful decommissioning to ensure minimum impact to the environment with respect to residuals management are as follows:

- The appropriate decontamination of all plant and equipment.
- Documented reports of all raw materials dispatched from the site.
- Documented reports on the disposal of hazardous waste including all certification required under regulations in force at the time.
- Documented reports on the disposal of non-hazardous waste including all certification required under regulations in force at the time.
- Clearance and documentation indicating final disposal for any asbestos found to be present in the station.
- Documented post-closure ADF, soil and groundwater programmes where appropriate.
- Secure archiving of all documentation.

4. Implementation of RMP

4.1 Strategy

Endesa intends to manage and execute the RMP using internal resources, supplemented as necessary and appropriate with external resources.

All external resources used for cleaning, waste disposal, etc. will be fully approved and licensed as appropriate.

A Residuals Management Team will be created to manage and execute the entire project and key activities will be supervised by personnel with appropriate experience and expertise. Only suitably qualified personnel will carry out decontamination works.

Options that will be available with regard to various residuals are broadly as follows:

- Reuse — Removal for reuse at other power station(s).
  Return to supplier
- Recovery / Recycling: — Sale to third-party
- Disposal — Disposal as waste

Waste sent off-site for recovery / recycling or disposal will only be conveyed to a permitted waste contractor and only transported from the station to the site of recovery / disposal in a manner that will not adversely affect the environment.

4.2 RMP General Activities

The activities within the RMP will be as follows:

- Cessation of all production.
- Cancellation of all incoming deliveries of materials to the station.
- Termination of all contracts other than those that are concerned with the RMP or related to safety of personnel or the environment.
- Return of materials to suppliers where possible, for resale or reuse.
- Isolation and purging of transfer lines from bulk storage to direct pipe contents back to bulk storage.
- Shutting and blanking of supply lines from bulk storage for oils and chemicals to intermediate storage and/or dilution tanks.
- Cleaning and decontamination of all plant and equipment.
- Removal of all laboratory chemicals.
- Cleaning and decontamination of all laboratory analytical instruments.
- Cleaning, decontamination and inspection of bunds, sumps and underground drains.
- Removal of old and obsolete equipment and destocking of the workshops and stores.
- Isolation and disconnection of all electrical supplies to pumps and motors.
- Draining of oil from obsolete transformers that will not be reused elsewhere.
- Decommissioning of redundant oil-filled cables and draining of header tanks.
- Cleaning of residues from boilers and cleaning and blanking off of fuel lines.
- Draining and cleaning of lube oil systems.
- Draining of water systems such as raw feedwater tanks, condensate storage tanks and supplementary cooling systems.
- Transfer of ion exchange resins to drum storage.
- Cleaning of water treatment neutralisation tank and removal of all waste and effluent for appropriate disposal.
- Maintenance of parts of the water supply system to provide wash-down and cleaning facilities during decommissioning and to meet the ongoing needs for fire protection and sanitary services.
- Maintenance of site drainage system and oil interceptors during decommissioning activities.
- Secure archiving of all relevant documentation including drawings, instrumentation diagrams, validation documentation, vendor manuals and data, project files, maintenance records, inspection records, waste disposal records and other appropriate documentation.

- Maintenance of a security presence on site on a 24-hour basis for ongoing monitoring of the site from a safety, fire protection and environmental perspective.
- Maintenance of defined site access procedures.

It is anticipated that any necessary decontamination of plant and equipment will be carried out on site. It will primarily involve cleaning in place and power washing of internal and external surfaces.

Endesa will seek approval from the Agency for any decontamination procedures and monitoring requirements to be employed.

4.3 Residual Liquid Fuel, Tankage and Pipelines

Drains in the areas where these facilities are located will be isolated before commencement of decommissioning activity.

Heavy Fuel Oil (HFO)

Great Island is fired on HFO. Its tank farm comprises five tanks each of 17,000 t capacity. There are also a transfer/service task of 4,000 t capacity, a test tank of 300 t capacity and a transfer pipeline stripping tank of 300 t capacity.

Tanks are of mild steel construction with man-made mineral fibre (MMMF) and aluminium cladding insulation. A programme of inspections of oil tanks, which includes out-of-service inspections and NDT, is undertaken in accordance with an Endesa in-house standard that specifies requirements for intervals of five, 10 and 15 years for all above ground fuel oil tanks. There have been no recorded losses of tank contents indicative of leakage through a tank base. Furthermore, where panels within tanks were replaced during application of the above in-house standard their condition was not such as to indicate that leakage had occurred. The tanks are thus expected to be in good condition at the time of decommissioning.

The maximum quantity of HFO will be used prior to the cessation of power generation so that the minimum quantity of unused HFO remains on site. Where possible, all pipelines and tanks will be drained using on-site pumps to 'loss of suction' to minimise the remaining HFO residues within tanks and pipework.

Tankage: The most effective method for cleaning of HFO tanks will be to absorb HFO residues by scrubbing / flushing with kerosene, diesel or a similar lighter petroleum based liquid. The kerosene / dissolved diesel will then be pumped to a tanker for treatment and re-separation / re-use of oil fractions and the tank will be jet washed with water / detergent to remove remaining residues. The tanks will then be suitable for either retention on site or removal for clean scrapping.

Pipelines: Pipework will be cleaned by a variety of methods including an in-situ pneumatic pipe cleaner / scourer machine (a 'pig'), retro-jetting with water, flushing with water or kerosene, or high-pressure air flushing. At this stage of cleaning the pipework will be in an acceptable state for either retention on site or removal for clean scrapping.

All cleaning activities will be facilitated by maintaining the steam heating system for all pipes and tanks to supply steam to aid the flow and removal of oil.

Diesel

The station's storage of diesel consists of a single tank of 55 t capacity within the HFO storage area. Fuel for station vehicles is held in a dedicated tank of small capacity.

The maximum quantity of diesel will be used prior to the cessation of power generation so that the minimum quantity of unused diesel remains on site.

Similar methods to those used for HFO facilities will be used for tankage and pipelines containing diesel.

4.4 Residual Chemicals and Tankage

The main bulk chemicals used at the station and that will be addressed in decommissioning or closure are as follows:

- Sulphuric Acid (H_2SO_4): Used in water treatment.
- Sodium Hydroxide (NaOH): Used in water treatment and in treatment of boiler washes.
- Hydrazine (N_2H_2): Used as an oxygen scavenger in boiler feed water.
- Ammonia (NH_3): Used for pH control in boiler steam cycle.

Stocks of the chemicals consumed in operation of the power station will be run down to a minimum at the cessation of power generation. Remaining bulk quantities of chemicals will then be available for either transfer to other power station(s), return to their supplier or disposal by contractors at licensed facilities.

Further to this, bulk storage tanks will be cleaned internally by contractors.

Cooling water is treated with 12 - 14% sodium hypochlorite (NaOCl). Stocks are held in Intermediate Bulk Containers (IBCs), which are delivered and replaced as required by the supplier. Decommissioning will be limited to internal cleaning of delivery pipelines.

With wet chemistry carried out in the station laboratory being substantially eliminated by the use of modern instrumentation, remaining stocks of laboratory chemicals that require disposal will be low.

4.5 Boiler Cleaning

The following activities already take place routinely at Great Island and are managed successfully.

Boiler Storage

A decision on station closure would likely be proceeded by a period where all or some of the station boilers are in storage. Dry storage is currently the preferred method and if this is in use no environmental emissions will result during decommissioning.

Boiler Washing

The fire side of the boilers will be washed with water using a high-pressure low-volume system The washwater from Units 1 & 2 will be drained to an internal floor sump and pumped from there to a steel settling tank. Washwater from Unit 3 will drain via the internal floor drains to an oil interceptor, the outlet from which is valved, where it will be conditioned by dosing with 47% sodium hydroxide (NaOH). It will then be pumped to the settling tank.

When the correct pH is achieved, the solids will be allowed to settle out and the supernatant effluent, being pH6 - pH9, will be discharged to the cooling water channel where it will be added to the cooling water flow in a controlled discharge to achieve a high dilution rate.

The settling tank will be cleaned down and all waste and effluent wiill be removed for appropriate disposal.

The cooling water system will be retained in operational condition until boiler washing is completed.

4.6 Drainage Line Cleaning

Drainage systems within the station involve 13 separate discharges to the Barrow Estuary. These systems, whose designations below are those used in IPPC Licence Reg. N° P0606-02, are broadly categorised as follows:

- Seven discharges fully or partly comprise trade effluents, namely PE2, PE5, PE6, PE7, PE8, SW12 and PE13.
- Two discharges comprise sewage/washing effluent, namely SW3 and SW9.
- Four discharges comprise surface waters/station drainage exclusively, namely SW1, SW4, SW10 and SW11.

Of the above, the discharges that are of concern and key components thereof are as follows:

- SW1 - HFO and diesel tank farm.
- SW4 - Oil stripping tank.
- PE5 - Boiler House of Unit 3.
- PE6 - Engine Room of Unit 3 and Boiler House (part) of Units 1 & 2.
- PE7 - Engine Room of Units 1 & 2, Boiler House (part) of Units 1 & 2 and transformer bunds.
- SW12 - Area east of Unit 3 and an internal sump.

All of the above are protected by oil interceptors and there is no potential for impact upon the Estuary if the drainage system is left in place after decommissioning. However, cleaning of station drains will be required to mitigate the potential for oil residues to be present within pipelines.

This will involve water jetting using the existing oil interceptor system and vacuum tankers. Oil interceptors will be cleaned down and all waste and effluent will be removed for appropriate disposal. No areas of heavy or free product oil residues that would require steam cleaning are expected. On completion of decommissioning the site drainage will be in a suitable condition for removal or more likely to be left in place to continue to provide surface water drainage for the site.

The station will continue to properly operate and maintain the site drainage system prior to and during implementation of the RMP.

4.7 Demolition Nuisance Mitigation

Any demolition works that are carried out in connection with or associated with the RMP have the potential to lead to elevated noise levels and to creation of dust. Additional traffic movements will also arise. The following mitigation measures are proposed:

Noise

All works will be carried out during daylight hours and noise levels will monitored to ensure compliance with the requirements set out in IPPC Licence Reg. N° P0606-02.

Noise minimisation measures will be employed. These will include such measures as using saw-cutting machinery instead of rock breaking equipment.

Dust

Surfaces that have the potential to generate dust during their demolition will be wetted prior to the work commencing.

Demolition on windy days will be avoided to the extent possible.

Traffic

While traffic will arise in the removal from site of residuals, this will coincide with the elimination of current sources of traffic associated with station operations. It is considered that the demolition related traffic will not pose undue difficulties.

5. Test Programme

5.1 Monitoring

The monitoring and reporting requirements set out in IPPC Licence Reg. N° P0606-02 will be complied with in full until the licence is surrendered to the Agency. The monitoring will identify if any contamination of air, surface water, groundwater or soils has occurred during the lifetime of the IPPC Licence.

In the event that a future environmental incident causes contamination of these media, which has not been quantified at the time of the closure of the facility, a test programme will be established as part of the RMP to identify the nature and scale of any associated environmental pollution.

Tests will be carried out on wash waters generated during the decontamination works to confirm that they are suitable for discharge.

While testing has already confirmed that there is no reason to believe that such contamination may be present, soils will be sampled and tested for PCB contamination.

5.2 Validation

Following implementation of the RMP, a validation report will be produced to demonstrate its successful implementation. It will confirm that there is no continuing risk of pollution to the environment from the site.

The Report will address:

- Disposal of materials
- Decontamination of items of plant and equipment
- Decommissioning of plant and equipment
- Results of monitoring and testing
- The need for ongoing monitoring and investigations

The report will be submitted to the Agency within three months of completion of the RMP.

5.3 Environmental Summary Report

In addition to the above validation, in line with ESB's policy in relation to closure of its power stations, a full environmental summary report will be prepared.

This will outline the following:

- The full history of the power station site from its initial development through to closure.
- The various investigations undertaken and reports prepared during the operation of the plant
- The actions taken in the course of the RMP.

The Environmental Summary Report will be made available to future users of the site, whether this is Endesa or a third party.

6. Costing & Financing

Endesa has a very significant working capital and any decommissioning or closure of Great Island would be a well resourced activity. The company has adequate resources of finance and manpower to implement the RMP through to completion.

More significantly, Endesa makes specific financial provision for closure of its power stations.

Further to the above, Great Island site covers a considerable area and being an industrial site it has considerable potential for redevelopment. Its jetty is a significant asset that will remain following decommissioning. Furthermore, much of the plant and equipment will have very significant residual value. The value of the site and its plant and equipment alone provides a fund that greatly exceeds the potential costs of decommissioning.

Specific costings have not been developed for the RMP at Great Island. However, it is evident from the limited number of issues that required inclusion in the scope of the RPM that the company's financial provisions and the value of the assets at Great Island are orders of magnitude greater than the costs that may be incurred.

7. Comment

Since commissioning of its first unit in 1967, the presence of Great Island Generating Station has not resulted in significant environmental impacts and the station will continue to be operated in a responsible manner. Issues that are likely to arise upon closure at Great Island have all be dealt with successfully in the past at other Endesa sites and similar care will be taken when decommissioning at this site.

Appendix I – Key Substances

Material / Substance	Amount Stored	Nature of Use
Algicide (Alkyl dimethyl benzyl ammonium chloride and Ethanol)	0.4 t	Water treatment
Ammonia Solution (35%)	1,500 litres	Boiler treatment
Gas Oil	50 t	Fuel
Heavy Fuel Oil (HFO)	85,000 t	Fuel
Hydrazine Solution (35%)	1.5 t	Boiler treatment
Ion Exchange Resins	150 m^3	Water Treatment
Laboratory Chemicals	Various	Laboratory analysis
Lubricating oils	10,000 litres	Lubrication
Pentomag (Magnesium Hydroxide)	13,000 litres	Boiler additive
Propane	2,000 litres	Ignition fuel
Sodium Hydroxide Solution (47%)	30 t	WTP regeneration
Sodium Hypochlorite Solution	2 t	Cooling water treatment
Sulphuric Acid	40 t	WTP regeneration

Appendix II – Station Waste

Hazardous Waste

Item	Amount
Waste Oils	16,750 litres
Oil interceptor waste	3,000 litres
Batteries	250 kg lead acid & 10 kg Ni-Cd
Oil contaminated materials	30 No. 220 litre barrels
Asbestos	50 kg
Smoke detectors	1 No.
Gaseous discharge lamps	350 No.

Other Waste

Item	Amount
Administration, plastic packaging and canteen waste	36 m³
Waste paper and cardboard	20 bales
Grounds maintenance waste	See Note 3.
Scrap metal	14 t
Timber	2 t
Solids from boiler cleaning	5 t
Ion exchange resins	17 m³ over 5 years
Non-hazardous insulation materials	1.5 m³
Sewage sludge	Two-year clean
Toner cartridges	0.5 m³
Cooking oils	200 litres

Notes:

1. The above are wastes as listed in Schedules 3(i) and 3(ii) of IPPC Licence Reg. N° 715.
2. The amounts are those arising annually, except as noted, based on Section 17 of the station's application for its IPPC Licence.
3. Waste item is listed in Schedule 3(ii) Other Wastes for Disposal/Recovery of IPPC Licence Reg. N° 715 but is not listed as a waste stream that arises at Great Island in Section 17 of the station's application for its IPC Licence.

3.2. Preliminary Demolition Environmental Assessment

3.3. Quantitative Risk Assessment – Land Use Planning Report

Quantitative Risk Assessment – Land Use Planning Report CCGT Power Plant Great Island

Client: Endesa Ireland Limited

November 2009

Delivering sustainable solutions in a more competitive world

ERM

Endesa Ireland Limited

Quantitative Risk Assessment – Land Use Planning Report CCGT Power Plant Great Island

November 2009

0100952

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Signed: 

Position: Partner

Date: 19th November 2009

CONTENTS

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Endesa Ireland Limited (Endesa) plans to construct and operate a gas fired power station on the site of the existing Great Island heavy fuel oil (HFO) power station on the confluence of the River Suir and River Barrow in County Wexford, Ireland.

The Irish health and safety regulator, the Health and Safety Authority (HSA), requests that operators applying for planning permission for new major hazard facilities submit a quantitative risk assessment (QRA) report with their planning application. The QRA report assists the HSA in coming to an informed view on the safety implications of the proposed facility with respect to land use planning in the vicinity of the establishment. In addition to safety risks, the HSA must also make a judgement on the risk of major accidents to the environment (MATTEs).

In order to provide a comprehensive set of risk results, the above ground installation (AGI) associated with the connection between the power plant and the incoming pipeline (provided by Bord Gáis) have also been addressed in the study.

The general QRA methodology used for this study is consistent with the approach used by the HSA [1]. In addition, guidance documents produced by the UK Health and Safety Executive have also been used as the basis for the methodology [2].

In order to make the necessary comparisons with risk criteria (see *Section 5*), the scope of the QRA was to generate the following risk outputs:

- Individual risk of fatality contours;
- The individual risk of fatality at the nearest residential property; and,
- The societal risk of fatality for the workforce and people off-site in the vicinity of the installation.

1.2 LOCATION AND SURROUNDINGS

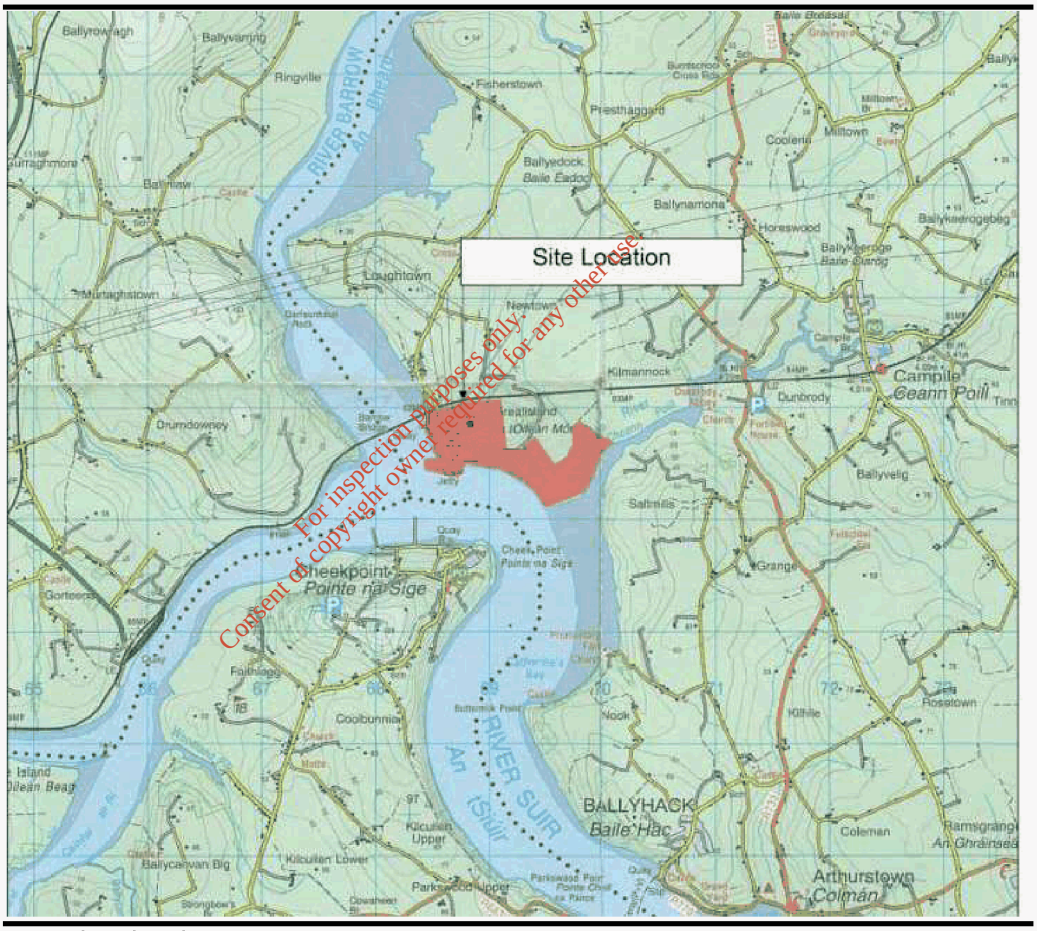
The Great Island site is an existing power generating plant located on a 68 hectare site at the confluence of the River Suir and River Barrow, on the shores of Waterford Harbour. The nearest area of settlement is at Cheekpoint on the opposite side of the estuary, in County Waterford, which is approximately 1 km from the site of the proposed power plant. The nearest house is 100m from the main gate. There is also a hamlet in Newtown, which is 200m from

the northern site boundary, which comprises 8 to 10 houses. The village of Campile is located approximately seven kilometres away (*see Figure 1.1*).

The surrounding area is predominantly agricultural. A railway track and some agricultural lands are located to the north of the site. To the south is the River Suir estuary. More agricultural lands are located to the east. The River Barrow flows along the western boundary of the site.

The River Barrow and the River Suir, as well as the neighbouring estuary, are designated as Special Areas of Conservation (SAC) under the European Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC), otherwise known as the Habitats Directive.

Figure 1.1 ***Site Location***



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The power generation buildings and infrastructure ("Station Grounds") comprise a series of tiered benches cut into the bedrock, which step down towards the River Suir estuary (*see Figure 1.1*). A former waste disposal area with two rectangular shaped cells is located to the east of the Station Grounds. It is not intended to construct in the aforementioned waste disposal area, which will remain intact throughout the construction and operational phases. There is a heavily vegetated undeveloped area known as the Wetlands beyond the former waste disposal area.

1.3 OUTLINE OF THE PROPOSED DEVELOPMENT

1.3.1 *Overview*

The existing plant comprises three generation units with a total electricity generation capacity of 240 MW, (two 60 MW units and one 120 MW unit). Heavy Fuel Oil (HFO) is the main fuel and distillate oil is used for start-up. The HFO is shipped to the site and stored in an oil tank farm. Distillate oil, also stored on site, is tankered to site by road.

Great Island Power Plant currently operates on Heavy Fuel Oil (HFO) with a maximum electrical export capacity of 216 MW. All of these units are at the end of their life span.

Endesa proposes to construct a new Combined Cycle Gas Turbine (CCGT) power plant at Great Island. The new CCGT power plant will use the best available technology to generate approximately 430 MW of electricity at an efficiency of circa 58%. The new CCGT plant will operate on natural gas with a back-up supply of distillate oil. It is anticipated that the introduction of the new technology will bring substantial improvement in relation to effects on the environment.

It is intended that the new CCGT power plant will be commissioned in 2012. The new CCGT will be constructed while the existing units are still in service whilst maintaining the highest safety standards. The existing oil fired power plant will continue to operate until the new plant is operational. Once the CCGT plant becomes operational the existing units will be decommissioned.

1.3.2 *Combined Cycle Power Plant*

Endesa intends to develop a circa 430 MW Combined Cycle Gas Turbine (CCGT) power plant at Great Island, County Wexford.

The proposed process of operation is summarised in the following paragraphs and illustrated in *Figure 1.2*.

A 'Combined Cycle' plant combines the technologies of gas turbines and steam turbines in order to produce electricity more efficiently than can be produced using either of these technologies separately.

The gas turbine consists of a compressor section, a combustion chamber and a turbine section. Air is drawn in through an intake filter, compressed and fed into the combustion chamber where fuel is injected and ignited. The resulting hot combustion gases pass through the turbine which rotates the shaft that drives the electrical generator to produce electrical energy.

The high temperature exhaust gases exiting the gas turbine will pass through a Heat Recovery Steam Generator (HRSG) which is used to produce steam

from high purity water. Any hot gases remaining from the process will be emitted to atmosphere via an exhaust gas stack.

The steam generated in the HRSG is passed through a steam turbine which converts the thermal energy in the hot steam to mechanical energy which is then used to drive an electrical generator which produces electrical energy. The exhaust steam from the steam turbine will be condensed back to water by cooling it with seawater in a condenser. This condensed water will then be fed back into the HRSG so that the process can start again.

The CCGT power plant proposed for Great Island will be arranged in a "single-shaft" arrangement which means that the gas turbine and steam turbine will be installed in a straight line with a common electrical generator located between each turbine.

The new power plant will use the most up to date technology and it is intended that it will operate as a 'base-load' plant with an efficiency of approximately 58%.

The plant will be designed to operate primarily on natural gas supplied from the Bord Gáis Networks' grid. A new natural gas pipeline will be required to bring natural gas to the power plant and this will be constructed and operated by Bord Gáis Networks/Gaslink.

The power plant will also include back up storage of distillate oil which will allow the plant to operate for five days in case of an unlikely interruption to the gas supply. This is in accordance with the Commission for Energy Regulation (CER) requirements presented in CER Decision Paper *CER/09/001, Secondary Fuel Obligations on Licensed Generation Capacity in the Republic of Ireland, January 2009*.

The electrical power generated will be exported from the power plant via the existing 220 kV substation located at the Great Island site.

Cooling water (CW) will be required for the new power plant to absorb heat from the steam turbine condenser and other heat exchangers associated with the proposed CCGT power plant. It is intended to continue to abstract seawater from the River Suir for this purpose, in accordance with current operations, utilising the existing water intake, supply and outfall systems. A seawater CW system has been continuously in operation at the site since the late 1960's. It is anticipated that the existing CW system will continue to be used so that no new construction in the River Suir environment will be required. It is also anticipated that, when fully commissioned, the volume of aqueous discharges from the proposed CCGT plant will be considerably less than the existing licensed discharges. Consequently, the discharge flow rate, and subsequent area of heat dissipation in the receiving waters, are predicted to be significantly less. In addition, it is anticipated that the volume of cooling water required to operate, at full capacity, for the proposed CCGT will be significantly less than that required for the existing units.

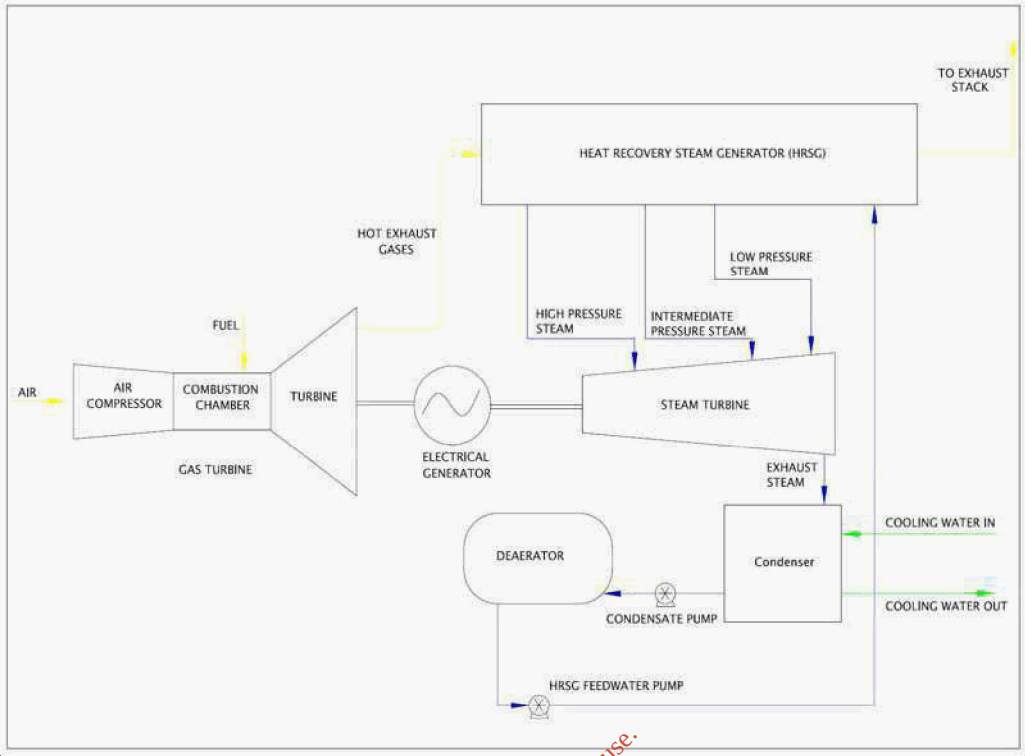
As well as the main power train items (Gas Turbine, Steam Turbine, HRSG and Generator) there will be a number of auxiliary systems required to operate the plant including:

- Water treatment plant
- Water storage facilities
- Distillate oil system and storage facilities
- Fuel gas system / Above Ground Installation (AGI)
- Fire protection system
- Compressed air system
- HRSG chemical dosing system
- Exhaust Stack
- Auxiliary boiler (if required)
- Transformers
- Electrical switchgear
- Electrical cabling
- Drainage system
- Foul water treatment system
- Building structures to house the main power train items
- Workshop / stores building
- Internal roads and parking

It is intended to utilise as much of the existing power plant infrastructure as possible including:

- Fuel storage tanks
- Cooling Water pumphouse, inlet and outfall
- Administration / Control Building
- Workshop and Stores
- Fire pumphouse building
- Surface water drains
- Roads and fencing
- 220 KV station
- Raw Water/Fire Water Storage

Figure 1.2 ***Single Shaft CCGT Cycle Flow Schematic***



1.3.3 *Incoming Gas Pipeline*

The incoming gas pipeline to the Great Island site will be owned and operated by Bord Gáis and will be connected to the site boundary AGI, which will also be Bord Gáis' responsibility. The gas supplied to the AGI will normally be at a pressure of 40 barg, but can be as high as 70 barg. The pipeline diameter is yet to be confirmed, but is expected to be 150mm. The gas pressure will on occasion fall below this value, but will not be less than a guaranteed value of 19 barg. The operating pressure of the gas at the outlet from the AGI will be selected to suit the requirements of the gas turbine, but will not be more than 50 barg.

At times when the incoming gas pressure to the AGI is below the pressure required by the gas turbine, the gas will be compressed to the required pressure by compressors located near the gas turbine, before being routed to the combustion chamber of the gas turbine system.

1.3.4 *Above Ground Installation (AGI) and Gas Lines*

The AGI will consist of the final section of the supply pipework, tariff metering, pressure control and a suitable valved connection for the pipeline which will convey gas to the new power plant. Bord Gáis will supply, install, erect and commission the AGI that will be positioned to the north-east of the power plant.

The proposed pipeline connecting the AGI to the gas compressor will be up to 10" (250 mm) in diameter and will be routed east-west from the AGI to the gas

compressor. The gas will then be compressed, if required, to 50 barg and routed to the combustion chamber of the gas turbine system.

1.3.5 *Distillate Storage and Containment*

Distillate oil will be the standby fuel for the gas turbine in addition to fuel for the emergency generator set. It is proposed that the middle tank to the north of the storage area will be completely refurbished for the storage of the distillate oil. The inventory of distillate present on site will be 11,000m^3, which is the minimum legal requirement.

1.4 *SEVESO IMPLICATIONS*

The Great Island facility will be a lower tier Seveso site because of the inventory of distillate that will be present. Distillate is a generic name used to describe a complex mixture of hydrocarbons, mainly paraffinic, naphthenic and aromatic in the range C10-C28. Other commonly used names are diesel and gas oil and are listed under petroleum products with respect to the Seveso Directive. The threshold quantity of petroleum products for a lower tier establishment is 2,500 tonnes and 25,000 for top tier.

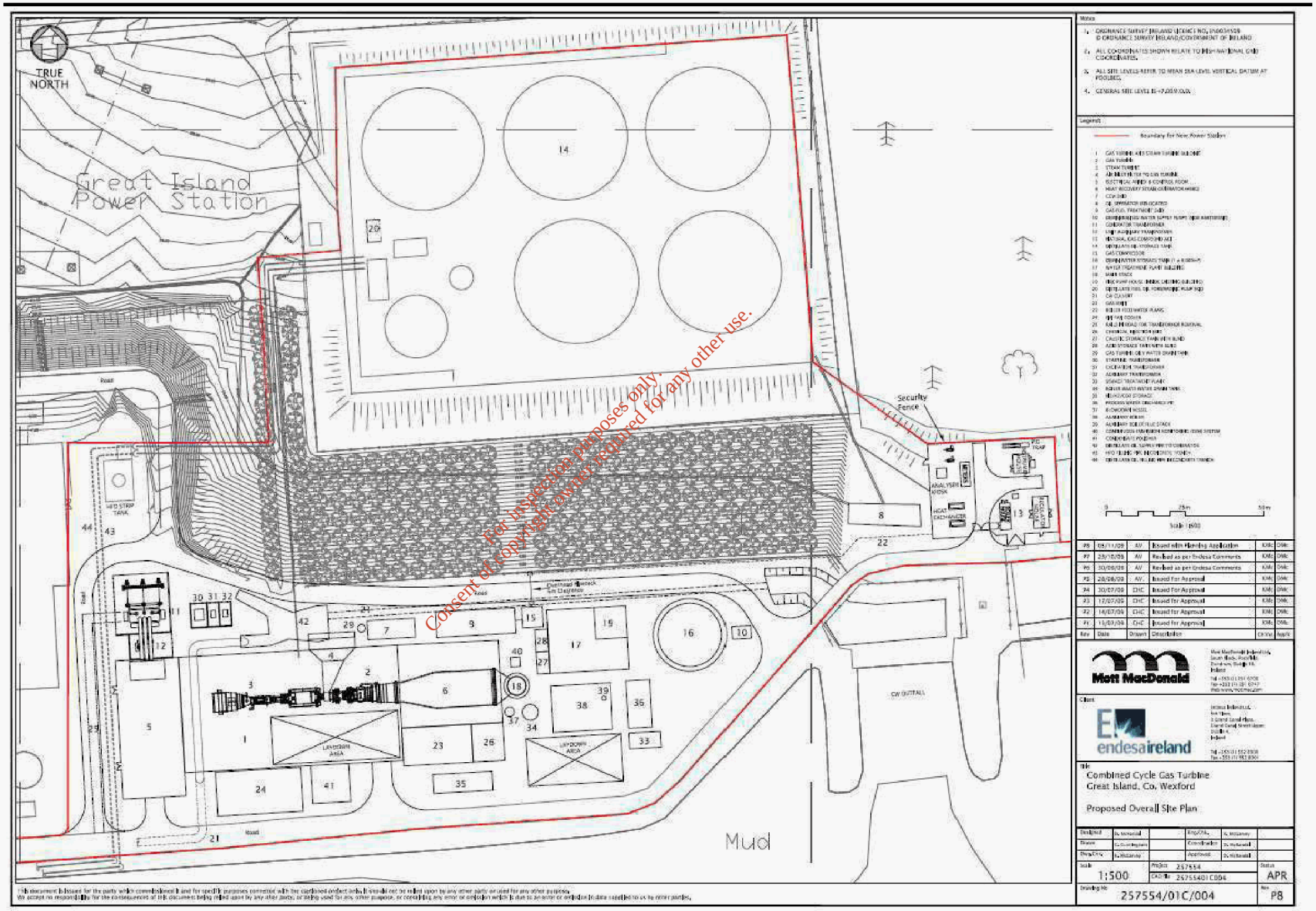
The requirements for lower tier establishments are summarised as follows (as defined in the HSA's (2007) *A Short Guide to the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2006. S.I. No. 74 of 2006*):

- notification to the HSA and the local planning authority;
- discharging certain general duties;
- preparation and implementation of a major accident prevention policy;
- action in the event of a major accident; and
- maintaining a register of notifiable incidents.

Figure 1.3 ***Location of Existing Great Island Power Plant***

Figure 1.4 ***Existing Facility Layout***

Figure 1.5 Proposed Facility Layout



1.5 *REPORT LAYOUT*

The remaining sections of this report are set out as follows:

- *Section 2* describes how the potential major accident scenarios included in the QRA and MATTE assessment were identified;
- *Section 3* presents the methods and data used in the calculation of the frequency of potential major accidents and MATTEs;
- *Section 4* details the analysis of the consequences of potential major accidents and MATTEs;
- *Section 5* describes risk criteria as used by the HSA;
- The calculation of the fatality risks and results obtained are presented in *Section 6* and the options for reducing environmental damage are presented and discussed in *Section 7*; and
- *Section 8* presents the study conclusions and recommendations.

2 IDENTIFICATION OF MAJOR ACCIDENT SCENARIOS

For the purposes of the QRA, the general approach taken for identification of the hazards has been to consider the loss of containment of hazardous materials for various failure sizes from isolatable sections of the plant facilities. The two main hazardous materials present at the Great Island combined cycle power plant will be natural gas and the distillate fuel oil. The hazardous properties of these materials and the potential outcomes arising from their accidental release are included in *Section 2.1*.

The plant facilities were broken down into a set of 'isolatable' inventories (i.e. sections of plant that could be isolated in the event of an accidental release) that would typically be achieved by the closure of emergency shutdown valves (ESDVs).

As stated, the accident scenarios included in the QRA were then obtained by assuming a range of failure sizes from each of the isolatable inventories, varying from a small hole to complete rupture. The inventories defined are listed in *Table 2.3* and the accident scenarios identified for the analysis are summarised in *Table 2.4*.

Additionally, major accidents involving the release of flammable and combustible liquids and natural gas that have occurred at Buncefield and Ghislenghien, Belgium are outlined. The lessons learned and recommendations arising from these accident events and their implications for the design and operation of the facilities at the Great Island combined cycle power plant are discussed. This is covered in *Section 2.2*.

2.1 PROPERTIES AND HAZARDS OF DISTILLATE AND NATURAL GAS

The principal hazardous materials with the potential to cause major accidents or MATTEs that will be present at the site are distillate and natural gas. Other hazardous materials that will be present but are not considered to give rise to potential major accidents are included in *Table 2.2*.

2.1.1 *Distillate*

Distillate is a generic name used to describe a complex mixture of hydrocarbons, mainly paraffinic, naphthenic and aromatic in the range C10-C28. Other commonly used names are diesel and gas oil. The distillate which will be used as a backup fuel at Great Island is classified as a Gas Oil Petroleum Product in the Seveso II Directive[3].

The generation of a distillate spray, vapour or mist can be a potential fire or explosion hazard and the thermal decomposition of the distillate may lead to the formation of a multiplicity of compounds some of which may be

hazardous. With incomplete combustion smoke and hazardous fumes and gases, including carbon monoxide may be formed.

The distillate is also classified as dangerous for the environment.

2.1.2 *Natural Gas*

Natural gas used as the primary fuel at the power station is a mixture of low molecular weight (typically ≤ C_4) hydrocarbons (predominantly methane). The physical properties for methane, ethane and propane (the principal constituents of natural gas) are provided in *Table 2.1*[4].

Table 2.1 Properties of Hazardous Materials

Substance	Methane	Ethane	Propane
Chemical Name	Methane	Ethane	Propane
Chemical Formula	CH_4	C_2H_6	C_3H_8
CAS Number	74-82-8	74-84-0	74-98-6
Appearance at 20°C	Colourless Gas	Colourless Gas	Colourless Gas
Atmospheric Boiling Point (°C)	-161.5	-88.6	-42.1
Melting Point (°C)	-182.5	-183.3	-187.7
Liquid Specific Gravity	0.422	0.546	0.59
Vapour Density (air = 1)	0.55	1.1	1.5
Lower flammable limit (vol %)	5	3	2.1
Upper flammable limit (vol %)	15	12	9.5
Flash Point (°C)	-188	-135	-104
Auto Ignition Temperature (°C)	595	504	450
Long term exposure limit	N/A	N/A	N/A
LD_{50}	N/A	N/A	N/A
Eco-toxicity	Unlikely to cause adverse effects	Unlikely to cause adverse effects	Unlikely to cause adverse effects
Degradability	Disperses rapidly	Disperses rapidly	Disperses rapidly

The principal hazards of the natural gas arise from its flammability; ignited releases can result in a jet flame, flash fire and explosions.

2.1.3 *Toxicity and Asphyxiation*

Methane, or natural gas, is not toxic or a carcinogen. There is no occupational exposure limit value (OELV) for methane in Ireland or immediately dangerous to life or health (IDLH) value in the United States. Methane is a simple asphyxiant gas. However, the risk of harm to personnel due to asphyxiation from releases of the natural gas (which comprises mostly methane) is deemed to be negligible and has been discounted from the analysis. This is because losses of containment of the gas would be at high pressures that would mix rapidly with air as it is released into the atmosphere

and being lighter than air would disperse in an upward direction. Furthermore, the open nature of the site minimises the risks of accumulation in confined areas.

A fire involving distillate can produce a multiplicity of compounds some of which may be hazardous from a distillate fire. Furthermore, with incomplete combustion smoke, hazardous fumes and gases, including carbon monoxide, may be formed. However, the smoke and combustion products generated from the large fires at Buncefield did not cause any serious harm to people and on this evidence the risks from exposure to any toxic products generated in a distillate fire were considered to be negligible.

2.1.4 *Fire Hazards*

Pool Fire

When a flammable liquid is released from a storage tank or pipeline, a liquid pool may form. As the pool forms, some of the liquid will evaporate and, if flammable vapour finds an ignition source, the flame can travel back to the spill, resulting in a pool fire. However, since the distillate is not classified as a flammable liquid, a pool fire is only likely if there is a strong ignition source, such as from a jet flame or from hot work activities such as welding or cutting. A pool fire involves burning of vapour above the liquid pool as it evaporates from the pool and mixes with air.

Jet Fire

If gases are released from pipework under pressure, the material discharging through the hole will form a gas jet that entrains and mixes with the ambient air. If the material encounters an ignition source while it is in the flammable range, a jet fire may occur. Larger jet fires could occur from ignited releases from the high pressure (approximately 70 barg) import gas lines. Such fires could cause severe damage, but associated consequences are highly dependent on the direction of release (i.e. not omni-directional).

Flash Fire

When a volatile, flammable material is released to the atmosphere, a vapour cloud forms and disperses (mixing with air as it does so). If the resultant vapour cloud is ignited before the cloud is diluted below its lower flammable limit (LFL), a flash fire may occur. The combustion normally occurs within only portions of the vapour cloud (where mixed with air in flammable concentrations), rather than the entire cloud. A flash fire may burn back to the release point, resulting in a pool or jet fire but is unlikely to generate damaging overpressures (explode) when unconfined.

A gas jet release that loses its momentum, such as if directed towards the ground and/or on impact with surrounding equipment and structures is considered to form a flammable vapour cloud, which, if ignited would result in a flash fire.

Explosions

As discussed in the previous section, a flash fire can occur if the natural gas is released into the atmosphere and ignited. If ignited in open (unconfined) areas, pure methane is not known to generate damaging overpressures (explode). However, if some confinement of the vapour cloud is present, methane can produce damaging overpressures. Areas congested with equipment and structures can facilitate damaging overpressures if a vapour cloud is ignited within such an area. For example, if a vapour cloud infiltrates a process plant area with various vessels, structures and piping, and the cloud ignites, the portion of the cloud within that congested area may generate damaging overpressures.

2.1.5 *Other Hazardous Materials*

Other materials, some of which are categorised as being hazardous that are currently present at the Great Island combined cycle power plant site are listed in *Table* 2.2. An indication of their annual usage is also given.

At present, 1.5 tonnes of 4% hydrazine solution is stored on site. Although Hydrazine is a listed substance under Seveso with a lower tier threshold of 0.5 tonnes and an upper tier threshold of 2 tonnes, its concentration is such that the Seveso requirements do not apply. However, the hydrazine will be replaced by carbohydrazide, which is non-hazardous and has also been included in *Table* 2.2. Therefore, hydrazine has not been included in the hazard analysis.

Table 2.2 Other Materials Present at Great Island Combined Cycle Power Plant Site

Material/ Substance	CAS Number	Hazard	Amount Stored	Annual Usage	Nature of Use	Risk Phrase, R	Safety Phrase, S
Acetylene	74-86-2	Explosive	10 bottles	9 bottles	Welding	5, 6, 12	9, 16, 33
Amino Acid F Reagent	None	Corrosive	15 litres	15 litres	Silica monitor reagent	36,	
Ammonia solution	7664-41-7	Corrosive	1.5 tonnes	3tonnes	Boiler treatment	34, 36/37/38	7, 26, 45
Argon	7440-37-1	None	9 bottles	15 bottles	Welding		
Carbohydrazide	497-18-7	None	1.5 tonnes	3 tonnes	Boiler treatment		
Carbon Dioxide	124-38-9	Asphyxiant	50 bottles	45 bottles	Generator purging		
Citric Acid / Surfactant Reagent	5949-29-1	Irritant	15 litres	15 litres	Silica monitor reagent	36	24/25
Fluorescein	05/07/2321	None	5 kg	5 kg	Condenser leak detection		
Hydrazine solution	302-01-2	Toxic	1.5 tonnes	3 tonnes	Boiler treatment	10, 23/24/25, 34, 43, 45	45, 53