



DELIVERABLE B2.1.
Final P&IDs of the METP

Public summary

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Summary

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1. Introduction

The work of this task captured the process design of the METP in a diagrammatical form as a Process and Instrumentation diagram (the P&ID). This document describes the process sequence in a simplified way and list every piece of hardware and instrument used to operate/control the process (valves, motors, pumps, sensors, etc...). The P&ID is a fundamental reference document for the design and then fabrication of the system.

As a result of the work carried out during action B1, it became apparent that treatment performance would benefit from a flexible approach where a plant can be reconfigured to meet specific site requirements. Elentec's approach of 'process modularisation' fitted this requirement well, consequently the P&ID originally submitted was updated to reflect this.

By 'breaking up' the process into interchangeable modular components (the 'Process Modules') the same plant can be reconfigured to optimize its performance to a given site. The P&ID described below (and attached) is presented in the configuration for the first test site (Frongoch – Wales).

2. Process description

A simplified description of the process is presented below where the 'Control module' manages the METP as a whole and communicates with each individual module.

Broadly, the modules' functionality is as follows:

- the 'Process module' collects the effluent from its source and circulates it through the METP
- the 'EC module' coagulates dissolved and suspended contaminants into macroscopic aggregates (the floc)
- the 'Mixing module' ensures homogeneous mixing of the floc
- the 'UF module' (micro filtration) separates coagulated contaminants from the effluent and concentrates the sludge
- the 'NF module' (nano filtration) separates non-coagulated contaminants (e.g. salts, dissolved metals) from the effluent (not shown here)

In this configuration (Figure 1) the first stage is EC treatment where the 'EC modules' coagulate dissolved metals. The particles generated in the EC reactor (the floc) are thoroughly mixed in the 'Mixing module' before being physically separated from the effluent by a 'UF module'. The output from the 'UF module' is the clean effluent and a contaminants sludge.

Test data showed that this configuration can achieve >90% metal removal rates whilst significantly reducing the volume of sludge produced since the 'Metals sludge' output (i.e. the process sludge) has a solids concentration >10%.

Each 'EC module' has two reactors thus a total of four reactors is available which can operate sequentially or in parallel depending on whether larger throughput or longer intervention intervals are preferred.

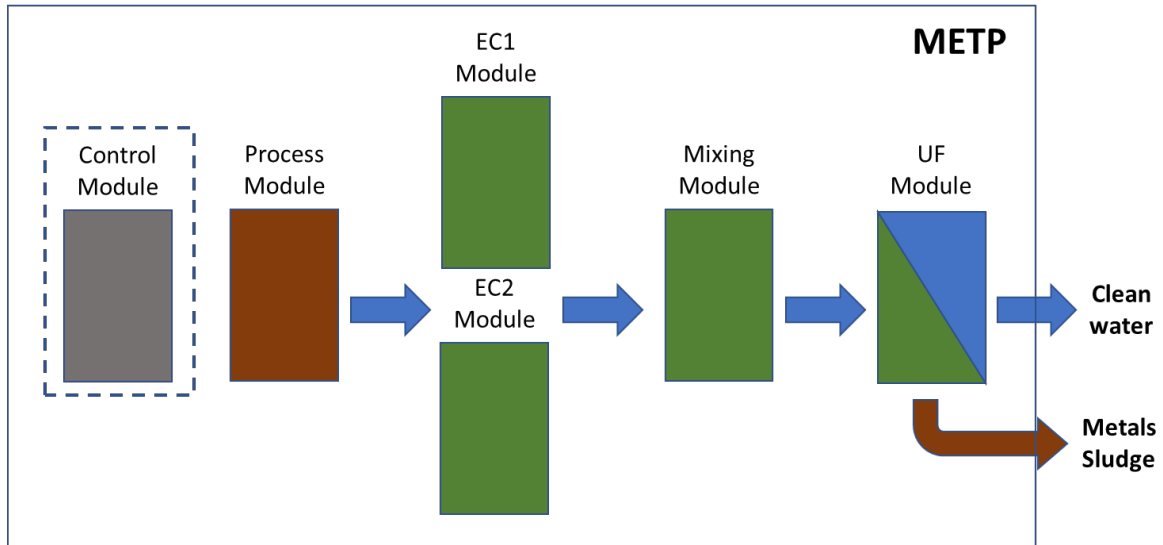


Figure 1: Block diagram representation of METP configuration for Frongoch mine site – Wales.

3. Module description

Control module

The control module manages the process as a whole, communicates with each individual module, stores information and enables remote access.

The unit houses the EC reactors power supply, the main process controller unit (PLC), the electrical panel and the process control touch screen.

EC module

The EC module houses the electrochemical reactors (two per module), the ancillary pipework and valves and a local control unit that communicates with the PLC. The reactors are 'plug and play' to enable quick replacement once plant is on site and operating.

Along with the process line (that carries the effluent) the EC module also has a 'Clean-in-place' (CIP) line (that carries the cleaning solution), for automated reactor maintenance, and a compressed air line for operation of automated valves.

Mixing module

The mixing module houses the mixing stage, that ensures complete homogenization of the floc previously generated in the EC module, and a local control unit that communicates with the PLC.

A polymer dosing module is also included if acceleration of floc aggregation is required for a particular sites.

Process module

The process module houses a local control unit that communicates with the PLC and key elements for process operation:

- the process pump – circulates effluent
- the compressor – provides compressed air for valve operation
- the clean in place pump and tank – automated cell cleaning
- the process dosing pump and tank – for effluent dosing
- the air extractor – for plant ventilation

Micro filtration (UF) module

The microfiltration module houses the array of membrane modules along with the set of valves and instruments for control of the unit. The membrane modules are arranged in two sets (duty/standby) to ensure continuous operation if/when cleaning is required.

The respective filtration pumps are mounted on this rig.

Nano filtration (NF) module

The nanofiltration module houses the array of membrane modules along with the set of valves and instruments for control of the unit. The membrane modules are arranged in two sets (duty/standby) to ensure continuous operation if/when cleaning is required.

The respective filtration pumps are mounted on this rig.