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Brendan Foley
Office of Environmental Enforcement,
Environmental Protection Agency,
Regional Inspectorate,
Inniscarra,
Co. Cork

27th September 2006

License Number: W0041-01

REF: SEW AMMONIUM BIFLUORIDE RECOVERY PROCESS

Dear Mr Foley,

Please find below a Specified Engineering Works as required under condition 4.12 of our waste license for an Ammonium-bifloride Recovery Process. Enva propose to install and operate the process initially on a trial basis for three months. During this time all emissions will be monitored and recorded and a full report will be prepared in relation to the operation of the trial. It is then proposed that the plant would be operated on an ongoing basis following the successful implementation of any recommendations arising from the trial and with the agreement of the Agency.

This proposal differs significantly from earlier attempts at ammonia recovery. Details of this are outlined at the end of this letter under the heading "Past Trials of Ammonia Treatment".

Overview of Ammonium-bifloride Recovery Process

Enva Ireland Ltd propose to install plant and operate a process for treatment of ammonia wastes. The process is a continuous system and is fully enclosed apart from initial air intake and final air emission. The process comprises a 6.5 m^3 reactor vessel and three stage packed column tower system. The reactor will be fed by a lime slurry tank and a feed tank containing the ammonia waste. Ammonia containing liquor will be extracted and ammonia air stripped in the first stage. In the second stage the ammonia laden air will be washed with acid to produce an ammonium sulphate or ammonium nitrate product. The final stage is for abatement of any residual ammonia before discharge of air to atmosphere. Atmospheric emissions will be monitored continuously.

Initial reaction: The process will involve pumping of ammonia-bifluoride waste to a 6.5 m3 reactor vessel and addition of lime. This will produce an aqueous ammonia solution (NH_4OH) and a non-hazardous precipitate sludge of calcium fluoride. These will be separated from each other using a centrifuge. The calcium fluoride (a non-hazardous calcium based salt) will be analysed and disposed to landfill.

First stage: The aqueous ammonium solution will be pumped to the first of three packed column towers, the Ammonia Recycle stage. At this stage air will be drawn through the tower and will strip out ammonia from the liquor. The air/ammonia will pass through to the second stage, leaving behind the water from which it was stripped. The waste will be discharged to trade effluent following analysis against existing license ELVs.

Second stage: The air / ammonia mix will then continue into the second packed column, the Acid Recycle tower. Here the ammonia (gaseous phase) will combine with Sulphuric Acid / Nitric Acid (liquid phase) to form Ammonium Sulphate and/or Ammonium Nitrate (liquid phase). This will be collected separately for supply to the fertiliser industry for use as a raw material. The air will continue on to the third stage for final scrubbing.

Third stage: Air passing through the Acid Recycle tower will be drawn through the final packed tower, the Weak Acid tower. The weak acid will strip any remaining ammonia from the air prior to final discharge. A continuous detector will monitor for presence of ammonia at the final discharge point. When the weak acid solution becomes spent it will be transferred to the stage two tower and its acidity strengthened.

Plant & Equipment

The following plant will be involved:

1 Dedicated incoming ammonia-biflouride waste holding tank.
1 Dedicated ammonium-biflouride reactor vessel, 6,500 litres capacity.
1 Centrifuge.
3 Packed column air-stripping/scrubbing towers and associated ductwork & piping.
Extractor Fan
Online continuous ammonia detector.

All tanks and vessels will be fitted with High-High and High-Low level detectors. Ultimately the system will be under SCADA control.

Emissions & Controls

Solid waste: Calcium fluoride salt will be generated from the process. This will be passed through a centrifuge to remove any remaining liquor. The waste will be analysed and will undergo leachate testing. It is entirely non-hazardous and will be suitable for disposal by landfill.

Atmospheric emission: No significant emissions of ammonia are expected. Enva propose to limit any emission to less than 510 mg/m^3. This value was determined in 2003 to comply with 1/40th OEL, 1/40th STEL and odour threshold for ammonia at receptor points (refer to letters of 17th November 2003 and 8th December 2003) for a stack of similar specifications. Emissions will be continuously monitored during operation and any potential excursion of the limit will result in alarm sounding and will trigger an immediate shutdown. Additionally this proposal incorporates extraction of airborne ammonia arising from the reactor vessel in order to minimise potential for fugitive loss.

Aqueous Discharge: Effluent will arise from the first stage (Ammonia Recycle stage). This can be recirculated until ammonia levels are well below license ELVs for ammonia. Prior to discharge it will be monitored against all relevant license parameters and will undergo further treatment if necessary. As a result levels of ammonia and other parameters in the aqueous discharge will be well within license ELVs.

Waste Recovery: Enva propose to recover the ammonia as Ammonium Sulphate and/or Ammonium Nitrate (depending on market conditions). The recovered product will be routed to the fertiliser industry via an established fully licensed operator already involved in

acceptance of ammonium from waste recovery outlets in mainland Europe. As a result the recovered product will undergo full quality control testing and certification prior to processing into fertiliser products.

No Fugitive Loss: The entire system will draw air through the three packed towers to the discharge point. As a result the packed towers and associated duct-work will be under a slight negative pressure. This will ensure that there is no potential for fugitive loss during normal operation. In the event of emergency shut-off or breakdown of the plant valves can be closed in order to isolate the Ammonia Recycle and Acid Recycle stages (stages one and two) and thereby prevent further emission.

Past Trials of Ammonia Treatment

I recognise that ammonia treatment trials were carried out in the past. Enva has incorporated the learnings from past trials into this proposal. Accordingly this proposal differs from earlier ones in the following crucial ways:

- Airborne ammonia emissions from the reactor vessel will be collected and drawn through the system thereby substantially minimising any risk of fugitive loss, occupational exposure or nuisance odour.
- The system consists of three packed columns rather than two. The last column will abate any residual ammonia from the air stream prior to release to atmosphere.
- A centrifuge is used rather than a plate and frame filter press. This ensures the system is closed and minimises potential for fugitive loss during this stage of the process.
- All emissions will be monitored. This includes continuous detection of ammonia and sampling/analysis of wastes/effluent generated. Detection of ammonia levels will be near instantaneous.
- Emergency controls including isolation valves, continuous ammonia detection on the emission point and alarms are incorporated into the design.
- The trial will last for a defined time period (three months from completing installation of plant) after which a full report will be submitted to the Agency and Enva will seek permission to operate the plant on an ongoing basis.
- The full report will address the following issues as a minimum:
    - Efficiency of the plant.
    - Quantity of waste treated.
    - Estimated emissions (solid waste generated, quantity of ammonium sulphate/nitrate, effluent generated, total mass of emissions to atmosphere).
    - Emission monitoring results.
    - Detailed Air Emissions Assessment in relation to ammonia.
    - EWC codes of any wastes generated.
    - Assessment of nuisance potential vis-à-vis noise, odour etc (including any complaints).
    - Any relevant difficulties encountered.
- Supply of ammonium sulphate/nitrate to fertiliser industry will be in accordance with EPA approval as per condition 5.19. Enva is in discussions with licensed operators on the continent who are currently accepting material from similar sources and will seek Agency approval prior to sending the first consignment.

Please find attached a schematic of the proposed plant.

Please indicate the Agency's approval of the above proposal.

I trust the above is satisfactory. If you have any further queries in relation to this please do not hesitate to contact me.

Yours sincerely,

David Burke
HSE & Compliance Manager.

ENCL.
Schematic Drawing of proposed ammonia-bifluoride treatment plant.

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ENSURING SAFE ENVIRONMENTS

The **iTX Multi-Gas Monitor** is the industry's most versatile portable gas detection instrument. Designed to grow with you as your monitoring needs change, the iTX can go from being a single gas unit to a six-gas monitor, or anything in between, with just a few simple user configurations and sensor changes.

Featuring advanced "smart" sensor technology, the iTX is capable of recognizing and configuring a wide assortment of field replaceable, interchangeable sensors. Enhanced benefits include a 50 ppm resolution for hydrocarbons, LEL and methane sensor over range protection, and a four electrode ammonia sensor for increased stability. Providing simplified, single-button operation and calibration functions, the iTX's special Quick-Cal feature quickly calibrates up to four sensors at once, saving time and calibration gas costs.

The iTX provides superior, user configurable datalogging and hygiene functions which allow the monitor to store up to 300 hours of survey data at one minute intervals. The unit also includes STEL and TWA readings and alarms as well as iButton® technology, which allows the operator to input user data and site information.

The iTX also features a backlit LCD that simultaneously displays all gases monitored, ultra-bright LED visual alarms and a powerful 90 dB audible alarm, all encased in a compact, rugged stainless steel housing to provide maximum durability and RFI protection.

The iTX boasts superior security and safety features including configurable user access codes to protect calibration and alarm settings, and a time delay power button to prevent accidental turnoff. The unit is also DS2 compatible to utilize the additional benefits of the Docking Station.

- **Completely customizable and field upgradeable**
- **User configurable datalogging functions – up to 300 hours of storage time**
- **Monitors from one to six gases simultaneously and continuously.**
- **Quick-Cal function calibrates four sensors simultaneously.**
- **High, Low, STEL and TWA alarms for all sensors**
- **LEL/CH4 over range protection**
- ***Displays last cal date and next cal due reminders***
- **Configurable security access code protects *all calibration and alarm settings.***
- **Interchangeable, lithium-ion battery pack can be charged in/out of the monitor.**
- **Docking Station™ compatible**

GAS DETECTION **CONTAINMENT**

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ENSURING SAFE ENVIRONMENTS

iTX Multi-Gas Monitor
Product Specifications

The iTX is available in a 1,2,3,4,5 or 6 (only with CO/H2S) gas configuration and will continuously and simultaneously monitor for unsafe concentrations of combustible gas, oxygen and/or any three (or 4 with CO/H2S) of the following toxic gas sensors: CO, H2, H2S, SO2, NO2, HCN, HCL, Cl2, ClO2, PH3, NO, & NH3.

- Made in USA
- **Dimensions:** 121mm x 81mm x 43mm (4.75" x 3.19" x 1.68") max.
- **Weight:** 18.5 ounces (with lithium-ion battery) max.
- **Case Material:** Type 304 Stainless Steel, .024" (.61mm) thick.
- **Measuring Ranges:**

LEL	50 ppm-100% LEL in 1% increments
CH4	0-5% CH4 in 0.1% increments
O2	0-30% O2 in 0.1% increments
CO, H2, H2S, NO	0-999 ppm in 1 ppm increments
SO2, NO2,	0.2-99.9 ppm in 0.1 ppm increments
HCN, HCL,	0.2-30 ppm in 0.1 ppm increments
Cl2	0.2-50 ppm in 0.1 ppm increments
NH3	0-200 ppm in 1 ppm increments
ClO2, PH3	0-1 ppm in 0.01 ppm increments

- **Sensor Type:**

LEL, CH4.....Catalytic Diffusion
CO, H2, H2S, O2, SO2, NO2, HCN, HCL, Cl2, NO, ClO2, PH3, NH3, CO/H2S.....Electrochemical

- Measures combustible gases with 50 PPM resolution to LEL alarm set-point.
- Proprietary 4-electrode combination CO/H2S sensor to allow instrument to be configured as 6-gas monitor.
- 4-electrode electrochemical ammonia sensor for increased stability and lifetime.
- Temperature range: -20oC to 50oC (-4oF to 122oF) typical
- Humidity range: 15 to 95% RH typical
- Dot matrix graphic liquid crystal display.
- Classified intrinsically safe for use in EEx ia IIc T4 hazardous locations.
- Field replaceable/reconfigurable sensors with automatic recognition.
- Simultaneous display of all gases being monitored.
- LEL/CH4 over range protection.

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ENSURING SAFE ENVIRONMENTS

iTX Multi-Gas Monitor
Product Specifications

- One-button turn on/off with time delay to prevent inadvertent turn off.
- One-button automatic calibration.
- Quick calibration: calibrates four sensors simultaneously
- Compatible with the DS2 & DS1000 Docking Stations for automatic calibration and record keeping.
- Audible and visual alarms activated when gas concentrations exceed preset levels.
- High, Low, STEL and TWA alarms for all sensors.
- Interchangeable rechargeable lithium-ion or "AA" alkaline battery packs.
- Typical 24 hour run time (non-alarm) with rechargeable lithium-ion battery pack.
- Typical 12 hour run time (non-alarm) with "AA" alkaline battery pack.
- Maximum 5 hour recharge time for fully discharged battery with appropriate charger.
- Easily replaceable battery, capable of being charged in or out of the instrument.
- Radio Frequency Interference protection third party certified to European Standard EN50081-2.
- Peak/Hold feature.
- User configurable security access code protection of all calibration and alarm settings.
- Optional 103dB external audio visual alarm accessory.
- External environmentally sealed keypad for all instrument user operations.
- On-screen instruction for calibration and instrument settings.
- User configurable real time clock/calendar.
- Optional parasitic sampling pump for remote sample draw capability.
- Automatic backlight activation in the event of alarming conditions.
- User configurable datalogging option including:
  - 300 hours log time (at 1 minute intervals).
  - User configurable datalogging intervals
  - User configurable data overwrite capability
  - User configurable datalogger with on/off and automatic function.
  - Real and log time display.
  - TWA and STEL readings and alarms
  - iButton® automatic data entry capability.
  - Keypad entry of up to 16 characters of user data
- User configurable Last Cal Date or Next Cal Due display.
- Nylon carrying case.

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iTX Multi-Gas Monitor
Features and Benefits

Feature	Benefit
• **Up to six interchangeable/field replaceable sensors**	Provides flexibility of monitoring in a variety of applications. Reduces operating costs and downtime associated with instrument/sensor service.
• **50 ppm resolution for hydrocarbons (HC) up to the LEL alarm set point**	Allows the user to precisely monitor total hydrocarbons at lower levels.
• **LEL/CH_4 sensor over-range protection**	Shuts off power to the LEL/CH_4 sensor when the concentration of sampled gas exceeds 100% LEL or 5.0% CH_4, extending the life of the sensor, ensuring calibration integrity and lowering replacement costs.
• **4 electrode ammonia (NH_3) sensor**	Increases the stability and lifetime of the ammonia sensor thus raising the operator's efficiency and lowering their costs.
• **Interchangeable lithium-ion and alkaline battery packs.**	A variety of available power sources including the latest rechargeable battery technology provides the user with round-the-clock monitoring capabilities, and battery power available at a moment's notice.
• **User configurable operating system**	Allows user to "tune" the instrument to their specific application for display, alarms, calibration, datalogging and other instrument operations.
• **Simultaneous display of all gases monitored**	Provides confidence and ease of use allowing the operator to view all gas readings immediately at a single glance for uninterrupted work time.
• **Compatible with DS2 and DS1000 Docking Stations** [TM]	Provides automatic calibration and record keeping, reducing overall instrument operating costs and ensuring proper documentation.
• **One button operation and calibration**	Simplifies training and reduces time and calibration gas required for each calibration.
• **Quick calibration feature**	With blended calibration gas mixture applied, the Quick-Cal feature will calibrate the sensors simultaneously, saving time, gas and money.
• **RFI (radio frequency interference) protection third party certified to European standard EN50081-2**	Eliminates nuisance readings and alarms increasing the accuracy of the instrument while retaining worker efficiency.

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iTX Multi-Gas Monitor
Features and Benefits

Feature	Benefit
• **Access code protection of calibration and alarm settings**	Provides security and eliminates tampering with any instrument settings or calibration.
• **Peak/Hold value mode**	Allows user to track peak exposures during job functions or at the end of a work shift. Provides tracking of workers' gas exposures without the complexity of logging data.
• **Optional external parasitic sampling pump**	Allows the monitor to be used both for personal monitoring applications and remote sampling necessary in confined spaces. Parasitic pump eliminates need for extra batteries and charging equipment.
• **Stainless steel construction**	Provides durability, superior resistance to RFI, and reduces maintenance costs and downtime.
• **External alarm option (103 dB)**	Provides confidence and warning of dangerous conditions in the highest noise applications with external 103 dB audible and visual or vibrating alarms.
• **iButton® field data input capability**	Allows user to imprint the datalogger with user and location information automatically for validating gas survey data.
• **300 hours logging capacity (at 1 minute intervals)**	Exceptional data capacity provides more than a month's worth of extended shift, continuous data before memory capacity is exhausted.
• **User configurable datalogging/hygiene functions**	Allows the user to configure datalogging intervals, overwrite capability, automatic event datalogging, and TWA parameters providing the user with a monitor customized to their specific application.

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THE FAQs ABOUT THE iTX

1. Can I replace the sensors in my iTX?

The iTX utilizes all field replaceable, plug-in sensors. The user can replace any sensor in the field and have the instrument in service after performing a simple field calibration.

2. Can I use the sensors from my other Safetech instruments in the iTX?

No, iTX sensor modules are not interchangeable with other Safetech instruments.

3. Will the lithium-ion battery used in the iTX suffer from memory effects?
No. Along with its superior energy density, the major advantage of the lithium-ion battery pack is that it does not experience a loss of capacity due to memory effects that plague other rechargeable battery technologies.

4. How long does the lithium-ion battery pack last?

The iTX batteries have a rated life of 500 charge/discharge cycles. Under normal conditions, this should allow at least two years of normal use.

5. Will the iTX run continuously while connected to a battery charger?

Yes, the instrument can and will run continuously when plugged into the charging adapter. However, the instrument can not be taken into a hazardous location when used in this manner. Continuous operation while connected to an external power source will violate the intrinsic safety approvals listed on the unit.

6. What is the recommended flow rate for calibrating the iTX?

Safetech recommends a minimum flow rate of .5 litres per minute for calibrating the iTX. While some sensors can be accurately calibrated at lower flow rates, sensors for gases such as chlorine or nitrogen dioxide require a minimum flow rate of .5 litres per minute for calibration. This flow rate will ensure that the instrument is properly calibrated all of the time.

7. Why would the sensors in my iTX give me negative readings?

There are several factors which may cause negative gas readings on the iTX such as changes in relative humidity, changes in temperature or a negative signal from an interfering gas. The most common cause of negative gas readings, however, is zeroing the instrument in a background concentration of the target gas. If the iTX is zeroed in a background of 10 ppm carbon monoxide, the instrument will read –10 PPM in clean air. This can be avoided by using zero grade air to zero the instrument at any time the quality of the ambient air is unknown.

8. Does the iTX need to be returned to the factory for annual calibration or re-certification?

No, the only calibration required for the iTX is the recommended monthly field calibration of the sensors. There is no adjustment or calibration of the instrument circuitry required. Unless the unit has malfunctioned there is no reason to ever return it to the factory for service.

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9. How often do I have to calibrate the iTX?

Because the only way to be sure that your gas monitor will respond to gas is to test it with a known concentration of gas, Safetech recommends that a functional test or "bump" test be performed on the instrument before each use. A function test ensures that the instrument will respond when challenged with gas and will perform in the field. Safetech also recommends that the instrument is calibrated on a monthly basis as a minimum.

10. Will the combustible sensor in the iTX work in an oxygen deficient environment?

The combustible gas sensor in the iTX requires a minimum of 10% oxygen to provide an accurate reading. In any situation in which the oxygen reading is less than 10% the combustible gas reading must be considered to be in error. In applications where there is less than 10% oxygen present a 1:1 dilution fitting must be used in the sample line to provide sufficient oxygen to the sensor to get an accurate reading. When using a dilution fitting the user must always remember that the instrument will display one-half of the actual gas concentration being measured.

11. How often do I have to replace the sensors in my iTX?

Oxygen sensors in the iTX will typically last 2 years. On average, toxic sensors will last 3-4 years and combustible sensors 4-5 years. There is no need to replace these sensors before they indicate a marginal or failed calibration in the iTX.

12. You say that the iSP is a "parasitic" sampling pump. What is meant by the term "parasitic"?

The term "parasitic" refers to the way the iSP receives its operating power. The iSP draws its power from the battery pack in the iTX and has no self contained battery or power pack of its own.

13. Since the iSP uses the instrument's battery, will my instrument run time be reduced when I use the sampling pump?

Yes. The instrument's run time will be reduced by approximately 50% when using the iSP sampling pump continuously. However, the lithium-ion battery pack will still provide up to 10 hours of continuous use with the iTX/iSP combination.

14. How far can I sample using the iTX and iSP combination?

As a general rule, the iSP is rated to sustain a continuous sample draw for up to 100 ft. with 0.125-inch inside diameter sample tubing. However, the iSP will provide a constant flow sample at 0.5 litres/minute up to a vacuum pressure of 40 inches of H2O. The length of sample tube can exceed 100 ft. as long as the vacuum pressure required to draw the sample does not exceed 40 inches of H2O.

15. Is there a difference in life expectancy between the large and small toxic sensors used in the iTX?

The size of the toxic sensor has little or no impact on the life expectancy of the sensor. In general, the materials inside the sensor are not consumed by the reaction to gas so the amount of material in the sensor does not dictate how long the sensor should last.

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16. Since life span is not affected by the size of the sensor, when should I use the larger toxic sensor in the iTX?

The large or 7-series toxic sensor should be used in the iTX for 5 or 6-gas or special applications such as those that may require the combination CO/H2S sensor or hydrogen nullifying carbon monoxide sensor.

17. If I remove a toxic sensor from the iTX temporarily do I have to recalibrate the instrument after I reinstall the sensor?

No. All calibration information for the toxic sensors in the iTX is stored on the sensor module itself. If a sensor is reinstalled in the instrument it will be calibrated and respond exactly the way it did before it was removed from the unit.

18. If I have an iTX configured in the Basic Safety mode, can I activate other features without sending the unit back to the factory.

The iTX has a large number of user selectable features. Each of these can be activated independently by using the iTX keypad and display or by using the iTX configuration software utility on a PC.

19. When the datalogging features of the iTX are activated, how much capacity does the memory have?

With the recording interval set at 1-minute, the iTX will log data for up to 300 hours with 5-sensors installed. However, the recording interval is flexible and when set for 5- minutes the instrument will record up to 1500 hours of data with 5- sensors installed.

20. What happens when the datalogging memory is full on the iTX?

The iTX has two user selectable options for handling a full memory condition. The user can either select to be notified on the display when the memory is full at which time the instrument will stop logging data until the user manually resets the instrument or the user can select to have the instrument begin overwriting the data automatically. If the overwrite feature is selected, all previous instrument data will be lost as soon as the data memory is full and overwriting begins.

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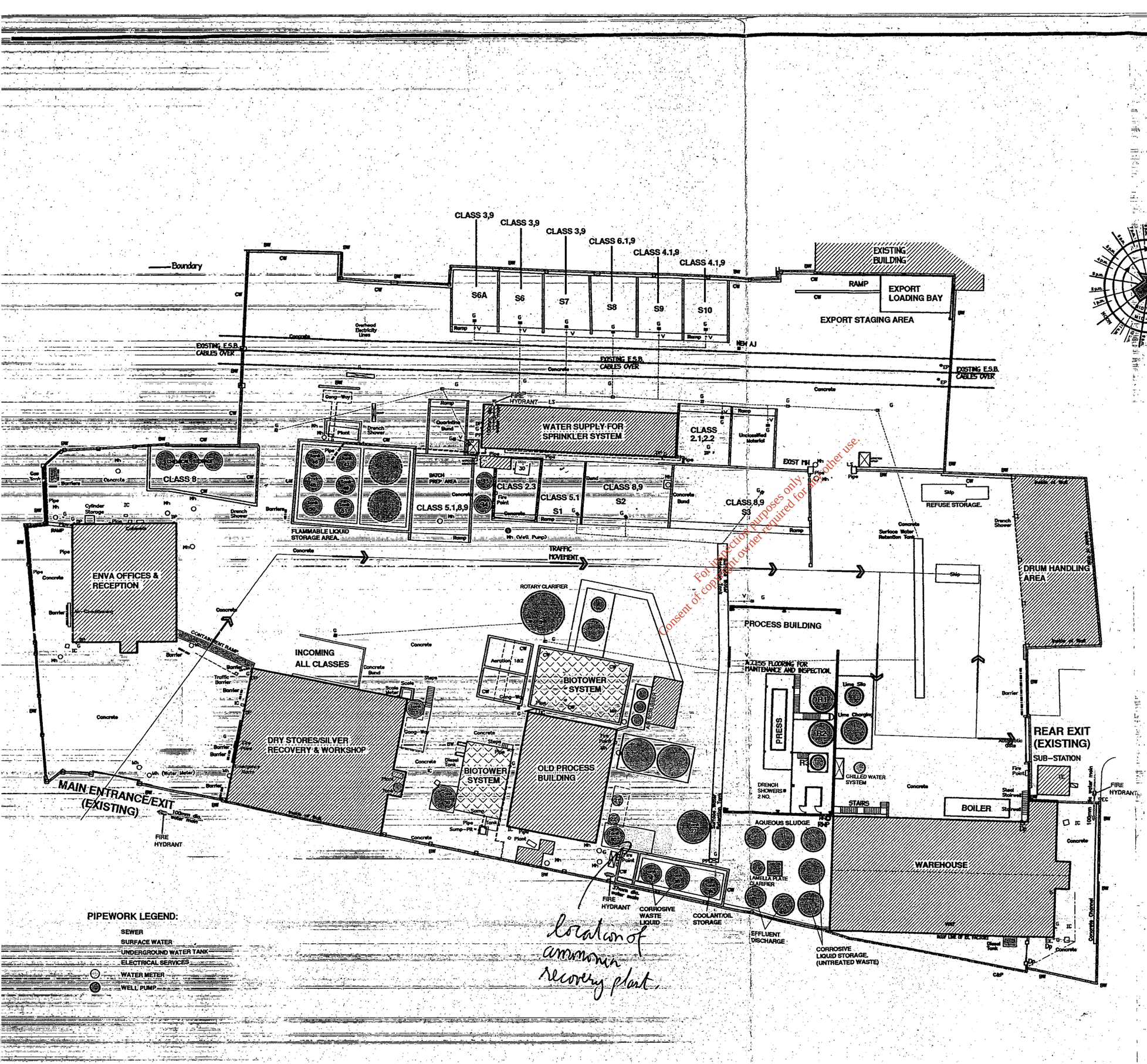
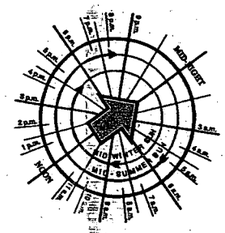
NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT KAVANAGH RYAN & ASSOCIATES DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS TO BE CONFIRMED. DO NOT SCALE DRAWING.





PIPEWORK LEGEND:

- SEWER
- SURFACE WATER
- UNDERGROUND WATER TANK
- ELECTRICAL SERVICES
- WATER METER
- WELL PUMP

NO.	REVISION	DATE
B	ALTERATIONS AS PER CLIENTS INSTRUCTIONS	1/09/06.
A	SITE AMENDED TO AS BUILT.	JULY '06.

Kavanagh Ryan & Associates.
Unit 48, The Egan Centre,
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DRAWN	SCALE	DRAWING No.
A.C.	1:500.	
JOB. No. C03068.	DATE April '05.	IH-SG 1.

NOTES:

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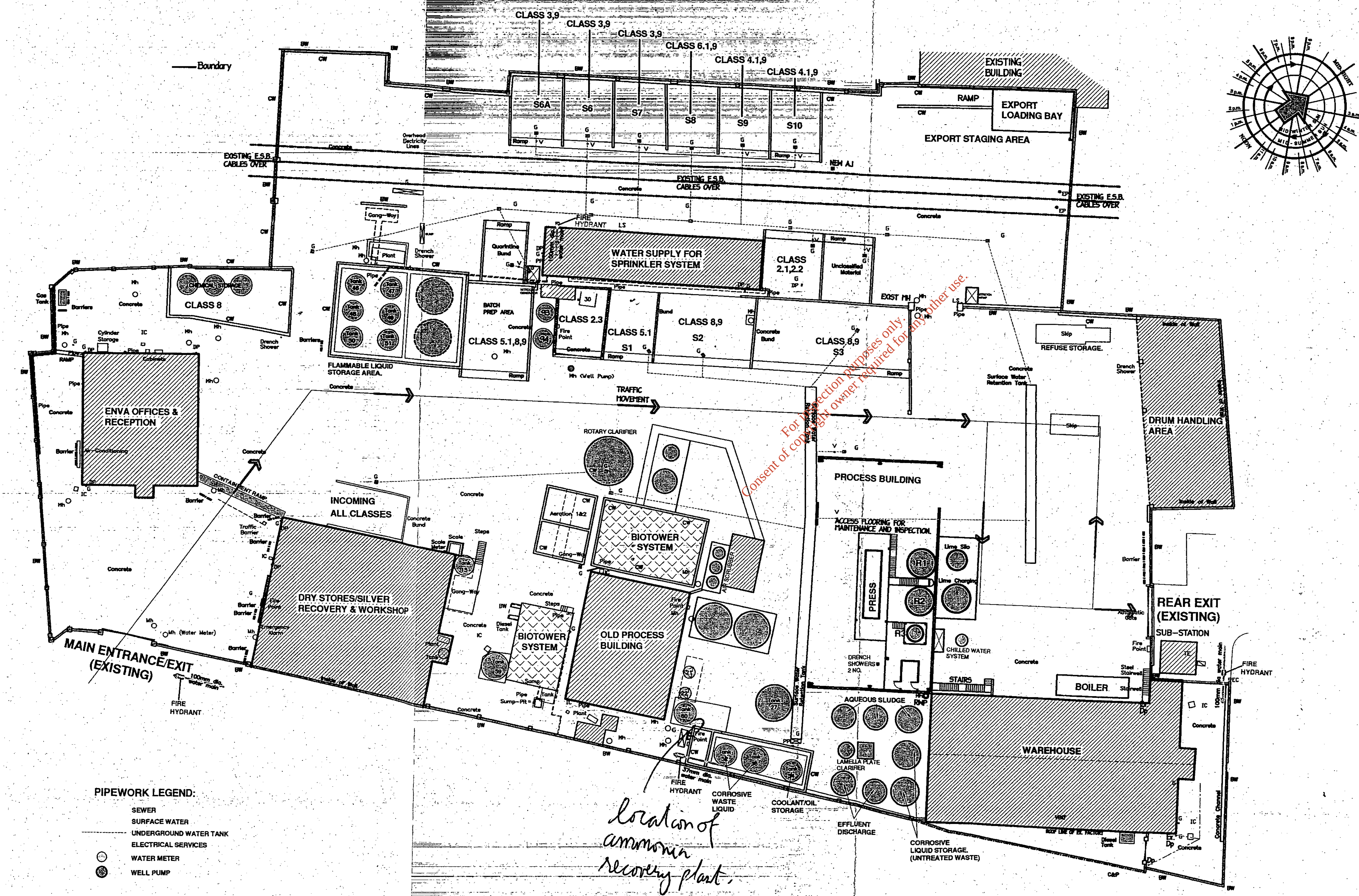

NO.	REVISION	DATE
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SCALE 1:500.

DRAWING No. IR-SG 1

JOB. No. C03068

DATE April '05