Attachment F

Treatment, Abatement & Control Systems

TABLE OF CONTENTS

1 Emissions to Atmosphere Abatement

Emissions to Atmosphere are detailed in Section E of the main application.

1.1 IC1 Solvent Recovery

This solvent recovery unit was installed at the time of construction of the original membrane plant. Concentrated solvents from the IC1 casting process are recovered for reuse in the Solvent Recovery Unit (SRU). This unit consists of a 3 stage distillation process for the 3 main process solvents (fully bunded). Recovered solvents are resin filtered and pumped to QC storage. On completion of the relevant tests the solvent is pumped to bulk storage for reuse in the process.

The system consists of a flash vessel followed by two packed distillation columns connected in series. The rig is designed to process two different waste streams during consecutive recovery campaigns; one campaign recovers methanol and DMAC, and the second acetone only.

Feed is introduced to the flash vessel as a liquid at ambient temperature and re-circulated through filters and a shell-and-tube heat exchanger. The filters are present to remove small quantities of a soluble polymer that comes out of solution when exposed to high temperatures, while the heat exchanger provides the necessary boil-up. The vapour generated in the flash vessel is then directed to a column where water/methanol and high boiling DMAC are separated. The DMAC is removed as a vapour side-stream and the remainder is fed to another column for separation.

During an acetone recovery campaign the vapour from the flash vessel is passed through a column without any separation taking place; the acetone/water split is carried out in a separate column. The overheads are then condensed and collected in a reflux vessel whereupon it is pumped to a column; a pre-determined fraction of condensate is returned to provide the necessary reflux. The final step in the recovery involves the separation of methanol/water, or acetone/water in a column. The methanol/acetone rich overheads are condensed and collected in the reflux vessel and pumped to the QC tanks for analysis and to the larger holding vessels for storage. A pre-determined fraction of condensate is returned to provide the necessary reflux, while the aqueous bottoms are directed to effluent.

Recovered solvents are resin filtered and pumped to QC storage. On completion of the relevant tests the solvent is pumped to bulk storage for reuse in the process.

1.2 IC2 Solvent Recovery

A second Solvent Recovery Unit (installed in 2008) is located adjacent to the IC2 tank farm. TheIC2 process was designed to maximise recovery of solvent waste streams and so minimise wastewater generation and loading on the WWTP.

This SRU is capable of recovering Acetone, Methanol, Dimethylacetamide (DMAC), NMP and TEG and is operated on also campaign basis similar to IC1.

The SRU consists of a Falling film evaporator, Wiped Film Evaporator and 2 distillation columns. Solvent is fed to the unit from waste solvent tanks in the tank farm with the recovered solvent being directed to dedicated solvent recovery tanks. The solvent is checked by QC prior to being stored in tanks awaiting reuse in the process.

The SRU is a packaged unit with all internal equipment, piping, electrics, installation and controls for operation and is linked to the site utility systems including cooling water and waste water treatment. The SRU is located in a bunded area, with all runoff diverted to the wastewater treatment plant.

1.3 Thermal Oxidiser Abatement Systems

Merck Millipore operates a series of regenerative ceramic oxidation beds which treat solvent vapours produced in the membrane manufacturing process by thermal oxidisation (see Process Flow Schematic 8 in Attachment D of the application). There are currently three ceramic oxidation beds onsite – TO1, TO2 and TO3. Both TO1 and TO2 vent directly to a shared exhaust stack – emission point A1-7. TO3 vents directly to its own stack – emission point A1-8.

Once treated, the exhaust vapours are vented to atmosphere. Treatment is characterised by converting the organic solvent to carbon dioxide and water by temperatures >800 °C. Any residual organic solvents will be detected by inline FID analysers and alarmed back to the production department accordingly. Similarly bed temperature, pressure, LEL concentration and air flow are also monitored to ensure compliant operation.

Should issues occur with operations of the TO whereby a bypass occurs, operations have 20 minutes to get the system back online. After 20 minutes process feeds to manufacturing area will be interlocked to prevent impact on the environment. The 20 minute protocol rule is based on air dispersion modelling which demonstrates the associated environmental risk of a bypass as approved by the Agency in 2011.

This application will also cover the installation of a new thermal oxidiser TO4. This thermal oxidiser will be located north of existing TO3 to form operational standby and redundancy for existing sources of process vapours. The same bypass protocol will be employed once fully operational.

1.4 Chromatography Media - Acid /Caustic Neutralisation System

The Controlled Pour Glass (CPG) and ProSep processes generate both acid and caustic waste water from the acid/base leaching and Prosep wash phases. This waste water is collected in dedicated acid and caustic waste neutralisation tank. The neutralization system comprises further 10m^3 vessel equipped with an agitation and pumped circulation system complete with pH monitoring. The system will operate to optimize the neutralization available

from mixing the acid and caustic wastes to minimize the requirement to use fresh neutralizing reagents. All emissions are discharged to WWTP.
The vent/head space from the neutralization tank is routed to the adjacent scrubber system.

1.5 CPG Dust Collection Systems

The CPG process generates glass dust at a number of locations in the process itself and in the final inspection and packaging areas. The dust is captured at source to ensure occupational exposure limits are met in all working areas of the plant. All dust laden air is directed to the dust collection system (emission point A2-30) where the dust is removed prior to discharge of the air to the atmosphere.

The dust collector is a conventional dust collecting unit equipped with cyclones and outlet filters. The unit is designed, installed and operated to ensure that the TA Luft standards are met. Annual monitoring since installation showed that all emission values are less than 1 mg/m^3 (IE limit)

The system is fitted with the following monitoring facilities:

- Operational indicator to confirm that the unit is operating
- Differential Pressure Alarm on the filtration system
- Filter Cleaning System operating indicator

As part of CPG product demand a second dust torit is required in 2015/2016. The same level of efficient technology and inline monitoring systems will be installed.

1.5.1 CPG Acid Fume Scrubber System

The CPG process uses hydrochloric acid and caustic solution as part of the glass formation process. The use of hydrochloric acid has the potential to generate acid fumes arising from its storage and use. All acid storage tanks and process equipment with the potential to generate acid fumes are directed to a fume scrubber system to ensure these fumes are removed from the air streams prior to discharge. The scrubber is a standard acid fume scrubber using low strength (~5%) caustic solution to neutralize the acid fumes. The caustic solution is circulated through a packed bed through which the process air is fed in a counter current direction. The scrubber is fitted with the following monitoring equipment:

- Scrubber liquid pressure
- Scrubber sump liquid level
- Scrubber sump pH

The scrubber liquid is replaced at routine intervals to ensure that the scrubbing process remains effective at all times. The spent scrubber liquid is sent to the neutralization system for treatment and onward disposal to the local authority sewer.

In accordance with the requirements of BAT (Best Available Techniques) Merck Millipore ensures that preventative measures are taken against pollution and that suitable abatement technologies are implemented to reduce the impact on the environment.

Process wastewater is treated in the onsite wastewater treatment plant.

2 Wastewater Treatment

Merck Millipore's wastewater is ultimately derived from process effluent from site membrane manufacturing processes (IC1, Aircast and IC2 with some minor volumes from Chromography Media manufacturing. The WWTP underwent a major infrastructural upgrade and process improvement in 2013. See Process Flow Schematic 7 in Attachment D of the application.

At present process effluent is discharged to the WWTP to one of three 200m^3 Catch Tanks (new) where it is monitored for solvent content and presence of chlorinated sanitate. Anti-chlorination agents are added accordingly to neutralise chloro-elements, where then the three Catch Tanks are forward fed to the Balance Tank, which combines the contents of the three tanks into a uniform consistency. After a period 6-7 days the effluent is then forward fed to one of two Aeration Tanks where activated sludge consisting of microorganisms will consume the effluent. To assist the process pH correction takes place as well as the introduction of nitrogen/phosphorous rich nutrients.

The Aeration Tanks are constantly monitored by a series of inline probes to determine oxygen content and process efficiently. After 12 days the treated effluent is forward fed to a new Dissolved Air Floatation process where the biomass and solids are removed. The treated effluent will discharge via SE1 (final emission point) and the biomass is sent to a sludge dewatering plant where the water is removed and sludge thickened for disposal (offsite – approved licensed treatment facility) whilst the water is returned to the WW process. SE1 discharges to Carrigtwohill treatment works operated by the Local Authority.

As part of the upgrade the entire WWTP is contained on hard standing ground. The new Catch Tanks are fully bunded. All pipework operates overground. All systems are automated with state of the art controls. A laboratory was constructed for day-to-day testing. Revamp dewatering plant was installed. All tanks are extracted to an odour control unit where WW vapours are treated by a biobed of seashell which render the vapours inert.

The Merck Millipore wastewater treatment plant operates 24hrs/7days with daily operator cover and out of hours back-up and emergency call out as required.

In this 6,100 m^2 building plastic parts are injection moulded and assembled as devices in a number of clean room assembly areas with various types of Merck Millipore membranes to produce a range of medical, life science and pharmaceutical filtration devices. Biotools operates 24 hours per day, either 5 or 7 days a week. The area is also supported by an onsite warehouse for packaging and dispatch of finished products.

Departments within the Biotools assembly plant building include:

- Millex 25
- Moulding
- Millex 33
- Stericup
- Centrifugal/ Amicon
- Millicell
- Multiscreen
- Membrane Filter-cutting

There are no process emissions from Biotools with the exception of recyclable plastics and general industrial waste. The area is supported by a dedicated EHS engineer.

The Standard Operating Procedure for the wastewater treatment plant is included with this attachment.

3 Control of Surface Water Discharges

See Process Flow Schematic 11 in Attachment D of the application.

All liquid contents inc. rainwater are gathered in bunded areas (i.e. tankfarms, drumstores) are pretested for Chemical Oxygen Demand and pH and pumped to the site's WWTP. All bunds/containment structures are tested every three years as per IPPC requirements.

Green/brown field areas are allowed to drain naturally to soil as industrial operations are prohibited on these areas.

All other hardstanding and roofed areas are collected via the site stormwater catchment system (underground drainage). Drainage flows from north to south where clean stormwater is discharged to the Slatty Waters at emission point SW1.

At the SE1 chamber, instrumentation tests the water for Total Organic Carbon and pH – once in compliance with site limits, a chamber control valve remains open. Should the limit be breached, then the control valve will automatically close, diverting all flows to firewater retention pond preventing contamination of the river.

The pond is lined with a suitable chemical resistance membrane. Its capacity will contain a worse case firewater event plus extreme stormwater water levels. The pond capacity was recently increased to ensure adequate firewater capacity following recent hardstanding expansions.

Operation & Control of Effluent Treatment Plant

Document Number	Revision Code	Document Type	Page Number
0040277SO	BE	Standard Operating Procedure (SO)	1 of 40

Title

OPERATION & CONTROL OF EFFLUENT TREATMENT PLANT (EHS)

Responsible Location	Approval Locations	Reference Locations	Language
R	N/A	N/A	English

Referenced Documents	Special Notes
00005457SS 0040544SO 0040253TM **0040221TM 0040541SO 0040120TM** **0040124TM 0040225TM**	N/A

1.0 SUBJECT

Operation and control of waste water treatment plant.

2.0 PURPOSE

The primary purpose of this procedure is to ensure compliance with Merck Millipore Ltd's Integrated Pollution Prevention Control License P0571-03. This procedure describes the correct operation of the waste water treatment plant and the actions to be taken given the results of specific tests.

3.0 SCOPE

This procedure applies to process waste water arising from IC1, IC2, Air Cast and CPG operations, all floor washings from process areas in IC1, IC2. Air Cast and CPG, surface water runoff from the tank farms and hazardous waste storage areas, and water condensate from the solvent recovery systems and boiler blow-downs.

4.0 RESPONSIBILITIES

4.1 The overall operation of the Waste Water Treatment Plant (WWTP) in compliance with the site IPPC Licence conditions is the responsibility of the EHS Manager. The day to day management of the plant and communication with Production Management on aspects of WWTP Performance which may impact on Operations is the responsibility of the WWTP Operations Lead / EHS Engineer.

4.2 The WWTP Operators are responsible for collection and analysis of samples and ensuring all analysis required by the license as per schedule B.3 'Emission to Sewer' is carried out. Decisions relating to the operation of the plant are made by EHS and the WWTP Team.

4.3 The Maintenance Department is responsible for the PM on electrical and mechanical equipment as per condition 6.6 as well as holding spares as per schedule C.1.1 Note 1.1.

4.4 The WWTP Team are responsible for calibration and maintenance of monitoring equipment as per condition 6.6 of the IPPCL.

4.5 EHS are responsible for reporting effluent plant monitoring in the AER as per Schedule D of the licence.

4.6 It is the responsibility of the WWTP Team to collect samples from the refrigerated composite sampler.

5.0 DEFINITIONS

EHS	Environment, Health and Safety
E.P.A.	Environmental Protection Agency (the agency)
C.O.D.	Chemical Oxygen Demand
B.O.D.	Biological Oxygen Demand
T.O.C.	Total Organic Carbon
Influent	Waste water entering effluent plant
Effluent	Treated water leaving effluent plant
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
pH	Log 10 of the hydrogen ion concentration
IPPCL	Integrated Pollution Prevention Control License
PM	Preventative Maintenance
WWTP	Waste Water Treatment Plant
TN	Total Nitrogen

6.0 PROCEDURE

6.1 Safety

The Major Hazards and controls with working in the effluent plant are shown below:

MAJOR HAZARDS	CONTROLS
Living biological material may be present in waste water (Aeration Tanks)	Always wear protective gloves such as Nitrile gloves and safety glasses when handling or taking samples. In the event of splashes, wash affected area with soap and water as soon as possible. Any cuts or broken skin should be covered. Always wash hands after working with effluent samples. Vaccination Sampling procedure in place
Drowning	Leaning over guide rails or reaching through guide rails to take samples is forbidden. Samples must be taken with sampler on a string or pole. Where maintenance work may involve work in or around effluent tanks the two man rule and confined space entry permit applies.
Chemical splash	Some of the chemicals used to treat waste water, such as nutrients and caustic, are corrosive. Impermeable gloves and safety glasses must be worn when handling containers. In the event of decanting IBC's, face shield protector must also be used. When working in the environmental laboratory, safety glasses and nitrile gloves are mandatory.
Back injury	Adopt good manual handling practices at all times. 25kg drums is to be avoided where possible. Use of mechanical aids (such as forklift, electric pallet truck) when possible. On heavy and awkward loads, ask for help.
Trip Hazards	The area surrounding the WWTP must be kept clear of all waste and redundant material which may present tripping hazards.
Lone Working	Man down pager

6.2 Environmental

Correct operation of the WWTP is required to ensure compliance with the Integrated Pollution and Prevention Control Licence.

All chemicals must be stored in bunded areas. Inspection of bunds is required on a regular basis to ensure they are empty at all times. Inspection records are recorded on the WWTP Daily Batch Log (Doc No.: 00005457SS)

Hazardous and non-hazardous waste must be segregated correctly:

- Cardboard waste to be placed in cardboard bailer
- Plastic waste to be placed in plastic bailer
- Glass waste to be placed the designated recycling glass bins.
- General waste to be placed in general waste bin
- COD Vials, Total Nitrogen Acid Vials and Total Nitrogen Hydroxide Vials are to be stored in designated drums within the laboratory. Once drums are full, these are transferred to the IC1 drum store for hazardous waste disposal.

6.3 Sampling

The requirements for sampling and analysis of Merck Millipore Ltd's final effluent are outlined in the Integrated Pollution Prevention Control Licence as follows:
In schedule B.3 Emission to Sewer, C.3.1 Control of Emissions to Sewer (See Attachment 1) and C.3.2 Monitoring of Emissions to Sewer (See Attachment 2)
The main parameters associated with the operation of the effluent treatment plant are:

Parameter	**Procedure**
TOC (Total Oxidisable Carbon)	Doc. No. 0040124TM
COD (Chemical Oxygen Demand)	Doc. No. 0040544SO
PH	Doc. No. 0040541SO
Suspended Solids	Doc. No. 0040221TM
Phosphorous	Doc. No. 0040225TM
Total Nitrogen	Doc. No. 0040253 TM

The effluent monitoring programme is to ensure good operation of the plant and compliance with License requirements and is located in attachment 2 and is as per schedules B and C of the IPPCL.

The following parameters are measured on line with continuous recording:

- WWTP IC1 Waste Stream Flow Meter (Instrument No: FT-901)
- WWTP MW2 Waste Stream Flow Meter (Instrument No: FT-902)
- WWTP Aircast Waste Stream Flow Meter (Instrument No: FT-903)
- WWTP CPG Waste Stream Flow Meter (Instrument No: FT-904)
- WWTP IC2 Waste Stream Flow Meter (Instrument No: FT-905)
- WWTP T-901 Catchtank 1 Level (Instrument No: LT-901)
- WWTP T-901 Catchtank 1 pH (Instrument No: AIT-901)
- WWTP T-901 Catchtank 1 LEL (Instrument No: AIT-904)
- WWTP Catchtanks Outlet Flow Meter (Instrument No: FT-906)
- WWTP T-904 Balance Tank Level (Instrument No: LT-909)
- WWTP T-904 Balance Tank pH (Instrument No: AIT-907)
- WWTP T-904 Balance Tank LEL (Instrument No: AIT-908)
- WWTP Aeration Tank 1 T-905 Inlet Flow Meter (Instrument No: FT-908)
- WWTP Aeration Tank 2 T-906 Inlet Flow Meter (Instrument No: FT-909)
- WWTP T-905 Aeration Tank 1 pH (Instrument No: AIT-923)
- WWTP T-905 Aeration Tank 1 Redox (Instrument No: AIT-909)
- WWTP T-905 Aeration Tank 1 D.O. (Instrument No: AIT-910)
- WWTP T-905 Aeration Tank 1 MLSS (Instrument No: AIT-911)

- WWTP T-905 Aeration Tank 1 Temperature (Instrument No: TT-901)
- WWTP T-905 Aeration Tank 2 pH (Instrument No: AIT-924)
- WWTP T-905 Aeration Tank 2 Redox (Instrument No: AIT-912)
- WWTP T-905 Aeration Tank 2 D.O. (Instrument No: AIT-913)
- WWTP T-905 Aeration Tank 2 MLSS (Instrument No: AIT-914)
- WWTP T-905 Aeration Tank 2 Temperature (Instrument No: TT-902)
- WWTP DAF 1 RAS Flow Meter (Instrument No: FT-910)
- WWTP DAF 2 RAS Flow Meter (Instrument No: FT-911)
- WWTP DAF 1 & 2 WAS Flow Meter (Instrument No: FT-923)
- WWTP T-911 Grey Water Tank 1 Level (Instrument No: Lt-913)
- WWTP T-923 Grey Water Tank 2 Level (Instrument No: Lt-939)
- WWTP Outfall Temperature (Instrument No: TT-913)
- WWTP Outfall TN (Instrument No: AIT-927)
- WWTP Outfall TOC (Instrument No: AIT-917)
- WWTP Outfall pH (Instrument No: AIT-916)
- WWTP Outfall MLSS (Instrument No: AIT-915)
- WWTP Outfall Temperature (Instrument No: FT-912)
- WWTP Combined Sewer Temperature (Instrument No: TT-914)

All the above parameters are monitored continuously and recorded on the effluent plant SCADA system. This system is also linked to production and maintenance areas. Alarms have been set for key parameters in the effluent plant.

Once a week, samples are sent to an external laboratory to comply with requirements of Schedule C.3.1: Control of Emissions to Sewer.

Each day a sample from the flow proportional composite sampler is retained until at least 16.00 in case of an unannounced visit by the EPA.

On occasion when the EPA does arrive on site to take a sample from SE1, the sample is split and Merck Millipore Ltd retains one to be analysed for the full range of parameters specified as per the IPPCL schedule B.3 for SE1.

On days when samples are sent to an external laboratory for analysis a second sample must be retained (refrigerated) with Merck Millipore Ltd. On receipt of the analysis report, results are reviewed, filed and recorded as follows:

File to: T:\EHS\3.0 Operational Control\3.12 WWTP\Operations Data\External Lab Results

Record to: WWTP Data located at T:\EHS\3.0 Operational Control\3.12 WWTP\Operations Data

Non-compliances are reported immediately to EHS in order to notify the EPA and County Council.

Attachment 3 contains the sampling programme developed to comply with requirements of the licence and to optimise process monitoring and control.

6.4 Overview of Plant Operations

The operation of the effluent plant depends on the demand made on it by production in Membrane Manufacturing Plant, CPG and other areas (such as boiler blow down). The plant runs seven days a week and 365 days/year. To ensure effective operation of the effluent plant, i.e. pumps running, valves open, etc, process and critical alarms are set up on SCADA. These alarms are continuously monitored by the WWTP Operations Team. The plant is manned 12 hrs a day, 7 days a week. At nights, the duty supervisors/team leads monitor the SCADA System for any critical alarm arising from the effluent plant and will respond to alarm as per Troubleshooting guide.

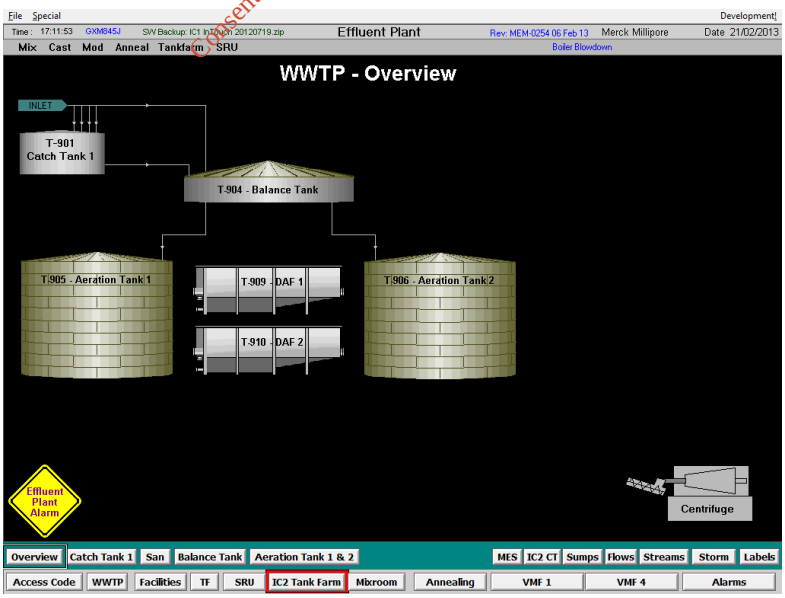
Link to WWTP Troubleshooting Guide:

T:\EHS\3.0 Operational Control\3.12 WWTP\Troubleshooting guide\WWTP Troubleshooting Guide_Safety Alarms.doc

This section will describe in detail SCADA Navigation and process automation. It will also identify process control key performance indicators and the management of them.

6.4.1 Navigation to T-901 Catch Tank 1

To navigate to the T-901 Catch Tank 1 overview screen, follow the link from the Effluent Overview screen, shown below.

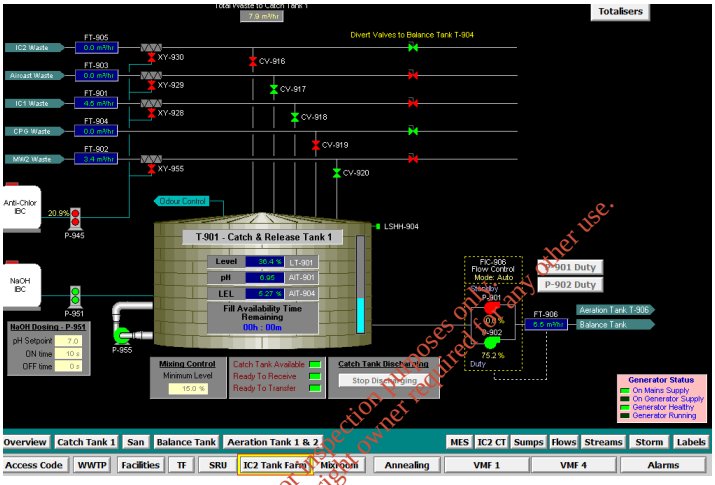


Waste Stream selection to Catch Tank or Balance Tank

There is automated control to divert the waste streams to the Catch Tank 1 or the Balance Tank.

The valves for diverting to Balance Tank are not actuated so require manual operation at the valve. The valves diverting streams to the Catch Tank1 (CV917, CV918, CV919 & CV920) are actuated and can be operated automatically, however due to the absence of actuated valves to the Balance Tank, it is advised that operators place the required valve into Manual Mode and open manually.
Note that there is no control of the route for IC2 waste stream as this uses the route leading directly to the balance tank. Flows from production areas: Aircast, IC1, MW2 have the facility to flow to the catch tank which then flows either to balance tank or aeration tank 2.

6.4.2 Instrument Control Catch Tank



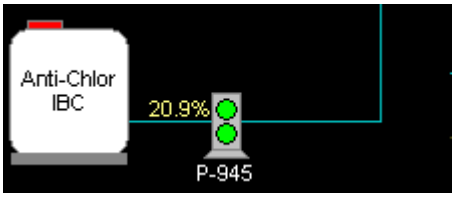
a) **Antichlor (Sodium Thiosulphate) Dosing for Sanitisations**

The antichlor dosing system is automated and should not require operator intervention.

- Valve XY-930 will dose to the existing IC2 route if the sanitisation for IC2be selected.
- Valve XY-929 will dose the Aircast waste stream if any of the areas in the Aircast dept select sanitisation.
- Valve XY-928 will dose the IC1 waste stream if any area in the IC1 department selects sanitisation.
- Valve XY-955 will dose the MW2 waste stream if MW2 is selected for sanitisation.

When any dosing valve described above opens then the dosing pump P-945 will run this will be indicated on the pump icon with a green run light. Currently P-945 will dose at 100% manually set at the dosing pump.

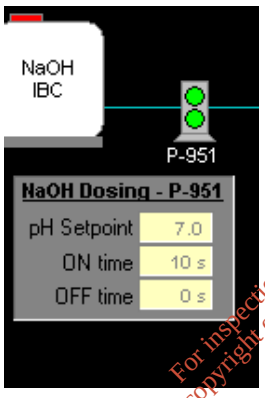
SANITISATION PUMP P-945 (Not Active red traffic light indication)



SANITISATION PUMP P-945 (In Active mode green traffic light indication)

b) **Caustic Dosing Catch Tank**

The NaOH caustic dosing system can be manually or automatically operated .In automatic the PH in the tank is dictated by a set point value (7.5 as shown on the mimic).



The dosing pump P-951 has an operator set point for ON and OFF time . Using the mimic as an example, when the PH level drops below the 7.5 value then pump P951 will energise for 10secs .until the desired set point is achieved.

c) **Catch Tank (T-901) mixing**

The jetox mixer P-955 recirculates the liquid within T-901 in order to mix it .The control to start and stop mixing is automated, based on a level set point in T-901 being attained (15% shown on the mimic)

This level can be adjusted (with suitable user log in) from the " mixing control" minimum level set point below T-901.Once the level measured LT-901 exceeds the set point for a short period ,P-955 is commanded to run. P-955 will continue to run provided level remains at the initial set point less 2% (to prevent erratic ON/OFF events at start) and the tank is not disabled due to LEL high level etc. Note that the jetox pump contributes to foaming within the catch tank, should this occur then the chemical S-10 can be added to the tank to reduce the foaming levels.

d) **Catch Tank (T-901) Discharging**

The discharging of T-901 is currently automatic, to ensure a constant feed to the downstream Balance Tank or Aeration Tank. Therefore the Discharge Start/Stop buttons beneath the tank can be ignored. Provided there is sufficient level in the Catch Tank and the downstream tank and units are available, the discharge pumps will run.

Currently the Catch Tank is discharging to the Balance Tank. An option is provided internally in the control system to discharge directly to Aeration Tank 2 (T-906) from the Catch Tank. This option is not available to users, instead selected by a controls engineer. This option is provided typically when the IC2 stream must be segregated, so IC2 waste will use the Balance Tank and Aeration Tank 1 (T-905) and all other streams will use Catch Tank and Aeration Tank 2 (T-906). The sequence of operation is described later.

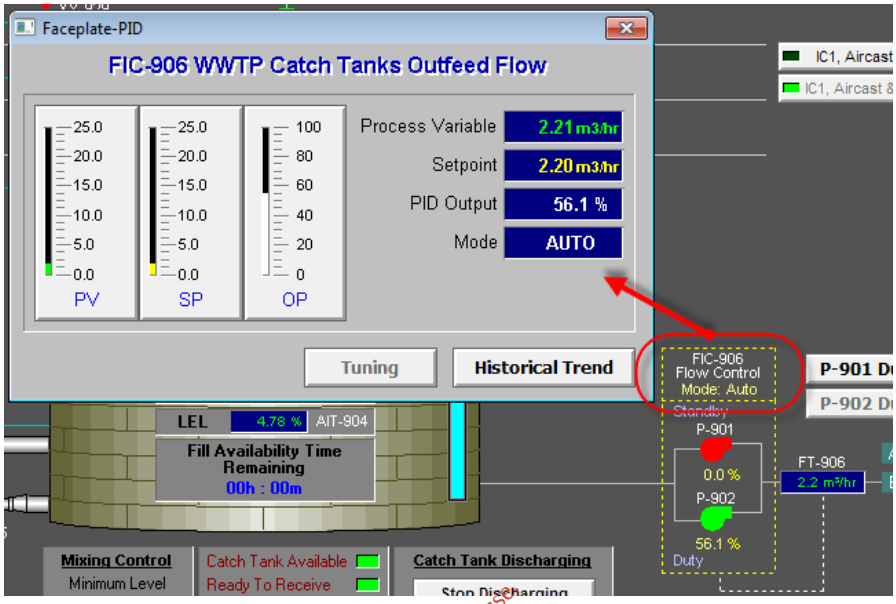
e) **Catch Tank (T-901) Discharge Flow Control**

The discharging of T-901 is controlled at a user set flow rate, in order to maintain a steady supply to the Aeration Tank. Therefore the operator will adjust the flow set point determined by conditions derived at the Aeration Tank.

To access the flow control functions, select the "FIC-906 Flow Control" object above the pumps P-901 & P-902 (highlighted in red, below). Note that the current Automatic or Manual mode of the flow controller is also displayed.

The flow control faceplate pop-up will appear (shown below). A suitable user login is required to adjust settings on this faceplate. The desired flow set point can be entered. If desired, the controller can be put into Manual Mode by clicking on the Mode Auto/Manual object. Once in Manual Mode, the "Manual Out" field becomes active and the operator can enter a fixed pump speed %, subject to minimum and maximum limits of the pump which are currently set at 40% and 100%.

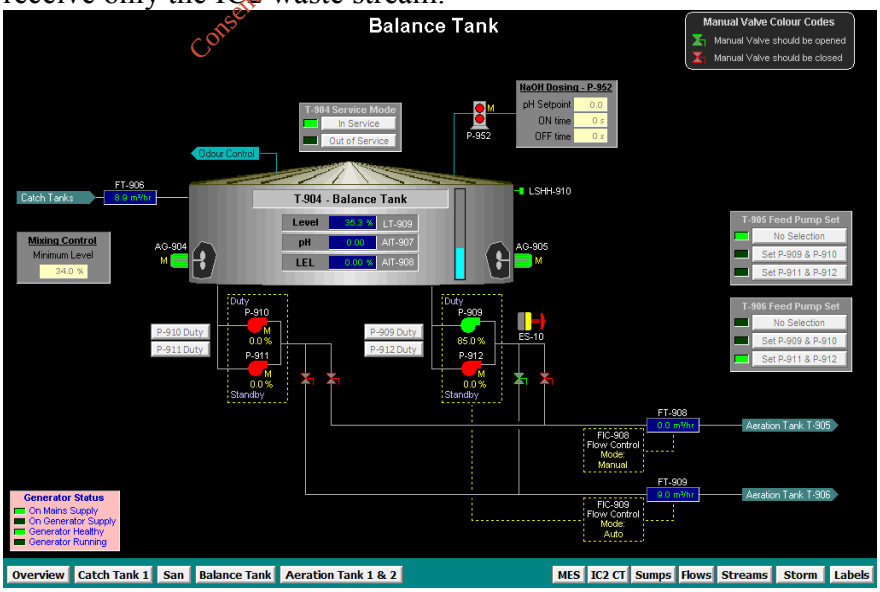
The current Duty of P-901 and P-902 can be switched by the operator, via the two buttons to the right of the pumps. There are indications of Duty and Standby alongside each pump. The Duty will automatically be switched on each cycle (each time either pump stops). If the Duty pump is unavailable, the Standby pump will automatically run.



Note: The flow set point will be determined by the WWTP Operations Team

6.4.3 Balance Tank (T-904) Description

The mimic screen for the Balance Tank is show below. Note that navigation links to the Aeration Tanks are located at the lower right corner. Currently, the Balance Tank receives mixed waste transferred from Catch Tank 1. Optionally, this transfer from Catch Tank will be diverted directly to aeration, and the Balance Tank will receive only the IC2 waste stream.



a) **Balance Tank (T-904) Mixing**

The mixers AG-904 and AG-905 control to start and stop mixing is automated, based on a level set point in T-904 being attained (34% as shown on the mimic). This level can be adjusted (with suitable user login) from the "Mixing Control" minimum level set point, left of T-904. Once the level measured by LT-909 exceeds the set point for a short period, both mixers are commanded to run. Mixers will continue to run provided level remains at the initial set point less 2% (to prevent erratic on/off events at start) and the tank is not disabled due to LEL high level etc.

b) **Balance Tank (T-904) Discharging**

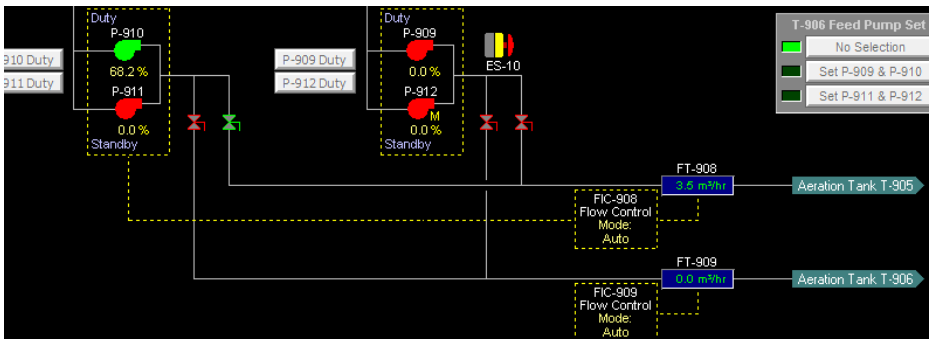
The discharging of T-904 is automatic, to ensure a constant feed to the downstream Aeration Tank. Provided there is sufficient level in the Balance Tank and the downstream tank and units are available, the discharge pumps will run.

Currently the Balance Tank is discharging to Aeration Tank 2 (T-906) via P-909 only (there is no Standby pump as yet). Optionally, discharge to Aeration Tank 1 (T-905) can be selected. This will typically occur when segregating IC2 waste through the Balance Tank and Aeration Tank 1 (all other streams will pass through Catch Tank 1 and Aeration Tank 2). In the final system, the Balance Tank can discharge to both Aeration Tanks simultaneously, if required. The sequence of operation is described later.

c) **Balance Tank (T-904) Discharge Flow Control**

The discharging of T-904 is controlled at a user set flow rate, in order to maintain a steady supply to the Aeration Tank. Therefore the operator will adjust the flow set point determined by conditions derived at the Aeration Tank.

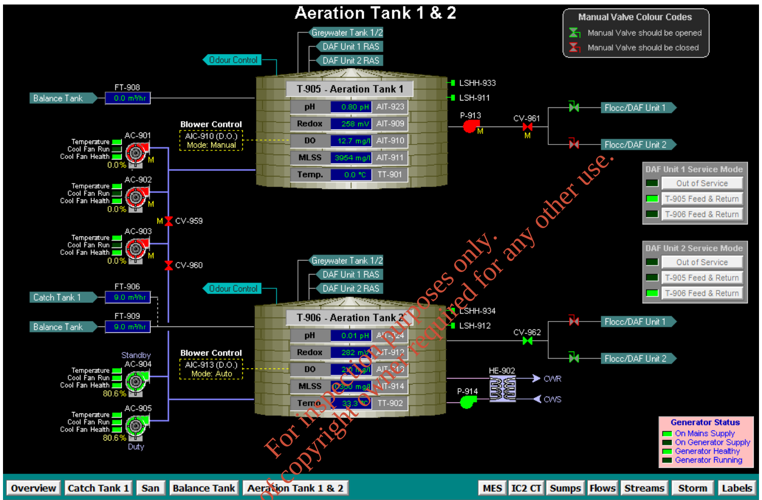
To access the flow control functions, select the "FIC-909 Flow Control" object for Aeration Tank 2 (T-906). Note that the current Automatic or Manual mode of the flow controller is also displayed. The PID pop-up is similar to that for Catch Tank 1 flow control, described earlier. (**Note:** Flows should only be changed by the WWTP Operations Team).



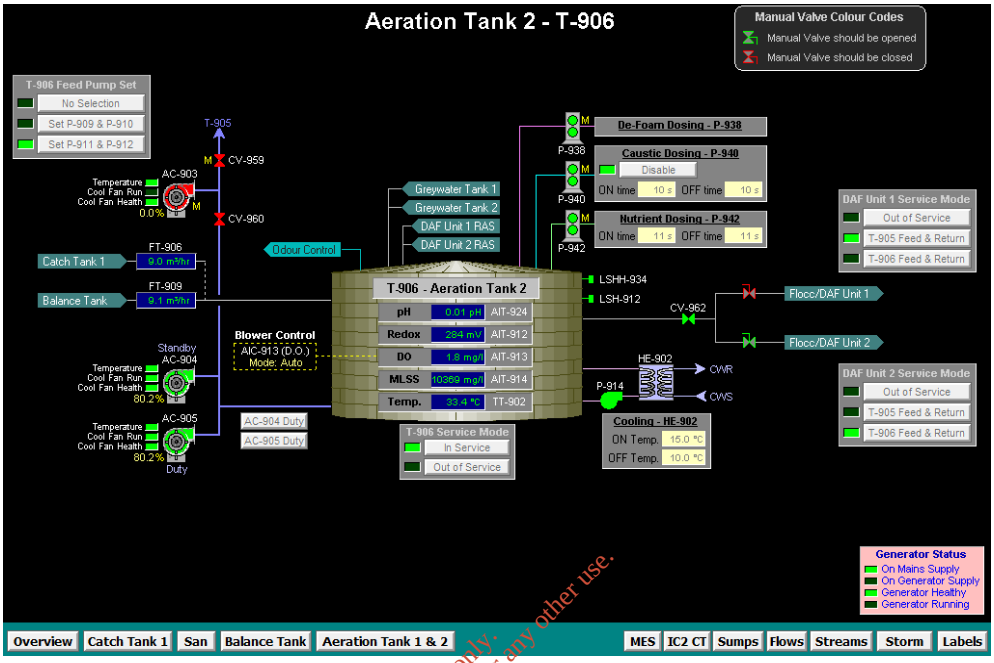
Flows can be adjusted manually at the pumps P-910 / P-911 and P-909 / 9-12 by varying the pump percentage (this varies the frequency of the pump) or by going to the PID (FIC-908 / 909) and enter the desired flow rate.

6.4.4 Aeration Tanks 1 & 2 (T-905 & T-906) Description

The mimic screen for Aeration Tanks 1 & 2 is show below. Currently, only the instruments and equipment associated with T-906 are to be noted, although T-905 operates almost identically. Links to the DAF1 and DAF2 mimics are located on the right side. Further links to the DAF mimics and the Grey water Tanks mimic are located above T-906. Manual Valve Colour Codes are used to advise the correct positions of hand operated valves, based on the selection of the route from T-906 to the DAF units.
The two vessels shown on the mimic are also navigation links to dedicated mimic screens for each tank.



The dedicated Aeration Tank 2 (T-906) mimic is shown below.
Below T-906 is a Service Mode selection. This allows an operator to select Aeration Tank 2 in or out of service. When out of service, all functions associated with T-906 will be stopped (blower control, feed from Catch or Balance Tank, etc.) Mode selection requires suitable user access level.
DAF Unit 1 and 2 also have a Service Mode selection, displayed on the right side of the mimic. They can be selected Out of Service (not selected to any Aeration Tank), or selected to be fed by either T-905 or T-906. Currently only T-906 is a valid selection as T-905 is not in use.
Note that only one DAF Unit can be associated with an Aeration Tank, so if DAF 2 is selected to T-906, then DAF 1 can only be selected to T-905. To select DAF 1 to T-906, it's necessary to change the selection of DAF 2 from T-906 first (Out of Service, etc.)



a) **Aeration Blowers**

T-906 has a duty pair of blowers, AC-904 and AC-905. These blowers are operated automatically, either singly or as a pair (when required) to maintain the Dissolved Oxygen (D.O.) within the aeration tank. The D.O. mg/l is measured by AIT-913, then a PID controller modulates the Duty blower speed up or down if this measurement is lower or higher than the set point.

If the Duty blower speed reaches 100% for a period of time, then the econd blower is started as an Assist. The speed of both blowers is then modulated to maintain D.O. at the set point.

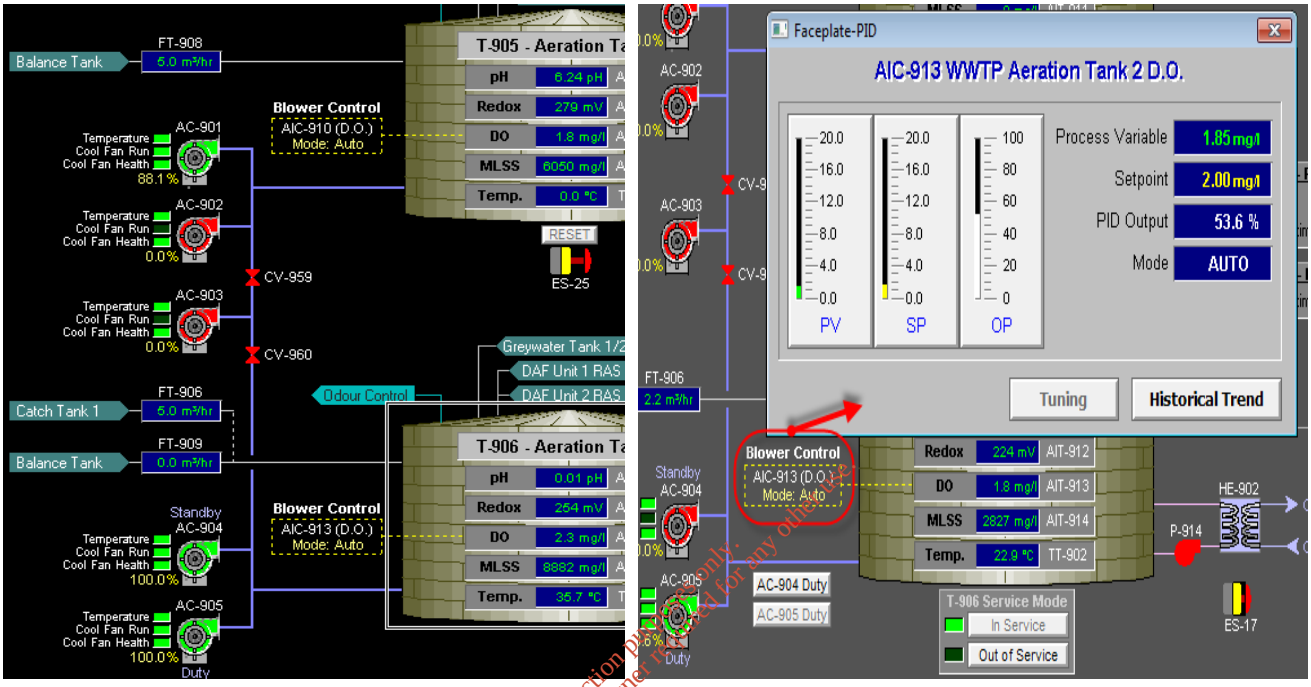
If the pair of blowers speeds reduce below 55%, then the Assist blower is stopped as it is deemed unnecessary. The Duty blower speed will then modulate as before.

Blower Duty is switched every 12 hours of run time, so when AC-904 runs for a total of 12 hours, then it is stopped and AC-905 run for a total of 12 hours. Blower Duty can also be changed from the screen by the buttons adjacent to the blowers.

If the Duty blower becomes unavailable due to a fault etc. then the Standby blower will operate automatically.

Each blower has 3 status indications, for enclosure temperature, cooling fan running and cooling fan health. A high temperature or trip of the cooling fan overload will trigger alarms.

The blowers PID control is accessed on the mimic, as shown below. This PID faceplate provides the same functions as described for FIC-906 Flow Control described earlier.



b) **Caustic Dosing**

The NaOH dosing system is manually controlled as there is currently no pH measurement from AIT-924. Therefore the Enable button must be selected /deselected to turn control on/off. The dosing pump P-940 has an operator set point for ON and OFF time. Using the mimic as an example, the pump will run for 10 seconds ON time, then stop for 10 seconds OFF time, then repeat.

c) **Nutrient Dosing**

The Nutrient dosing system is automatically started when the feed to the Aeration Tank starts (from Catch Tank 1). The dosing pump P-942 has an operator setpoint for ON and OFF time. Using the mimic as an example, the pump will run for 11 seconds ON time, then stop for 11 seconds OFF time, then repeat. When feed to T-906 stops, the nutrient dosing will also stop.

6.4.5 DAF Unit Description

The mimic screen for DAF Unit 2 is shown below. Note that DAF Unit 1 mimic is similar, so is not described in this document. The unit comprises of Flocculation Tank T-908 and DAF 2 (T-910). Navigation to Aeration Tank 2 is located on the left side of the mimic and also below T-910. Navigation to Grey water Tank 2 is located on the right side of the mimic.

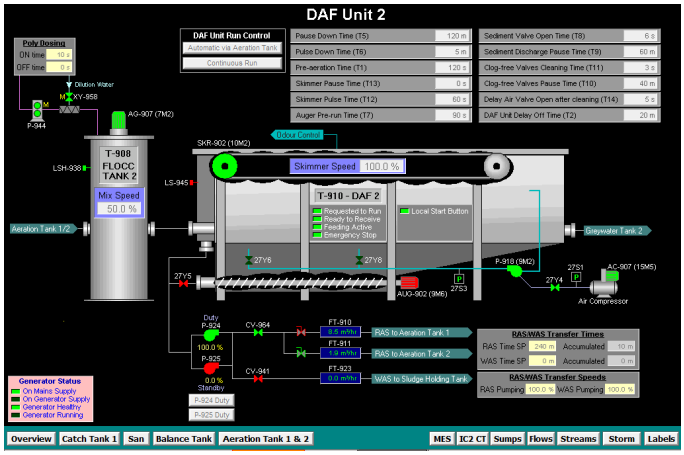
The DAF Unit Run Control selection allows the DAF to be started based on the demand of the selected Aeration Tank (normal mode) or selected to Continuous Run mode, which will command the DAF to run regardless of Aeration Tank state. This mode allows testing or setup of the DAF.

There are 12 process timer set points located above T-910. The function of these set points is described in the specific DAF operation documentation.

The Skimmer (SKR-902) and Mixer (AG-907) speed can be adjusted with their associated set points.

T-910 displays four status indications:

- Requested to Run – The tank feeding the selected Aeration Tank (balance tank or Catch Tank 1) is waiting to pump. This signal is a start request to the DAF.
- Ready to Receive – The DAF has completed its start-up procedure and is ready for Aeration Tank feed to commence. This signal is a ready handshake to the feeding tank (balance or Catch Tank 1).
- Feeding Active – The feeding tank has begun pumping to the selected Aeration Tank.
- Emergency Stop – When green the DAF emergency stop circuit is healthy. When flashing red the emergency stop circuit requires resetting. This must be done locally at the DAF panel.



6.4.6 Grey Water Tanks 1 & 2 Description

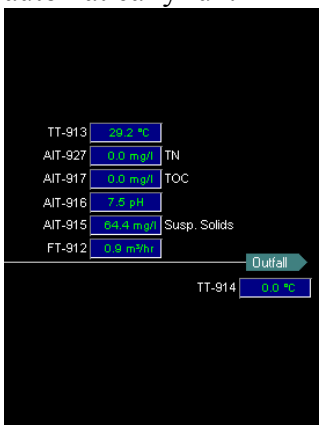
The mimic screen for Grey water Tanks 1 and 2 is show below. Grey water Tank 1 (T-911) is associated with DAF 1 Unit and Grey water Tank 2 (T-923) is associated with DAF 2. Navigation links to their respective DAF units are located to the left of each tank. Navigation links to the Aeration Tanks are located on the right side of the mimic.
Note that the Outfall instrumentation (FT-920, AIT-915 etc.) are not currently active, so can be ignored.

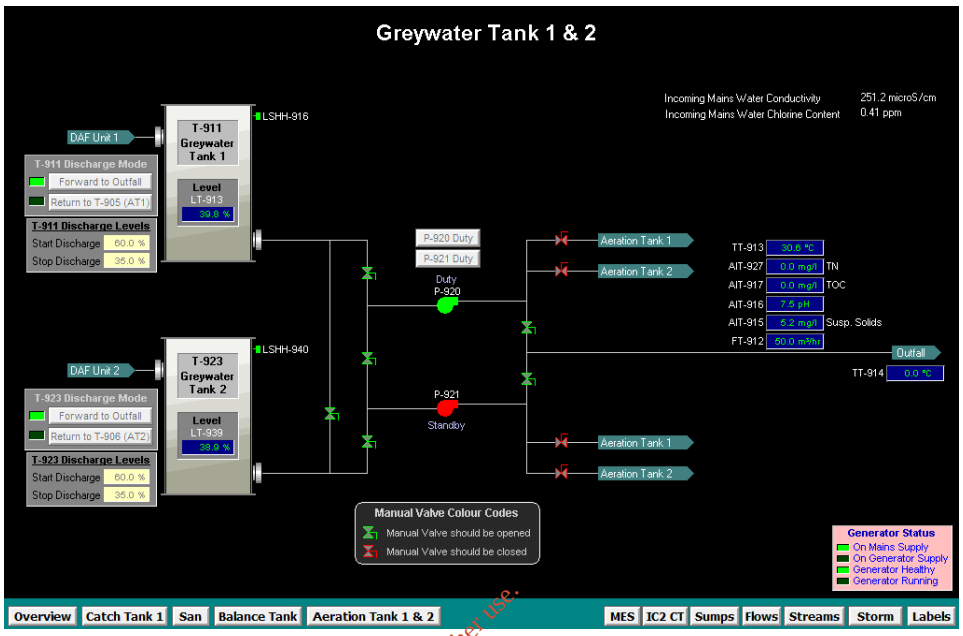
a) Grey Water Tanks Discharge Route Selection

Each Grey water Tank can be selected to discharge to Outfall (normal route) or to discharge back to the associated Aeration Tank from which the DAF unit was fed (if grey water is not suitable for discharge to outfall). This is done via the **Discharge Mode** selection located to the left of each tank. Note that if no Return selection button is visible and " Select DAF 1 (or 2) Mode" appears, this indicates that the associated DAF unit is not yet selected to either Aeration Tank. This must be done before a return selection can be made.
The Manual Valve Color Codes for the displayed hand operate valves will indicate whether a valve should be opened or closed, depending on the discharge selection of each tank.

b) Grey Water Tanks Discharge Level Control

There are level set points located to the left of each Grey water Tank. The Start Discharge set point is the level at which the Duty discharge pump will start, once the level in the tank reaches this set point.
Once the tank level drops below the Stop Discharge set point, the pump will stop. These set points can be accessed with a suitable user access level
In the current configuration, the pumps P-920 and P-921 will operate in Duty/Standby mode. The Duty switchover will occur each time a pump stops, ready for the next cycle. The duty can also be changed from the buttons located above P-920.
In the event that the Duty pump is unavailable, the Standby pump will automatically run.





6.5 Process Control

6.5.1 Pre-treatment Stage (Catch Tank 1 and Balance Tank)

The process lines entering the WWTP are originated from the following areas:

- IC1 process waste water
- IC2 process waste water
- Aircast process waste water (from J1, J2 and K machines)
- MW2 (Aircast) process waster
- CPG process waste water

Flow meters, one dedicated for each line, continuously measure and record volumes of wastewater entering the plant from the production areas. This information is recorded on the SCADA system. Process flows can vary in quantity and/or composition depending on production campaigns and operating conditions.

Under current operating conditions (Phase I CCU WWTP Project) each line entering the WWTP can be diverted to either Catch Tank 1 or Balance Tank. The conditions to divert process flows to Catch Tank 1 or Balance Tank are set by the WWTP Operations Team (considering quantity and strength of incoming flows and biological performance).

Both Catch and Balance Tanks are continuously agitated to ensure contents are mixed in chemical composition.

A discrete sample is taken on a daily basis from Catch Tank 1 and Balance Tank. These samples is analysed for the following parameters:

pH: to ensure a neutral feed
COD: to identify strength of feed
Total Nitrogen: to identify nutritional composition of feed (Nitrogen and Phosphorous)

These parameters dictate the control of forward feed rates to Biological Treatment (Aeration Tanks).

The level of effluent in the Catch Tank 1 and Balance Tank is measured and recorded in the WWTP Process Data Log.
Ultrasonic level detectors in both tanks relay the information to the SCADA System.

High level and low level sensors trigger alarms in the control room if the level of wastewater exceeds the set points (Refer to troubleshooting guide – T:\EHS\3.0 Operational Control\3.12 WWTP\Troubleshooting guide\WWTP Troubleshooting Guide_Safety Alarms.doc).

The following chemicals are applied to these tanks as required:
Caustic Soda Liquor 30% (Sodium Hydroxide): Used to achieve a neutral pH of tank contents.
Dosing pump is automatically controlled by pH inline probe in Catch Tank 1 and Balance Tank. pH range is between 6-9 (set point 7.5- neutral pH). The dosing pump will respond accordingly based on pre-set SCADA values.

Antichlor (Sodium Tiosulphate): used to neutralise sodium Hypo chloride arising from sanitanisations in production operations. Sodium hypo chloride contributes to negative effects of chlorine in the biological population.
The dosing pump is set, for each line, according to an established % of sodium hypochlorite in the process wastewater.
The Catch Tank and balance tank are tested for total/free chlorine on a daily basis, to ensure no residue is left after sanitisations.

BIOTECTOR: When the biotector detects a high total nitrogen in the primary stages of treatment (>220mg/L) an alarm flashes on the SCADA system. This will give the WWTP Operations Team an indication of high nitrogen influent so this can be closely monitored through all the treatment stages to ensure compliance at final emission point SE1.

6.5.2 Biological Treatment Stage (Aeration Tank 1 & 2)

Aeration Tank 1 (AT1) and Aeration Tank 2 (AT2) can be run in parallel or independent of each other.

When running in parallel, AT1 and AT2 receives flows from the Balance Tank, at the same flow rate and composition.
When the two systems are running independently, AT1 receives flows from Balance Tank, and AT2 received flows from Catch Tank Forward feed rates can vary.
Balanced wastewater is pumped to the Aeration basins where it is treated by activated sludge.
Two pumps dedicated to each aeration tank facilitate the transfer of effluent out of Catch Tank / Balance Tank to the correspondent aeration tank. These pumps can be set to operate in a manual or automatic mode. The pumps for each aeration tank operate on a duty standby system. Flow adjustments are made via the main control computer. Adjustments to flow must be made while pumps are running. The forward feed flow rates are measured and recorded on the SCADA system.
The forward feed rate is dependent on the COD load requirement of each aeration tank. The load must remain constant and needs to be calculated daily based on the COD of the incoming flow.

The design capacity of each Aeration Tank is 2400 Kgs of COD/day.

Process Control Calculations

COD loading (Kgs/day) = $\frac{\text{COD*(mg/L) x Forward feed (m3/day)}}{1{,}000}$

* Where the COD (mg/L) is the COD of the Catch Tank/Balance Tank.

Food/Microorganism (F/M) ratio:

The Food/ Microorganism ratio is defined as:

$$\frac{F}{M} = \frac{Kgs\,BOD/day}{Kgs\ MLSS} = \frac{\frac{BOD\left(\frac{mg}{L}\right) x\ Forward\ Feed\ Flow\ \left(\frac{m3}{day}\right)}{1000}}{\frac{MLSS\left(\frac{mg}{L}\right) x\ 1200\ (m3)}{1000}},$$

where 1, 200m^3 is the volume of each aeration tank, the MLSS (Mixed Liquor Suspended Solids) gives an indication of the amount of organisms present. MLSS is measured as per doc. no. 0040221TM.

The Food/Microorganism ratio describes the relationship between the BOD loading and the microbial concentration within the aeration tanks.

It is important that the loading requirements of the plant are maintained to ensure effective biodegradation.

For the Merck Millipore Ltd plant, the optimum F/M is 0.13 -0.18. The F/M ratio can be altered by either altering the forward feed rate to the aeration tanks (thereby adjusting the BOD loading) or by changing the wasting regime to either increase or reduce the MLSS concentration in the aeration tanks.
The F/M ratio must be calculated on a daily basis and the result recorded in the WWTP Daily Batch Log (Doc No.: 00005457SS)

Diffused Air System:
Both aeration tanks have a fine bubble diffused aeration system each with dedicated inverter driven blowers. There is a total of 5 blowers, 2 dedicated to each aeration tank and a duty-standby to serve either aeration tank, as required. Air is passed through a series of diffusers on the floor of the aeration tanks.
The oxygen concentration within each aeration tank is controlled by a dissolved oxygen probe and a REDOX probe which adjust blower intervention depending on oxygen availability.
The plant should run with an oxygen concentration greater than 1mg/litre and less than 4 mg/litter.
The table below shows the typical relationship between F/M loading and the required oxygen.

F/M Loading (Kg BOD/Kg MLSS/d)	Kg Oxygen required per Kg of BOD removed
<0.05	2.0
0.05-0.1	1.8 – 1.6
0.1 – 0.2	1.6-1.3
0.2-0.3	1.3-1.0

The Merck Millipore Ltd effluent plant ideally operates at an F/M of 0.13-0.18 which requires 1.6 kgs / oxygen per Kg of BOD removed.

Temperature Control

The parameter temperature has an ELV of 35^{o}C at emission point SE1. Therefore the temperature of the aeration tanks needs to be controlled so as to not exceed the ELV at 35^{o}C in SE1 / Combined sewer point.

A high temperature can also have an adverse affect on the bacteria.

The temperature in both aeration tanks is kept between 25^{o}C – 35^{o}C and can go as far as 40 ^{o} C and if rising, it can be controlled through the use of a tank dedicated spiral heat exchanger. The heat exchangers use cool water from the IC2 cooling tower to operate.

The heat exchangers should be serviced every six months by competent contractor. Before carrying out a service on the heat exchangers Facilities and IC2 need to be notified in advance as the cooling tower needs to be turned off in order to carry out a service. A permit needs to be sought before carrying out any service/maintenance on the heat exchangers.

pH Control

The pH of the aeration tanks is maintained between 6.5 and 8.5 with optimum pH being 7.5. pH within the aeration tanks can be adjusted using sodium hydroxide which is pumped to the aeration tanks via dosing pump from the chemical cabinet. This dosing pump setting is manually controlled by the WWTP Operations Team

Nutrient supply

If a biological system is to function properly nutrients must be available in adequate amounts. The principal nutrients required are Nitrogen and Phosphorous.

Nutrient supply in a typical wastewater treatment plant is calculated roughly in the proportion **100 carbon** (food which in our case is solvent) to **5 nitrogen** to **1 phosphorous.**

100:5:1

These are typical values and not fixed amounts as the percentage of nitrogen and phosphorous in cell tissue varies with the age of the cell as well as environmental conditions.

From experience gained of the nutrient requirements of the Merck Millipore Ltd effluent plant when the above theoretical values are applied, the plant is overdosed with nutrients. Therefore in order to adequately control nutrient additions in the plant the final effluent is monitored regularly for total P (at least 3 times weekly) as per doc 00402253FM and total Nitrogen (daily) as per doc. 0040253TM. There should be residual nutrient levels of Phosphorous in the final effluent which must be less than 3 mg/L and the level of Total N must be above 30mg/L. The rate of nutrient additions to the aeration tanks may be increased or decreased based on these analysis results.

The type of nutrient added to the plant is largely dependent on the levels of Nitrogen and Phosphorous already present as well as the type of feed from production areas.

Nutritech NP 8096, which is a combination nutrient and contains 15% N and 3%P is used to supply nitrogen and phosphorous to the microbes in the aeration tanks. This product is used predominately when operating on GV/VV production. The Nitrogen and Phosphorus ratio is already ideal in this solution.

Nutritech P880

When production is HV, DV or CV based or when running PES Express Campaign, Nitrogen is supplied to the plant by DMAC and NMP in the feed so a Phosphorous only nutrient is required.

Nutrients are supplied to each aeration tank via a dedicated dosing pump from the chemical cabinet or manually if necessary. Attachment 5 contains graphs showing pump settings on the nutrient pumps and the volume delivery for these settings.

Attachment 4 contains a list of chemicals approved for use in the Effluent Plant. All deliveries should be checked to ensure that only approved chemicals are used.

Microbiology

During normal operation there should be no need to add bacteria to the plant. However, in a start up situation or a collapse of the existing bacteria re-seeding will be necessary. Proprietary preparations of effluent treatment bacteria are available from a number of suppliers. Introduction of activated sludge originated in other industrial/municipal WWTP can also be carried out. The use of one or the other is an operational team decision.

Examination using Microscope

A sample of each aeration tank should be examined under a compound microscope at x100 magnification. When there is a doubt about the health of the bacteria.

During good operation the observer should see good floc size and a mixed abundance of life forms. The presence of long filamentous growths is a sign of problems (sludge bulking). In the event that filamentous forms are observed a sample of aeration liquor should be sent to an outside laboratory for analysis and validation of preliminary observations.

The results of microbial examinations should be recorded in the WWTP Daily Batch Log (Doc No.: 00005457SS)

Samples from each aeration tank are taken on a daily basis and analysed for the following parameters:

COD: to ensure treatment efficiency of each aeration tank

pH: to ensure contents of biologically treated effluent is kept to a neutral pH

MLSS: to identify population presence in aeration tanks.

Total Nitrogen: to identify nutrient requirements in each aeration tank.

Samples of each aeration tank are sent to an external laboratory on a monthly basis to identify the Total Suspended Solids in the system. The results will determine the amount of non-active (inorganic) material within the aeration tanks.

6.5.3 Post-treatment or Clarification Stage

Treated effluent from the aeration tanks overflows to a dedicated Flocculation Tank. Polymer is added to the mixed liquor prior to entering the dedicated Dissolve Air Flotation Unit (DAF)

Compressed dissolved air separates the solids from the clarified effluent.

Float sludge lifts to the surface for removal by a scrapper mechanism into the sludge hopper.

The clarified effluent is discharged to each dedicated Grey Water Tank and then pumped to the final outlet chamber (SE-1).

The sludge collected in the DAF Hoppers is either returned to the designated Aeration Tank (RAS) or wasted to the Sludge Holding Tank (WAS) prior to treatment.

(a) *Sludge Wasting*:

Sludge will need to be wasted periodically from the aeration tanks. Sludge is wasted on a timed basis automatically from the system. The rate of sludge wasting can be controlled by either increasing or decreasing the wasting frequency. The quantity of sludge to be wasted from the system on a daily basis will be determined based on the required MLSS in the aeration basin to maintain an optimum F/M.

The sludge wasting system is linked to the high level alarm in the sludge holding tank. When a high level is reached in the sludge holding tank, the system will stop wasting to the sludge holding tank and the sludge will be recycled until high level alarm clears. This ensures that the tank will not overflow.

The quantity of sludge wasted is recorded on SCADA from the totaliser flowmeter. This is used to calculate the sludge age.

In general 0.5 kgs of sludge is produced /Kg of BOD treated. The MLSS of the Aeration tanks should be maintained between 4,500 – 6,500mg/L depending on the BOD loading. Sludge wasted from the DAFs is dewatered using the 2 westfalia centrifuges. All dried sludge is disposed of via a licensed and approved waste disposal facility, see 0040513SO section 6.15 for details.

6.5.4 Outflow Chamber (Licence Emission Point: SE1)

Treated effluent is pumped from the grey water tanks and exits the plant via the outflow chamber. The final effluent is constantly being monitored by an online pH meter, an online suspended solids probe, an online temperature probe and a TOC/TN analyser. The flow leaving the plant is measured by an ultrasonic flow meter. All information is relayed to the SCADA system in the WWTP MCC Room.

6.6 Foaming

Anti foaming agent is added manually to the effluent when there is obvious build up of foam in the tanks. The level of foam must be reduced before it can be blown out of the plant by wind. Antifoaming agent may also be added directly to the catch tank or aeration tanks by manually switching on DP2. The amount of antifoam needed will depend on the level of foaming in the tank.

6.7 Odours

An odour patrol must be carried out at the effluent plant and the surrounding areas on a daily basis to ensure that there are no unpleasant odours emanating from the process. Daily odour patrols are logged in the WWTP Daily Batch Log (Doc No.: 00005457SS). Action must be taken to ensure that any strong odours detected in the daily odour patrol are eliminated as soon as possible. There is a local odour abatement unit in the WWTP. If odours are detected, the system performance needs to be checked to ensure its functioning correctly.

Other operational adjustments that can be done to help minimise the odours are by adding caustic to the balance tank / aeration basin to ensure the pH is >6.5, or reducing agitation in the balance tank by turning off the mixer. If a strong solvent odour is detected on the N25 by the person carrying out the patrol, he/she will verify this with another member of the EHS team and the EPA will be contacted immediately.

6.8 Analyses Results

In-house Analysis results (COD, pH, MLSS and Total Nitrogen) are entered into WWTP Daily Batch Log (Doc No.: 00005457SS). The daily and weekly data is also entered into the WWTP Process Log located at T:\EHS\3.0 Operational Control\3.12 WWTP\Operations Data

A summary of monitoring data is submitted to the Environmental Protection Agency as part of the AER.

6.8.1 Action to be taken in the event of high COD/BOD loading in final effluent

If the results of analysis show that there is a potential for discharge limits to be exceeded the following courses of action is to be taken:

a) Inform the EHS Manager/Engineer

b) If there is sufficient capacity in the Catch Tanks/Balance Tank the COD loading to the aeration basin may be reduced to allow the aeration basin to cope with the loading already in there and so help to reduce the COD in the final effluent.

Closely communication with production areas to ensure the loading and recovery of the plant is managed to ensure IPPC Licence compliance.

6.8.2 Breaches of Licence Parameters

The EPA has specified emission limit values for a range of parameters as per Schedule B.3 Emission to Sewer of the IPPCL.

In the event of a breach in any of the effluent Licence parameters schedule B.3 of the IPPCL, the EPA must be notified (by both telephone and via electronic database ALDER – as per Condition 11.1) as soon as possible and advised of the situation, and shall include as part of the notification, date and time of the incident, details of the occurrence and the steps taken to minimise the effect on the environment and minimise wastes generated.

All breeches of Licence parameters are recorded internally on the EHS Reporting Database and corrective actions are raised to ensure that incidents do not reoccur. A summary report of reported incidents shall be submitted to the Agency as part of the AER.

In the event of any incident as set out in Condition 11.2 of the IPPCL which relates to discharges to sewer, the Local and Sanitary Authority must also be notified as soon as is practicable after such an incident.

The Agency must also be advised of any malfunction or breakdown of control equipment or monitoring equipment set out in Schedule C 'Control and Monitoring'

6.9 Maintenance and Calibration of equipment

6.9.1 Routine Maintenance

Item No:	Action	Doc. No
pH Probes: Catch Tank 1, 2 3, Balance Tank, A.T.1 and A.T.2 and SE1 (Outflow)	Rinse with fresh water & calibrate	0040591SO
TOC/TN meter messages	Check Reagent levels, check for error messages	X
Pipettes in Lab	Check for precision of measurement	X
pH Meter in Lab	Calibrate	X

6.9.2 **The following items are under contract maintenance from contractor**

Item	**Action**
TOC/TN Analyser	Cleaning/Calibration – Quarterly
Diesel Generator	Quarterly service and check.

6.9.3 **Preventative Maintenance**

All Electrical and Mechanical equipment is included in the maintenance preventative maintenance programme. Spare parts as outlined in Schedule C.3.1 'Control of Emissions to Sewer' shall be held onsite.

6.9.4 A list of all operation and maintenance manuals for the waste water treatment plant are kept in the WWTP Office.

6.9.5 **Calibration**

Instruments undergo an overhaul and calibration by contract Technicians on a quarterly basis as per doc 0030467MP – Instruments for calibration include pH probe, oxygen probes, suspended solids probe, flow meters, auto sampler, analytical balance, oven, COD heating block, DR2010 spectrophotometer, Biotector TOC/TN Analyser Records of external calibrations are filed in the 'Effluent Plant Instrumentation-Calibration & Service Records' folder, which is maintained by the WWTP Operations Team.

6.10 Back Up Generator

In the case of a loss of power to the effluent plant the system can to be changed over to run on generator power using the following procedure:

1. Turn off Main Isolating Switch
2. Turn the selector switch from Mains to Off
3. Turn on generator and run it to 400 Volsts ro close to before returning to switch room
4. When the generator has stabilised turn the selector switch to generator
5. Finally when all this is completed turn the main switch back on

When power is restored, complete the steps above in reverse.

The generator should be run for 5/10 minutes each week to ensure it is operating properly.

Details are recorded on WWTP Daily Batch Log (Doc No.: 00005457SS).

N.B. After the generator has been running ensure that the diesel tank is refilled.

6.11 Compressed Air

Compressed air to the effluent plant is fed from the main plant.
Compressed air is for the operation of the actuated valves in the effluent plant.

6.12 Training

The effluent plant operator should receive training in the following areas. All training records are accessible through online GATE Training Database.
Chemical safety
Activated sludge process
General Treatment plant operation
Manual Handling
Laboratory Test Methods

7.0 QUALITY RECORD REQUIREMENTS

Daily records on effluent plant operation are recorded in the WWTP Daily Batch Log as per form No.: 00005457SS.

Effluent performance records are kept with the monthly analysis in a file maintained by the EHS Manager in the Effluent Sampling Record folder for a period of 3 years after this time the record should be archived as per procedure 000703MP.

Attachment 1: Control of Emissions to sewer (Page 1 of 1)

C.3.1. Control of Emissions to Sewer

Emission Point Reference No.: SE1

Description of Treatment: Equalisation tank, aeration tank, clarifier, sludge pressing and drying

Inlet to WWTP	Flow	Continuous	Flow meter
	TOC	Continuous	Online analyser
	Total Nitrogen	Continuous	Online analyser
Equalisation tank	Level	Continuous	
	pH	Daily	Caustic dosing pumps
	COD	Daily	
Aeration tank	Flow	Continuous	Flow meter
	Dissolved Oxygen	Daily	Oxygen probe/HACH meter
	pH	Daily	Caustic dosing pumps
	COD	Daily	
	MLSS	Daily	
	F/M ratio	Daily	
	Sludge Index	Daily	
	Nutrient Level		
	– Nitrogen	Daily	
	– Phosphorous	Three times per week	
	Sludge Microbiological testing	Fortnightly	
Clarifier	Upward Flow	Continuous	Flow meter
	Transparency	Daily	
	Odour	Daily	
Sludge Dewatering	Sludge return/wasting	As required	Sludge return pumps

Note 1: The licensee shall maintain appropriate access to standby and/or spares to ensure the operation of the abatement system.

Attachment 2: Monitoring of Emissions to Sewer (Page 1 of 1)

C.3.2. Monitoring of Emissions to Sewer

Emission Point Reference No.: SEI

Parameter	Monitoring Frequency	Analysis Method/Technique
Flow	Continuous	On-line flow meter with recorder
Temperature	Continuous	On-line temperature probe with recorder
pH	Continuous	pH electrode/meter and recorder
Biochemical Oxygen Demand	Weekly Note 1	Standard Method
Chemical Oxygen Demand	Daily Note 1	Standard Method
Suspended Solids	Daily Note 1	Gravimetric
Sulphates	Quarterly Note 1	Standard Method
Acrylates	Quarterly Note 1	Standard Method
Total Nitrogen (as N)	Weekly Note 1	Standard Method
Oils, Fats & Grease	Quarterly Note 1	Standard Method
Organic Solvents Note 2	Quarterly Note 1	Standard Method
Dichloromethane	As and when Dichloromethane is used on site	Standard Method
Total Heavy Metals	Annually Note 1	Standard Method
Respirometry	Annually	Standard Method
Toxicity Note 3	Annually	As agreed by the Agency

Note 1: All samples shall be collected on a 24-hour flow proportional composite sampling basis.

Note 2: Screening for priority pollutant list substances. (such as US EPA volatile and/or semi-volatile compounds). This analysis shall include those organic solvents in use in the process, which are likely through normal process operations to be diverted to the waste water streams.

Note 3: The number of toxic units (TU) = 100/x hour EC/LC_{50} in percentage vol/vol so that higher TU values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.

Attachment 3: Sampling Programme (Page 1 of 4)

1.0 Introduction

Merck Millipore is regulated by the Environmental Protection Agency (EPA) under the conditions of the Integration Pollution Prevention and Control (IPPC) License (Licence Reg. No. P0571-03)

The reasons for developing a sampling programme include:

- Compliance with legal requirements: Monitoring emission's quality for the evaluation of the plant compliance with the requirements of the license (compliance monitoring).
- Process monitoring and control: good sampling techniques provide reliable data on the quality of the plant emissions (process monitoring).

This programme requires also consideration of the manner in which samples are to be collected, the different sampling locations, analyses to be performed on the samples, and specific methods of sample collection transportation and preservation.

2.0 Parameters to be measured and sampling locations

The requirements for sampling and analysis of Merck Millipore's emissions are outlined in the Integrated Pollution Prevention Control Licence as follows:

- In schedule B.3 Emission to Sewer.
- In schedule C.2.3 Monitoring of Storm Water Emissions
- In schedule C.3.1 Control of Emissions to Sewer
- In schedule C.3.2 Monitoring of Emissions to Sewer.

The main parameters, associated with site operations, to be measured as part of both compliance and process monitoring, are shown in Table 1. This table presents sampling locations, sampling frequencies and analytical parameters/schedules for all site stream/processes according to the conditions of the license.

Attachment 3: Sampling Programme (Page 2 of 4)

Appendix 1 presents a site drawing with all site sampling locations identified.

Site Process/Stream	Sampling Location	Parameter for analysis	Analysis Location	Sampling Frequency	Sample type	Licensed parameter?
WWTP	Catch Tank 1	pH	In-house	Daily	Grab	No
		COD	In-house	Daily	Grab	No
	Balance Tank	pH	In-house	Daily	Grab	Yes
		COD	In-house	Daily	Grab	Yes
		Total Nitrogen	In-house	Daily	Grab	No
		BOD	External Lab	Weekly	Grab	No
	Aeration Tanks	pH	In-house	Daily	Grab	Yes
		COD	In-house	Daily	Grab	Yes
		Suspended Solids	In-house	Daily	Grab	Yes
		Total Nitrogen	In-house	Daily	Grab	Yes
		Sludge Microbiological	In-house	Fortnightly	Grab	Yes
	SE1	pH	In-house	Continuous	Composite	Yes
		Toxicity	External Lab	Annually	Composite	Yes
		BOD	External Lab	Weekly	Composite	Yes
		COD	In-house	Daily	Composite	Yes
		Suspended Solids	In-house	Daily	Composite	Yes
		Total Phosphorous	In-house	3 x weekly	Composite	No
		Total Nitrogen (as N)	In-house	Daily	Composite	Yes
		Sulphates	External Lab	Quarterly	Composite	Yes
		Total Heavy Metals	External Lab	Annually	Composite	Yes
		Oils, Fats and Greases	External Lab	Quarterly	Composite	Yes
		Acrylates	External Lab	Quarterly	Composite	Yes
		V.O.C	External Lab	Quarterly	Composite	Yes
		Respirometry	External Lab	Annually	Composite	Yes
Site Process/Stream	**Sampling Location**	**Parameter for analysis**	**Analysis Location**	**Sampling Frequency**	**Sample type**	**Licensed parameter?**
SE2, SE3	At discharge	Temperature	In-house	Biannually	Grab	Yes
		pH	In-house	Weekly	Grab	Yes
		COD	In-house	Fortnightly	Grab	Yes
		Suspended Solids	In-house	Fortnightly	Grab	Yes
		Sulphates	External Lab	Biannually	Grab	Yes
		Chlorides	External Lab	Biannually	Grab	Yes
		Total Heavy Metals	External Lab	Annually	Grab	Yes
SE7	At discharge	pH	In-house	Monthly	Grab	Yes
		COD	In-house	Biannually	Grab	Yes
		Suspended Solids	In-house	Biannually	Grab	Yes
		Sulphates	External Lab	Annually	Grab	Yes
		Chlorides	External Lab	Annually	Grab	Yes
		Total Heavy Metals	External Lab	Biannually	Grab	Yes
Storm Water*	Storm Water Discharge	pH	In-house analyzer	When discharging	Grab	Yes
		COD	In-house analyzer	When discharging	Grab	Yes

Attachment 3: Sampling Programme (Page 3 of 4)

External Portable Bunds	External site bunds as per doc HSE00539	pH	In-house	Weekly	Grab	Yes
		COD	In-house	Weekly	Grab	Yes
IC2, CPG, etc	As required	pH, COD, MLSS	In-house	As required	Grab	No

*Storm water is currently discharged to the foul sewer. However, there is a TOC Analyser in place which continuously measures TOC and pH. This is currently under data validation and agency approval and the system will be linked to an automated system whereby surface water emissions will be discharged to the Slatty Creek provided they are free of contamination.

3.0 Sample collection / types of sampling

The primary goal of sampling is to ensure that the sample taken is representative of the flow stream to be analyzed. Because the sample represents a small portion of the flow, developing sampling techniques is fundamental in order to avoid invalid data and therefore, erroneous process control decisions.

In Merck Millipore, samples are collected in two different ways, manually or automatically.

- Grab samples:
- Composite samples: a 24 hour permanent composite flow-proportional refrigerated sampler is used for analysis of the final effluent SE1 at the Onsite Waste Water Treatment Plant.

Some guidelines to ensure representative sampling techniques:

- Collect samples where the water stream is well-mixed.
- Avoid taking samples where settling occurs.
- Avoid areas with non-representative solids accumulated on walls, surface water, etc.
- For routine sampling, always sample at the same locations to build up reliable data collection.
- Where samples are to be collected from flowing pipes, keep the sample line as short as possible to avoid sample alteration.
- All sample containers are to be marked for each sample locations.
- Use the appropriate container and material for sampling collection (see Table 2).
- Use the same sampling device for the same type of sample to avoid contamination.
- Rinse sampling and measuring devices with the sample several times before collection.
- After collection, transport the samples to the lab as soon as possible; store the samples so that their composition will not change before testing. Refrigeration at 4^{o}C is typically appropriate (See table 2 below).

When sampling and analysis activities required special precautions due to risk infection, personnel exposed to chemical hazard, etc; procedures need to be followed accordingly and appropriate handling and protective measures are to be in place to ensure worker's safety.

Attachment 3: Sampling Programme (Page 4 of 4)

4.0 Sampling Timing / Frequency

All samples that require laboratory analysis should specify the:

- Use of correct type of bottles/containers/lids;
- Setting cleaning procedures for the bottles/containers/lids;
- Review of storage and transport conditions for each type of sample;
- Set the time allowed before analysis commences.

Table 2 presents the required containers, preservations and holding times for all licensed parameters in Millipore.

Parameter Name	Container	Preservation	Maximum Holding Time
COD	Polyethylene, Glass	Cool, 4°C	28 days
Total Phosphorous	Polyethylene, Glass	Cool, 4°C	28 days
pH	Polyethylene, Glass	Cool, 4°C	14 days
BOD	Polyethylene, Glass	Cool, 4°C	48 hours
Chlorides	Polyethylene, Glass	None required	28 days
Total Nitrogen	Polyethylene, Glass	Cool, 4°C	28 days
OFG's	Glass	Cool, 4°C	28 days
Sulphates	Polyethylene, Glass	Cool, 4°C	28 days
Temperature	Polyethylene, Glass	None required	Analyze immediately
MLSS	Polyethylene, Glass	Cool, 4°C	7 days
Total Heavy Metals			
Acrylates	Glass	Cool, 4°C	7 days
VOC	Glass Vial	Cool, 4°C	

In the case where the samples are to be transported to a contract laboratory, this transport has to be as quickly as practical and in a manner that, as a minimum, meets the following requirements:

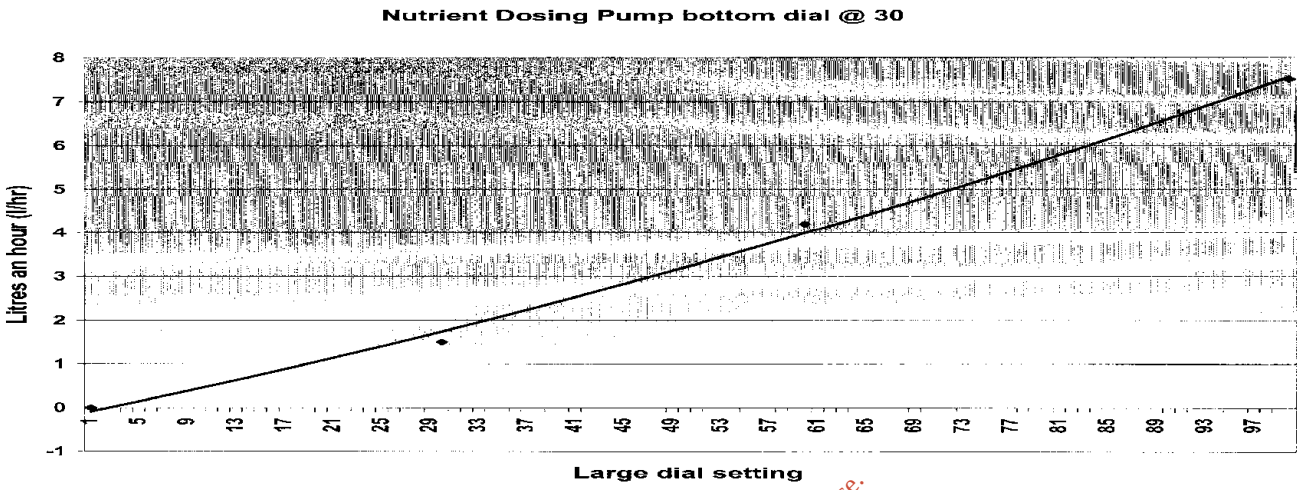
- The vehicle of transport is clean and adequate storage facilities for empty sample containers and for containers filled with samples are in place;
- it has provision for keeping samples cool and for cooling samples, when necessary;
- it is not used for any purpose that might cause contamination of samples; and
- its interior and cool boxes/refrigerators are regularly cleaned and maintained

Attachment 4 (Page 1 of 1)

List of Chemicals approved for use in the WWTP:

Chemical	Description	Approved Suppliers
Caustic Liquor	Sodium Hydroxide 30%	Celtic Watercare
Cell Floc C5	Water based Polyelectrolyte	Celtic Watercare
Cellfloc CE 190	Polyelectrolyte – Centrifuge	Celtic Watercare
Cellfloc A13	Flocculating agent containing aluminium chloride	Celtic Watercare
NP 8096	Combination nutrient containing N &P	Celtic Watercare
P 880	Phosphorous containing nutrient	Celtic Watercare
Defoam S 10	Antifoam	Celtic Watercare
Defoam V 20	Antifoam	Celtic Watercare
Antichlor	Chlorine neutraliser	Celtic Watercare

ATTACHMENT 5 (Page 1 of 1)



Attachment F.3

Tabular Monitoring Data

PT_CD	PT_TYPE	EASTING	NORTHING	VERIFIED
NSL1	N	180691	72552	N
AN1	N	180746	72600	N
AN2	N	180682	72470	N
AN3	N	180869	72310	N
AN4	N	180927	72315	N
AN5	N	180828	72617	N
AN6	N	180831	72613	N
AN7	N	181105	72519	N
AGW1	GW	180752	72432	N
AGW2	GW	180711	72490	N
AGW3	GW	180747	72592	N
AGW5	GW	180877	72418	N
AGW6	GW	180737	72376	N
SB2	GW	180928	72571	N
SB4	GW	180941	72572	N
SB5	GW	180906	72536	N
SB7	GW	180945	72572	N
SB8	GW	180951	72573	N
A1-7	A	180818	72557	N
A1-8	A	180837	72586	N
A2-30	A	180878	72507	N
A2-32	A	180915	72538	N
A2-40	A	180887	72496	N
A2-41	A	180888	72485	N
A1-1	A	180780	72578	N
A1-4	A	180794	72478	N
A1-5	A	180784	72582	N
A1-10	A	180790	72603	N
A2-42	A	180878	72514	N
A1-9	A	180837	72606	N
SE1	SE	180979	72584	N
SE2	SE	180802	72587	N
SE3	SE	180906	72552	N
SE7	SE	180877	72513	N
SW1	SW	180863	72389	N

Attachment G.3

Energy Audit

Cork, Ireland Energy Audit

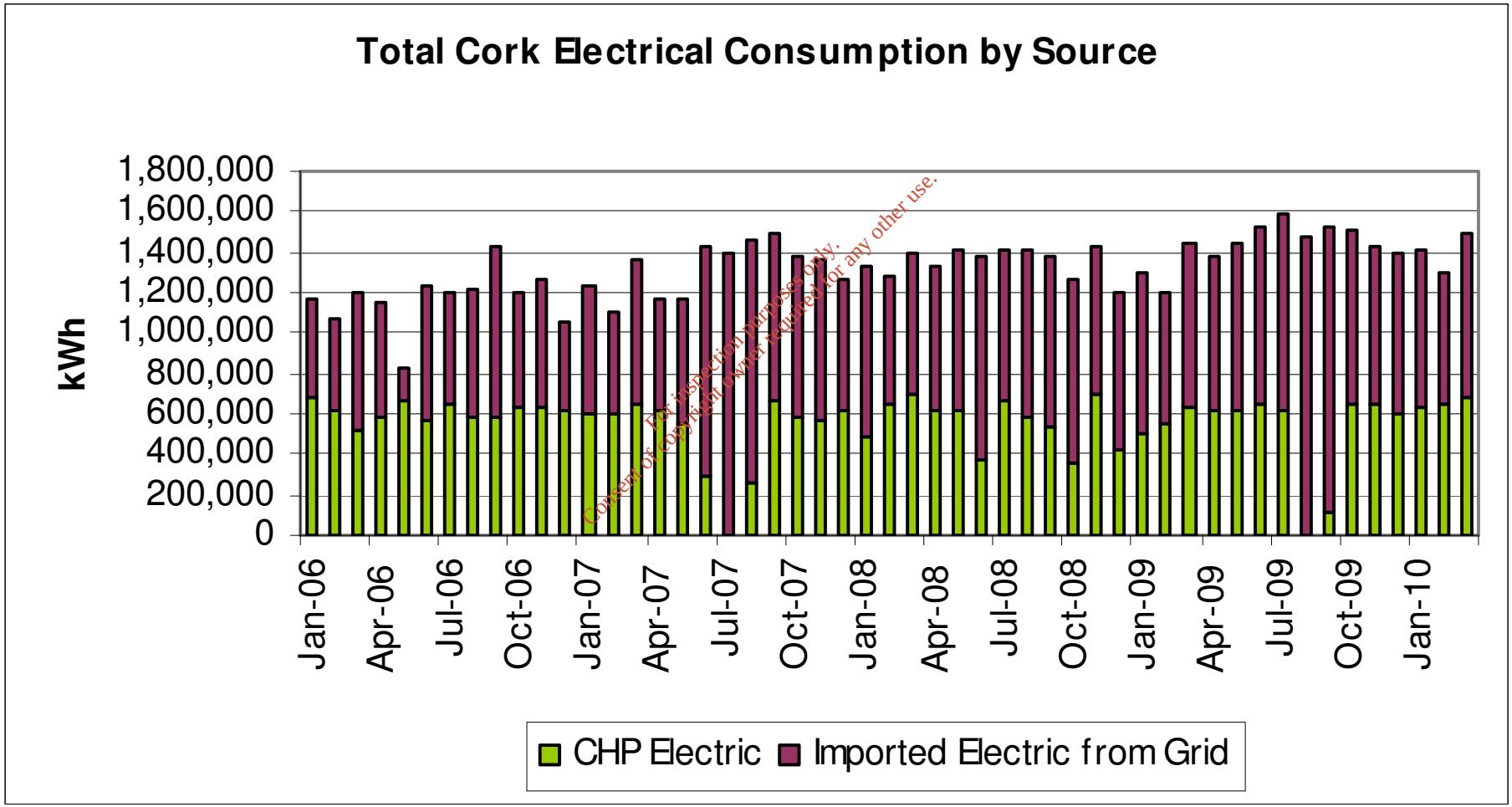
Chris Famolare, BSME, CEAIT

ADVANCING LIFE SCIENCE TOGETHER®

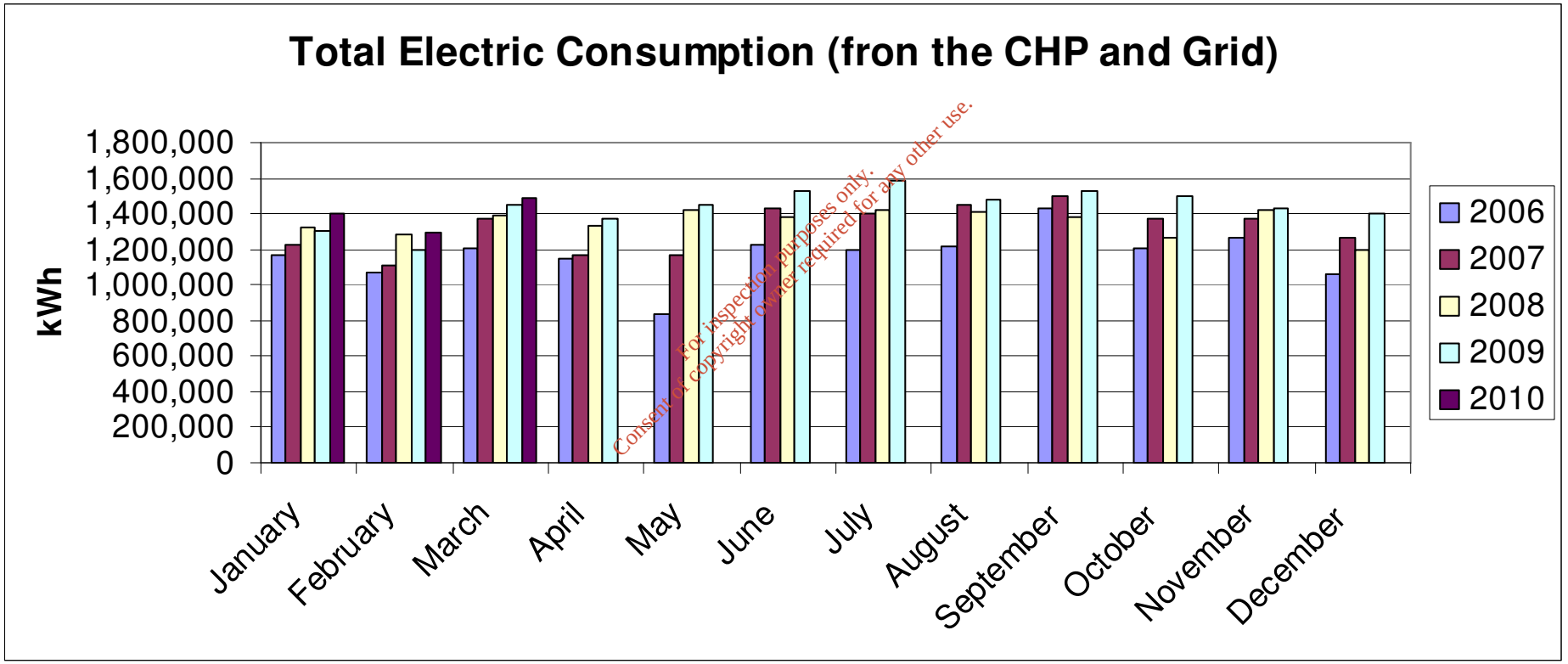
Scope of the Energy Audit

- Identify 3,000,000 kWh of energy saving solutions
- Generate a comprehensive report
- Intent: Work the identified Energy Efficiency Measures into the 2011 AOP

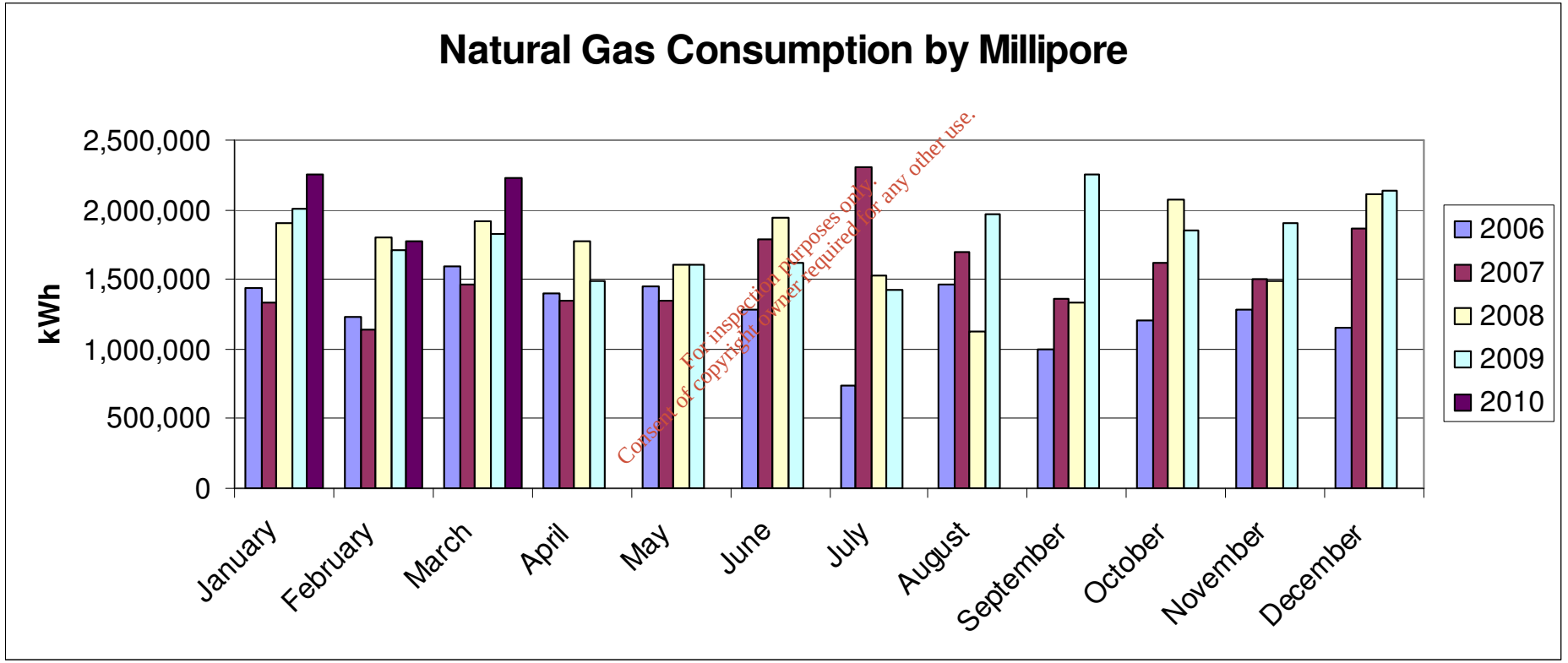
Electricity Consumption by Source



Monthly Electricity Consumption

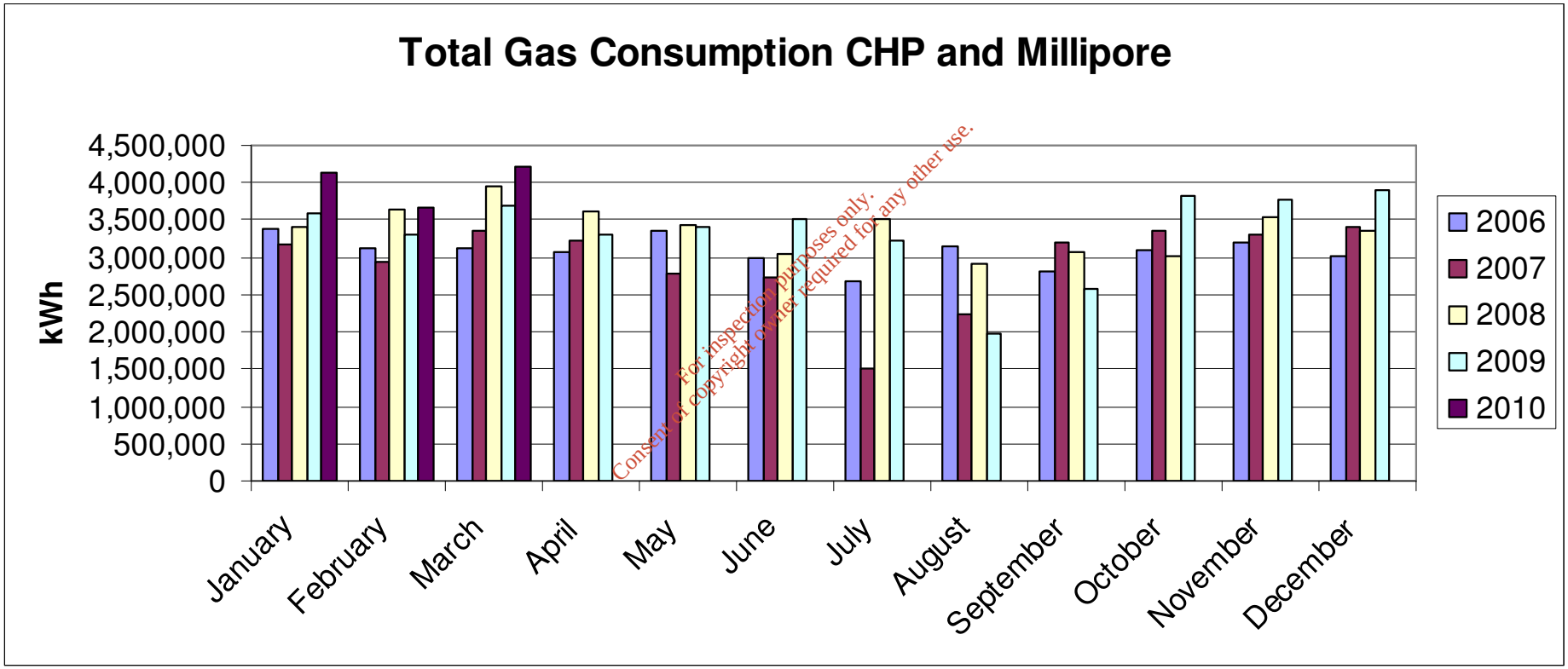


Natural Gas (excluding CHP gas)

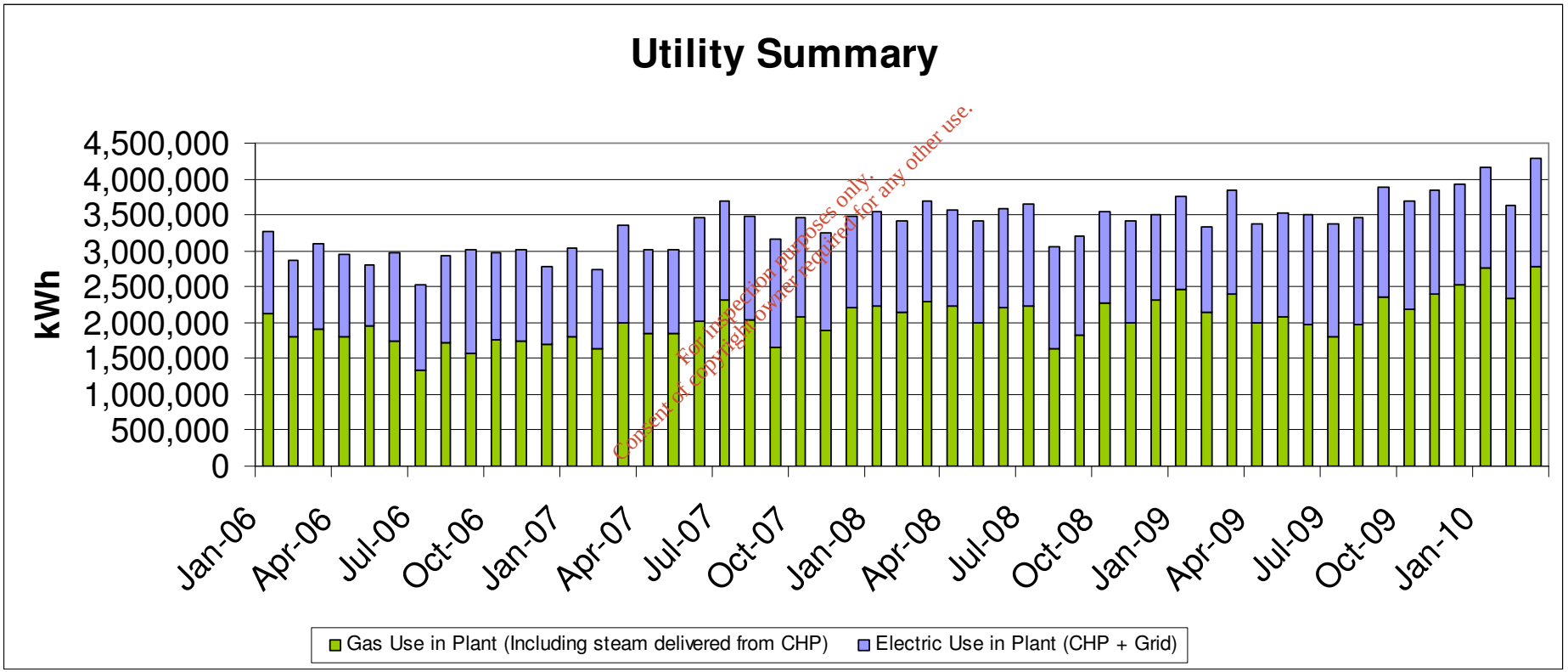


NOTE: Gas use in plant is up 58% (2006 – 2009)

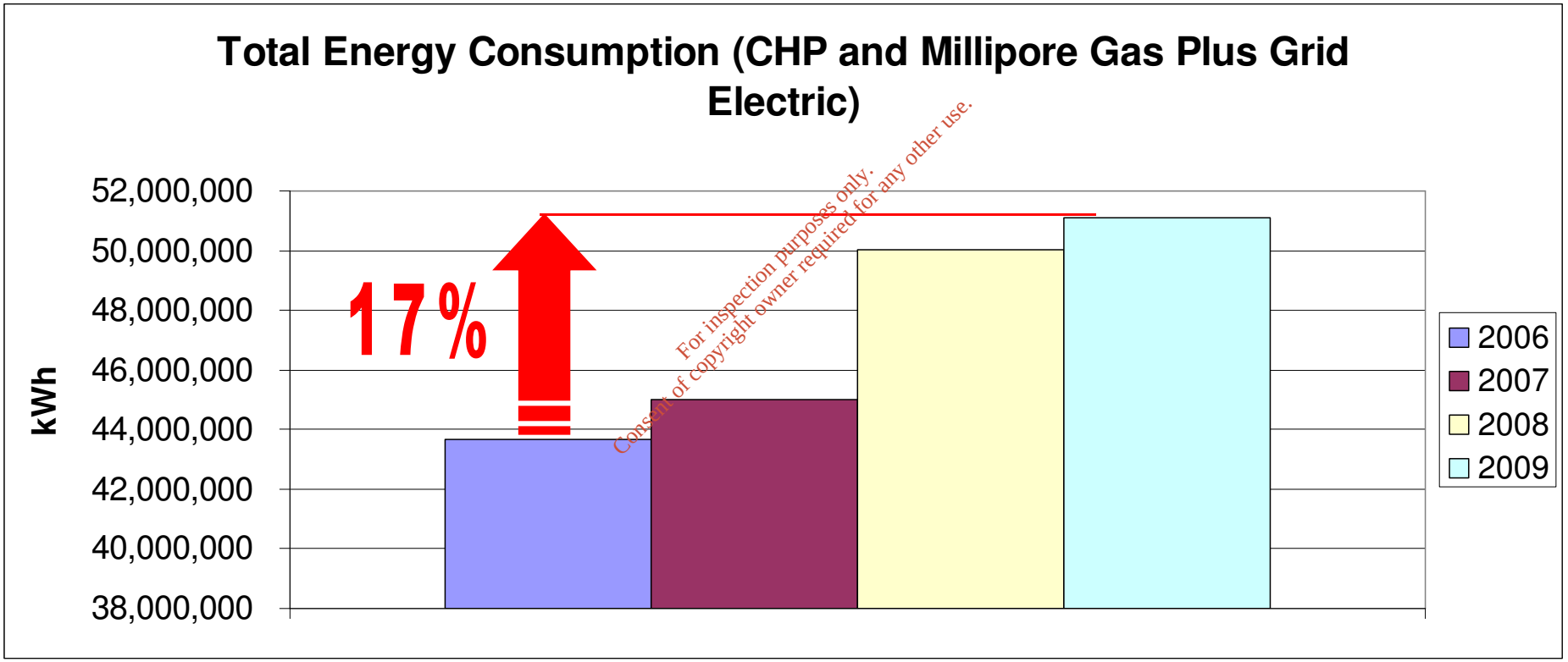
Natural Gas Consumption (including CHP)



Utility Summary



Yearly Energy Consumption



Motor Upgrades

61 Motors - Upgrade to Premium Efficiency	
kWh Savings	101,103
Cost Savings	€ 13,851
Implementation Cost	€ 36,700
SPB (Years)	2.65
NPV 10 yrs @12%	€ 41,561

Table 6, Page 17

- Quick payback
- Favorable NPV
- More reliable equipment

Lighting Upgrade

Cork, Ireland Lighting EEM Summary			
	Quantity	Individual Cost installed	Total Cost
Number of Ballasts	554	€ 75	€ 41,550
Occ Sensors (approx)	200	€ 200	€ 40,000
Bundled Project			€ 81,550
Energy Savings (kWh/yr)			232,730
Cost Savings per year			€ 31,884
Simple Payback (years)			2.56
NPV 5 years @ 12%			€ 50,199

- Better control
- New ballasts

Table 7, Page 17

Re-Commission Existing Lighting Controls

Re-commissioning (5 minutes less)	
kWh Savings	16,174
Cost Savings	€ 2,216
Implementation Cost	0
SPB	0
NPV 5 yrs	€ 7,988

Table 8. Page 18

- Tighter control
- No Cost

Compressed Air Demand Reduction

Compressed Air		
Action	**CFM**	**kWh**
Blue valve on roof for RTO duct	15	23,625
General air leak detection	75	118,125
VFD Compressor Air leak	20	31,500
Sum of kWh Savings	110	173,250
Cost Savings		€ 23,735
Implementation Cost		€ 24,000
SPB		1.01
NPV		€ 61,559.00

Table 9, Page 18

Compressed Air (Cont.)

Blue RTO duct valve on roof (~ 20 CFM continuous purge)

Chiller Replacement

Screw Vs Reciprocating	
kWh Savings	563,827
Cost Savings	€ 77,244
Implementation Cost over a Recip.	€ 45,180
SPB	0.58
NPV 10 yrs @ 12%	€ 391,265

Table 10, Page 19

- Better reliability
- Increased cooling capacity
- Variable speed (12% turndown)
- Reduced noise and heat in compressor room

Millipore Ops-2 Boiler Gas Consumption

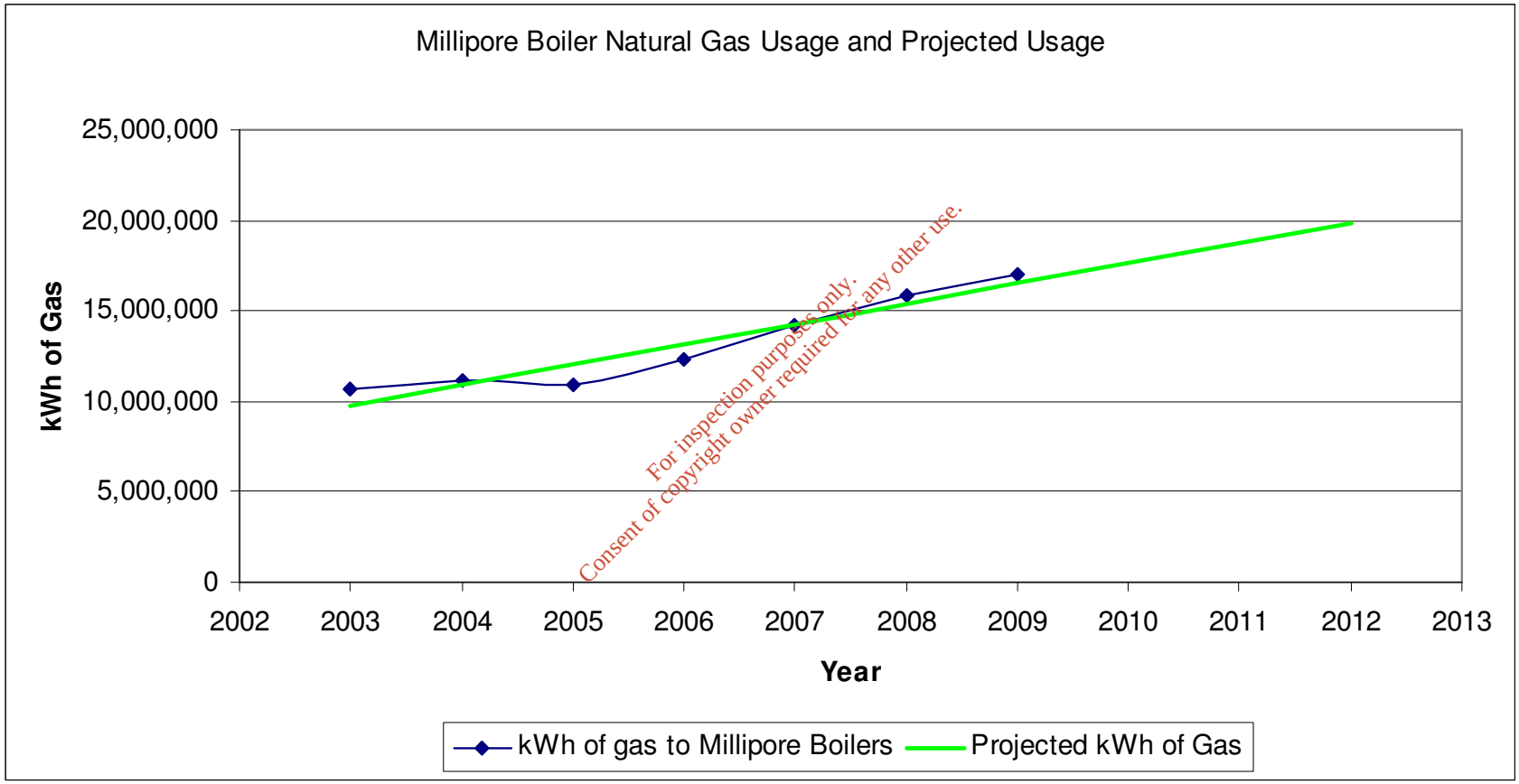


Figure 13, Page 21

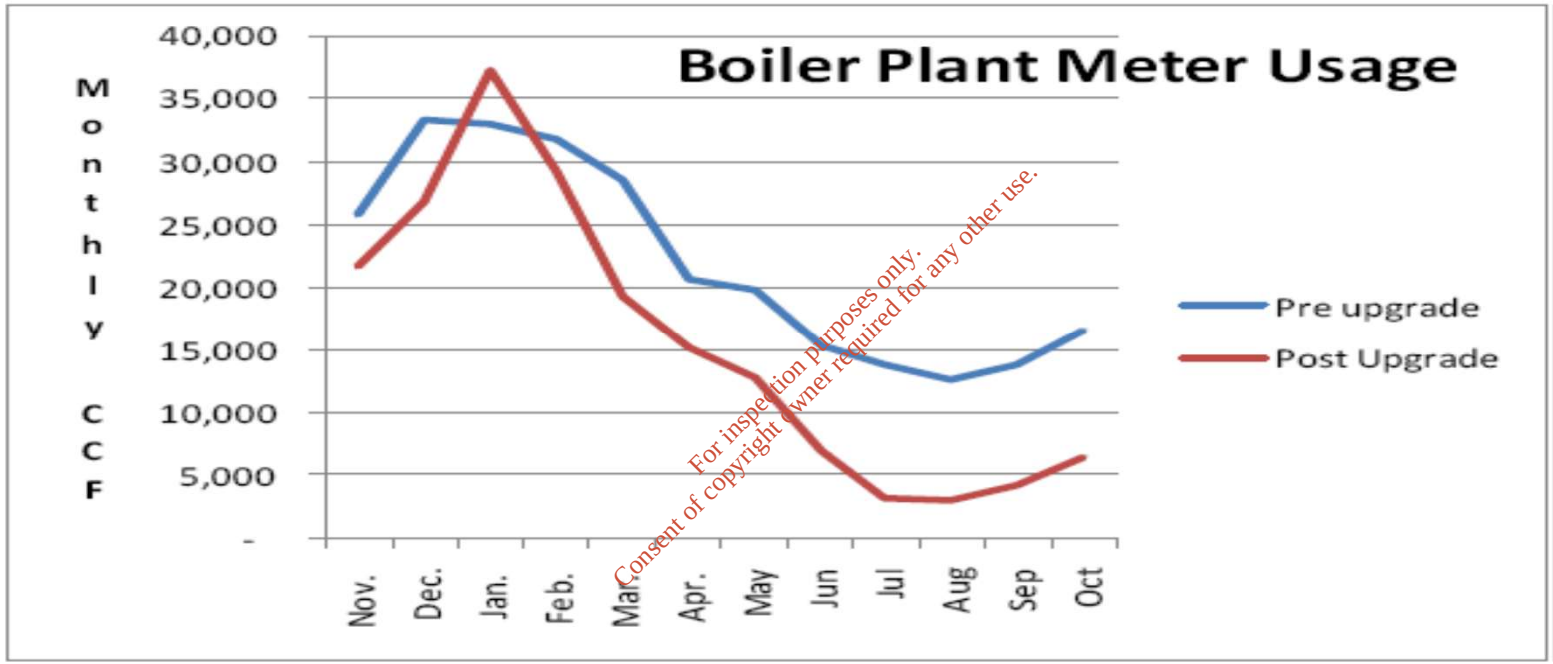
Boiler Burner Efficiency Upgrades

Boiler Burner Efficiency Upgrades	
kWh Savings. 15% burner efficiency increase	2,546,053
Cost Savings	€ 72,843
Implementation Cost	€ 131,784
Simple Payback	1.81
10 year Net Present Value at 12%	€ 279,795.00

Table 11, Page 19

- Less boiler maintenance
- Advanced controls
- Reduced noise
- Cleaner combustion

Bedford Boiler Results



29% boiler fuel reduction. Normalized for HDD

Other Boiler Related Savings

Insulate Back of Cochran Boiler	
kWh Savings	55,002
Cost Savings	€ 1,573.61
Implementation Cost	€ 3,000.00
SPB	1.91
NPV	€ 5,887.00

Table 14, Page 22

- Safer boiler room

Steam Leak Remediation	
kWh Savings	707,008
Cost Savings	€ 20,227.50
Implementation Cost	€ 3,200.00
Simple Payback	0.16
NPV 2 yrs @ 12%	€ 31,684

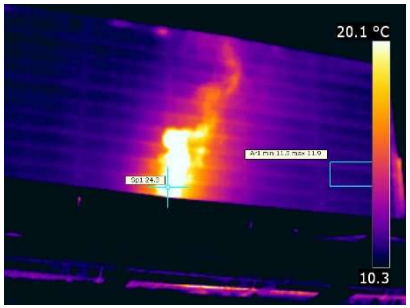
Table 16, Page 23

- Less AC load

Lower the Steam Pressure	
kWh Savings	454,750
Cost Savings	€ 11,056.46
Implementation Cost	0
Simple Payback	0
NPV 10 yrs @ 12%	€ 62,468

Table 15, Page 22

- Lower AC load
- Fewer leaks



Isolé Plug Controls

Isolé Plug Load Controllers	
# of desks	~150
kWh savings/year/desk	100
Energy Savings	15,000
Cost Savings	€ 2,055
Implementation Cost	€ 8,181
SPB (Years)	3.98
NPV 10 years discounted at 12%	€ 3,430

Table 17, Page 23

- Employee Engagement/Awareness
- Protection against power surge

EEM Summary

Cork, Ireland EEM Summary						
EEM	kWh Savings	Cost Savings	Implementation Cost	SPB	NPV	NPV Term (yrs)
Motor Upgrades	101,103	€ 13,851	€ 36,700	2.65	€ 41,561	10
Lighting Upgrades and Controls	232,730	€ 31,884	€ 81,550	2.56	€ 50,199	5
Existing Lighting Control Changes (non IC2)	16,174	€ 2,216	€ 0	0.00	€ 7,650	5
Steam traps, valves, and Calorifiers	707,008	€ 20,228	€ 3,200	0.16	€ 31,684	2
Isolé Plug Load Controls	15,000	€ 2,055	€ 8,182	3.98	€ 3,430	10
2 Chiller Replacements with Screw	563,827	€ 77,244	€ 45,180	0.58	€ 391,265	10
Boiler Burner Efficiency Upgrades	2,546,053	€ 72,843	€ 131,784	1.81	€ 279,795	10
Insulate back of Cochran Boiler	55,002	€ 1,574	€ 3,000	1.91	€ 5,887	10
Lower Steam Pressure to 9 Bar 75% of time	454,750	€ 13,639	€ 0	0.00	€ 62,468	5
Compressed Air Leak Audit	173,250	€ 23,735	€ 24,000	1.01	€ 61,559	5
SUM	4,864,896	€ 259,269	€ 333,596	1.29	935,498	7.2

Table 18, Page 25

Energy Reduction by Type

Energy Reduction Summary by Type					
	Natural Gas (kWh)	Electric (kWh)	CHP Heat (kWh)	kWh Overall	Cost
2009 Energy Consumption	21,811,302	17,204,800	3,377,906	42,394,008	€ 3,108,831
Reduction	3,762,812	1,102,084	0	4,864,896	€ 259,268
Percentage Reduction	**17%**	**6%**	**0%**	**11%**	**8%**

Table 22, Page 27

GHG Reduction

Greenhouse Gas Reduction resulting from proposed EEMs			
EEM	**Natural Gas Savings (kWh)**	**Electric Savings (kWh)**	**CO2 Reduction (lbs)**
Motor Upgrades	0	101,103	127,390
Lighting Upgrades and Controls	0	232,730	293,239
Existing Lighting Control Changes (non IC2)	0	16,174	20,380
Steam traps, valves, and Calorifiers	707,008	0	117,600
Isolé Plug Load Controls	0	15,000	18,900
2 Chiller Replacements with Screw	0	563,827	710,421
Boiler Burner Efficiency Upgrades	2,546,053	0	423,497
Insulate back of Cochran Boiler	55,002	0	9,149
Lower Steam Pressure to 9 Bar for 50% of time	454,750	0	75,641
Compressed Air Leak Audit	0	173,250	218,295
SUM	**3,762,812**	**1,102,084**	**2,014,512**
Current Operations	21,811,302	17,204,800	25,306,025
% Reduction	**17%**	**6%**	**8%**

EUI Reduction

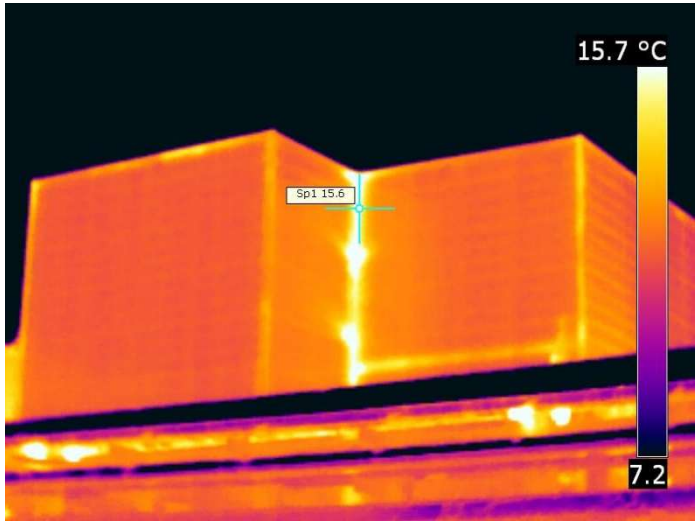
Cork EUI Evaluation (compared to Jaffrey)						
	Building Square Footage	kWh per year	EUI (kWh/ft2/yr)	Cork Reduction	Jaffrey EUI	% greater than Jaffrey
2009 Conditions	188,000	42,394,008	226	0	110	105%
Post EEMs	188,000	37,529,112	200	11%	105	90%

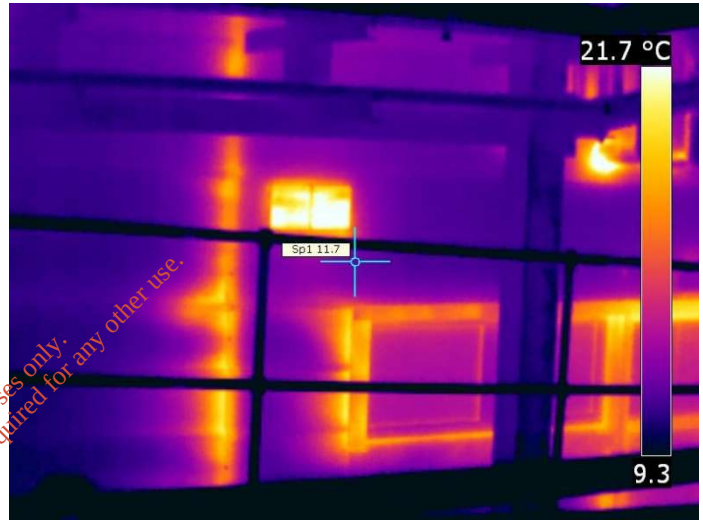
Table 21, Page 26

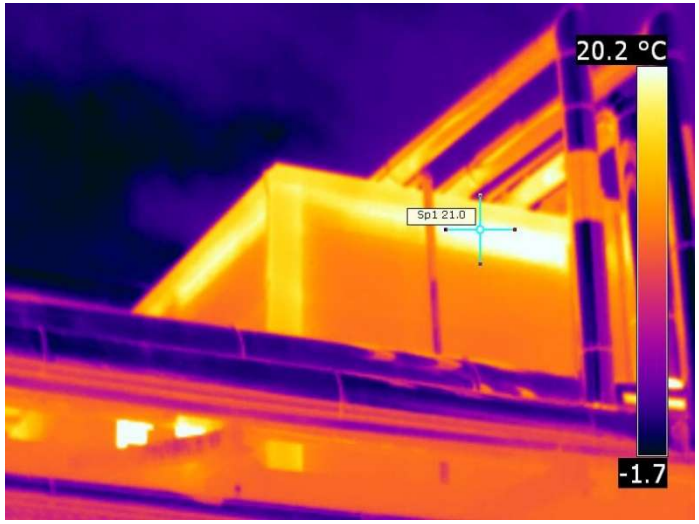
Other Areas of Interest & Future Work

- Seal building envelope leaks.
- Particle Counters – clean rooms.
- Pipe Insulation.
- Tempered vessel insulation.
- Removal of retired equipment on roof.
- Restroom exhaust fan occupancy sensors.
- Vacuum pump VSD.
- Re-Commissioning of the building.
- Re-negotiate CHP contract.
- Boiler Economizers.
- Remove all steam coils in AHUs and replace with hot water coils.
- Installation of better controls on the calorifiers.

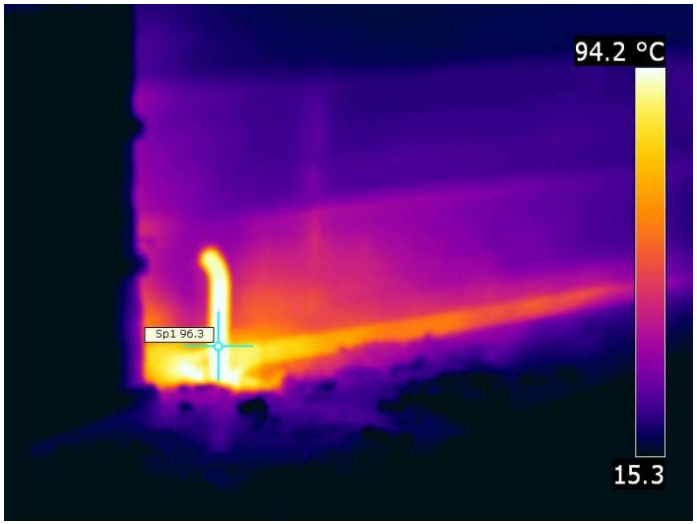
Thermal Images

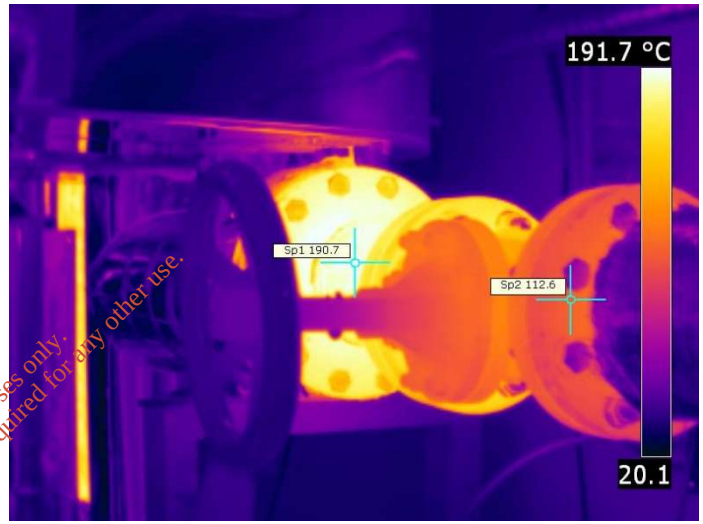


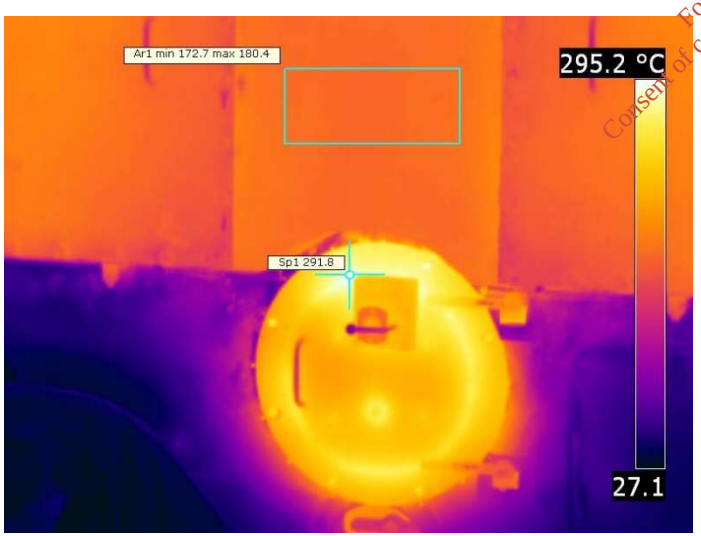


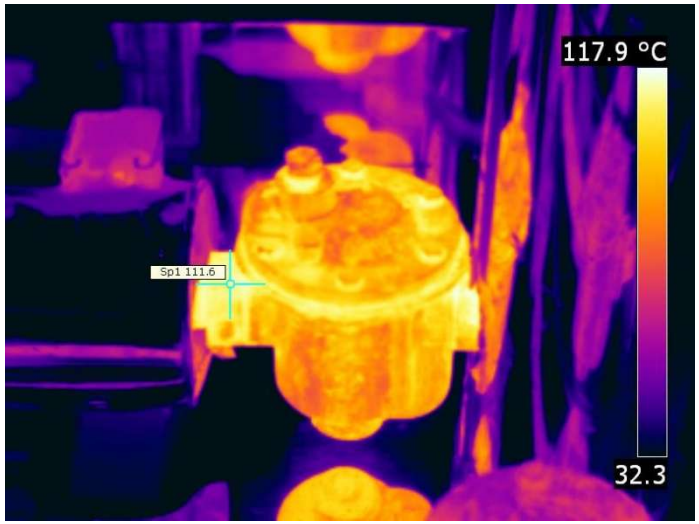


Thermal Images



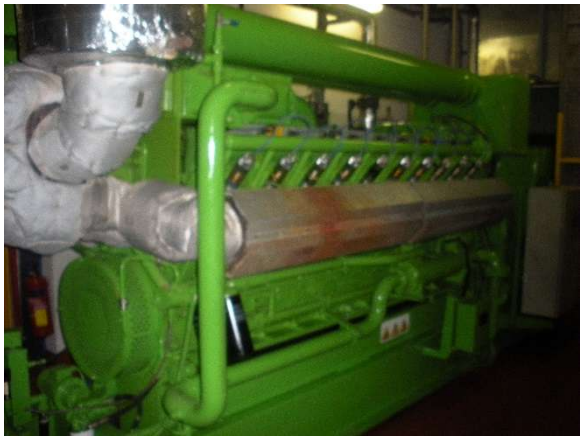






CHP

- Renegotiate
  - Minimum Take Pay
  - Operations of the CHP
    - Demand it operates at 100%, will require Dalkia upgrading their cooling tower or Millipore placing more load on the low temperature hot water by reducing or eliminating use of calorifiers.
  - Heat Rate (gas)
    - Prove our boiler efficiency using the Autoflame in order to lower cost of heat from CHP ~€11,000/year savings



Thank You

~Chris Famolare

Attachment H

Materials Handling

TABLE OF CONTENTS

1 Raw Materials, Intermediates & Product Handling

The raw materials, intermediates and products stored on site are listed in Table G.

1.1 Segregation Systems on Site

Every effort is made at the Merck Millipore site to ensure that materials are correctly segregated. Incompatible materials are not stored in close proximity to each other. Flammable drums are stored in approved fire resistant cabinets in dedicated areas.

1.2 Storage Facilities

Raw Materials
Materials used in the manufacture of the products on site are stored according to their optimum storage requirements. Merck Millipore adopt a 'just in time' policy to ensure materials are not stored for excessive periods of time.

All hazardous liquids are stored in bunded areas. These areas are structurally assessed every three years. The Bund Register is included with this Attachment.

Products
Finished products are stored in the warehousing area.

Organic Solvent Storage
A dedicated bulk organic solvent tank farm is located above ground. This tank farm supplies raw material solvent to the production areas. The area is adequately bunded and is subject to integrity testing on a three year cycle.

1.3 Transport and Handling on Site

Movement of solid material externally on-site is by pallet truck or fork truck. Liquid materials are transported on-site using over ground process lines, in steel drums and plastic containers. Within processing buildings, drums are charged from dedicated areas. Such areas incorporate closed drains for collection and containment purposes, which may be accessed to facilitate clean up of any spillages.

2 Waste Prevention

Wastes arising at the Merck Millipore facility from process, laboratory, packaging, and other typical sources are both hazardous and non-hazardous, and are classified in accordance with local procedures, EPA classification requirements and relevant waste legislation. Waste management programmes at the facility incorporate the waste management principles of prevention, minimisation, re-use, recycling, recovery and disposal. These rigorous waste management programmes are controlled by standard operating procedures, which are established on-site for waste segregation, handling, labelling, documenting, storage and treatment/disposal of waste off-site. The current waste procedures in Merck Millipore achieve segregation of various waste streams at source.

Wastes generated by the new development are similar in character to wastes currently generated by existing operations, but much smaller in quantity

The waste streams generated on-site, as summarised in tabular format in Tables H.3 (i) of this application.

Liquid wastes originating directly from the process operations are directed to the solvent storage tank farm where there are 3 options for further treatment;

1. Recovery in one of the Solvent Recovery Units;
2. Treatment in the on-site wastewater treatment plant or;
3. Held on site for disposal/recovery by a hazardous waste contractor.

There are dedicated hazardous and non-hazardous waste storage areas on site. These are detailed in the attached drawing.

2.1 Waste Description

The main sources of waste from the Merck Millipore facility are as follows:

- Process waste
- Laboratory waste
- Packaging waste
- Engineering waste
- Construction waste
- Utility waste
- Canteen waste
- General contractor waste including cleaners, painters, maintenance etc.

Waste management at the Merck Millipore facility is controlled by a number of procedures. These procedures cover the following practices:

- Waste segregation;

- Labelling and logging of waste;
- Waste contractor program;
- Documentation and record keeping of waste;
- Spill control procedures;
- Plant wide waste removal.

Hazardous and non-hazardous waste streams are collected, segregated and transported off-site by licensed waste management companies for appropriate treatment, recycling and/or disposal.

Merck Millipore continues to maximise the quantity of non-hazardous waste undergoing recycling. Currently Merck Millipore segregates and recycles the following non-hazardous waste streams:

- Timber
- Toner Cartridges
- Cardboard
- Paper
- Plastic
- Primary batteries
- Newspapers and magazines.
- Metal, wood and cardboard skips are installed at the Contractors' Compound to facilitate segregation of these waste arisings.

Merck Millipore's long-term environmental objectives are to, where possible maximise raw material usage efficiency which should in turn reduce the quantities of waste requiring treatment, or disposal and to also, where practicable, increase the amount of waste materials being recycled.

2.2 Segregation Systems on Site

In general all waste generated at the Merck Millipore facility is categorised as being either hazardous or non-hazardous in nature. Each area producing solid and liquid hazardous and non-hazardous waste is responsible for ensuring that this waste is logged in the appropriate waste logbook. Each waste stream is identified by using the relevant waste label. All hazardous waste labels are used both for internal identification and also for off-site transportation purposes.

Contractor Companies who generate waste at the Merck Millipore site must also ensure that waste generated from their respective projects (e.g. construction activities or general on-site work) is correctly identified and removed from site in accordance with the conditions of Merck Millipore's IE Licence using approved waste management companies and with prior approval from the EHS Department.

2.3 Transport and Handling

Waste Contractors

Wastes are transported and handled by the following primary waste management companies/waste transfer stations.

Waste Licences:	
Veolia	W0050-02
Greenstar	W0136-03

Waste Collection Permits:	
Veolia	WCP CK 14 0578-01 (c/o South Coast Transport)
Greenstar	NWCPO-13-11193-01

Management of any non-routine waste will be agreed in advance with the EPA. This waste will be transported off-site by an appropriately licensed and EPA approved waste management contractor for off-site treatment.

Bund Register

SIZE
A1

Notes

INTERNAL SITE DRAWINGS ARE ROTATED 356.5 DEGREES OFF NORTH ABOUT 0,0 FROM ITM.

Drawingref #	Containment Structure ID No.	Containment Structure Description	Ownership	Type	Construction Material
A	CS001	VMF1 Sump	IC1	Sump	prefabricated
B	CS002	VMF4 Sump	IC1	Sump	prefabricated
C	CS003	VMF 4 Sump Pump Bund - No.32	IC1	Sump	prefabricated
D	CS004	VMF 1 Sump Pump Bund - No.31	IC1	Sump	prefabricated
E	CS005	Durapore Mixroom Sump (inside building)	IC1	Sump	Reinforced concrete and SS
F	CS006	Hi-Flow Tank Farm Bund	Aircast	Bund	Reinforced Concrete
G	CS007	Durapore Tank Farm Bund	IC1	Bund	Reinforced concrete and SS
H	CS008	IC1 Drumstore	IC1	Sump/Retention	Reinforced Concrete
I	CS009	IC1 Tanker Loading Bay	IC1	Loading Bay	Reinforced Concrete
J	CS010	Aircast mixroom Pit Sump	Aircast	Sump	Reinforced Concrete
K	CS011	Microweb 2 Sump and chambers	Aircast	Sump	prefabricated SS
L	CS012	J1 Sump and chamber	Aircast	Sump	prefabricated SS
M	CS013	IC2 Tank Farm Bund	IC2	Bund	Reinforced Concrete
No	CS014	IC2 Loading Bay	IC2	Loading Bay	Reinforced Concrete
O	CS015	IC2 Drumstore	IC2	Sump/Retention	Reinforced Concrete
P	CS016	IC2 Waste Tank Bund	IC2	Bund	Reinforced Concrete
Q	CS017	IC2 SRU Bund	IC2	Bund	Reinforced Concrete
R	CS018	Cooling Tower Bund - chem store	Facilities	Bund	HDPE (chem resistant plastic)
S	CS019	Firewater Retention pond	EHS	Retention Lagoon	Impermeable membrane over aggregate
T	CS020	PMU transfer pipework/pump area	PMU	Bund	SS
U	CS021	T3Transformer	Facilities	Bund	reinforced concrete
V	CS022	T1,2,6 Transformer	Facilities	Bund	reinforced concrete
W	CS023	Op2 Chiller Bunds	Facilities	Bund	reinforced concrete
X	CS024	Trane chiller	Facilities	Bund	reinforced concrete
Y	CS025	IC2 Chiller Bund	Facilities	Bund	reinforced concrete
Z	CS026	MW2 Chiller Bund	Aircast	Bund	reinforced concrete
AA	CS027	CPG Bund (acid/caustic)	CPG	Bund	reinforced concrete
AB	CS028	CPG Bund Leach Area	CPG	Bund	reinforced concrete
AC	CS029	IC1 Foam Tank Bund	Facilities	Bund	reinforced concrete
AD	CS030/ CS009	IC1 SRU Sump	IC1	Bund	reinforced concrete
AE	CS031	PMU Catch pot bund	PMU	Bund	reinforced concrete
AF	CS034	SE2 Sump	Facilities	Sump	reinforced concrete
AG	CS035	New boilerhouse sump	Facilities	Sump	reinforced concrete
AH	CS036	T4 Transformer	Facilities	Bund	reinforced concrete
AI	CS037	T7 Transformer	Facilities	Bund	reinforced concrete
AJ	CS038	SMF Mod bund	SMF	Bund	reinforced concrete
AK	CS039	SMF Cast bund	SMF	Bund	reinforced concrete
AL	CS040	WWTP Catch Tank Bund A + B	WWTP	Bund	reinforced concrete
AM	CS041	PMU Chemstore bund floor drain	PMU	Bund	reinforced concrete
AN	CS042	CPG Leaching Area Drainage (Internal Area)	CPG	Bund	Glass reinforced Plastic

REV	DETAILS	BY	CH'D	DATE
1	Initial drawing for licence application	DS	RD	03.04.15

MERCK MILLIPORE LTD.
TULLAGREEN, CARRIGTWOHILL,
CO.CORK, IRELAND.

External Consultants Logo

Status
For submission

Approved By

Approved Date

Approved Signature

Drawing Title
SITE BUNDS &
CONTAINMENT STRUCTURES

Legacy File Name

Dwn By	DS	Date	03-04-2015
Scale	NTS A1	Sheet	1 OF 1
Drawing No.	MMCK-AD010-C-0314	Rev	1

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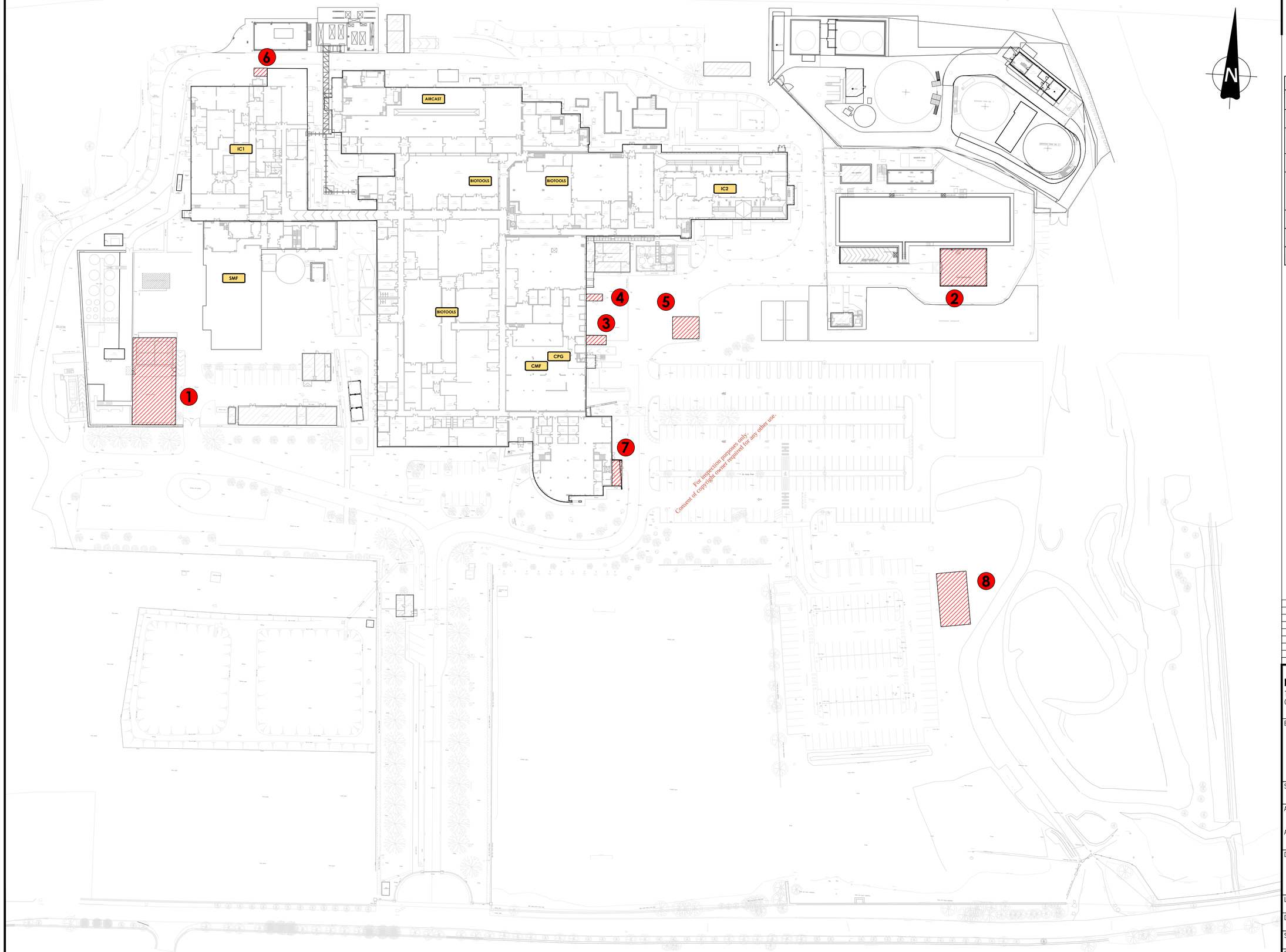
AN	CS042	CPG Leaching Area Drainage (Internal Area)	CPG	Bund	Glass reinforced Plastic

Drawing - Waste Collection & Storage Areas

SIZE
A1



Notes

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Waste Collection/Storage Areas

Ref:	Description
1	IC1 Drumstore: Haz Waste
2	IC2 Drumstore: Haz Waste
3	Recycling: Cardboard, plaster, bailers, glass recycling
4	Compactor: General Waste
5	Recycling Area: WEEE,Batteries, Annealing paper, PET Rolls, Plastic regrind, pallets
6	Scrap/Electronic Waste Storage
7	Canteen Waste Storage
8	Recycling Trailer

REV	DETAILS	BY	CH'D	DATE
1	Initial Drawing for licence application	DS	RD	01.04.15

MERCK MILLIPORE LTD.
TULLAGREEN, CARRIGTWOHILL,
CO.CORK, IRELAND.

External Consultants Logo

Status
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Approved By

Approved Date

Approved Signature

Drawing Title
WASTE COLLECTION & STORAGE AREAS

Legacy File Name

Dwn By	DS	Date	01-04-2015
Scale	NTS A1	Sheet	1 of 1
Drawing No.	MMCK-AD010-C-0313	Rev	1