



- **High speed electronics and advanced ratemeter algorithm for high sensitivity and wide measurement range**
- **Runner mounted top shield section allows easy access to detector and chamber for maintenance and calibration**
- **Small footprint for ease of installation**
- **High Safety Integrity (optional conformance to industrial standard IEC61508)**

The Lab Impex Systems (LIS) Off-line Liquid Effluent Monitor (OFLEM) has been developed to continuously measure the concentration of radioactive gamma isotopes in liquid media. The system can be used for various applications from monitoring extremely low radiation levels to the detection of abnormal activity levels during accident scenarios. The OFLEM is a loop system, with a constant stream of sample taken from the process, through the system and returned back to the process.

The OFLEM uses a steel mounting frame allowing an easy floor mount installation. For most applications, the frame arrangement will typically consist of centrifugal pump, lead shielding, detection vessel, amplifier module and I/O termination junction box.

Low Background and High Detection Efficiency

The heart of the system is the lead shield assembly and detection vessel. Using a 4 inch thick, 4 pi lead configuration and 2.7 litre chamber with NaI(Tl) sensor, the OFLEM provides the optimum combination of low background and high detection efficiency.

The stainless steel detection vessel is 'Marinelli' style and can be easily removed and disassembled for ease of replacement and decontamination. The chamber is designed to facilitate a swirling upward flow of liquid providing homogeneity of sample and helping to minimise plate-out on the chamber walls. Purge connections are included for chamber cleaning and a base drain connection can be used for removing sediment build up.

Sample flow rate is monitored at all times and visually indicated via a rotameter. Flow can be controlled by a throttling valve and in the event of low flow alarm condition an audio-visual alarm is activated, and, in order to protect the pump, the pump can optionally be shut down during low or no flow conditions.

Ready Access to Detector and Chamber

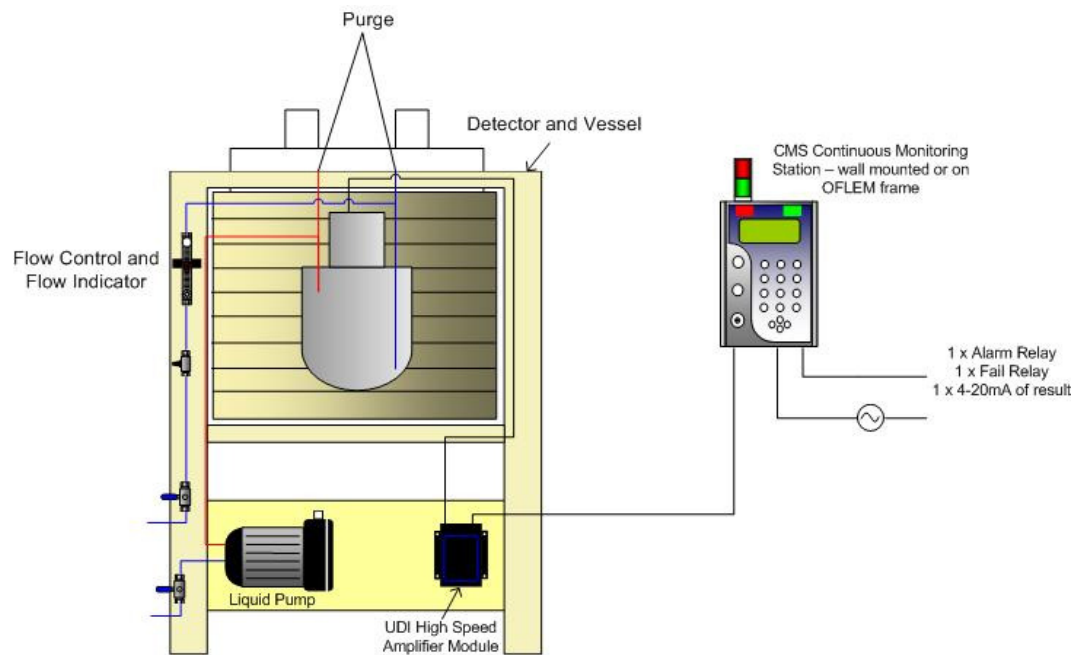
The frame is complete with isolation valves and disconnection fittings, and optional solenoid operated valves may be used to control the sampling process for grab sample measurement. To enable easy access to the detector and chamber, a runner mounted shield section is included on the top of the assembly. For calibration, fittings are included on the top of the detection vessel to allow the assembly to be temporarily substituted with a sealed liquid source phantom.



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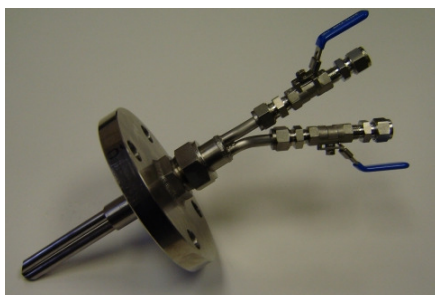
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Continuous Monitoring Station

A CMS Continuous Monitoring Station, either mounted on the frame, or remote from it, provides the display, alarm, control and communication functions for the system. The CMS system can be configured in a gross count mode, or an ROI (region of interest) can be used for energy specific measurement. Results can be displayed in various units including uCi/ml, Bq/m³ or gross cps/cpm.

As required, the CMS will generate audible visual alarms in the event of conditions such as high activity, detector fail, and low flow. On board relay contacts and analogue devices also allow transmission of result and status to other areas of the plant. For process lines where total discharge data (in Ci or Bq) is required, the CMS can combine measured concentration with process flow rate to give a display of totalised discharge in the last day, week, month and year.



'LIS offer a range of process sampling probes for simple and easy installation in the process line'

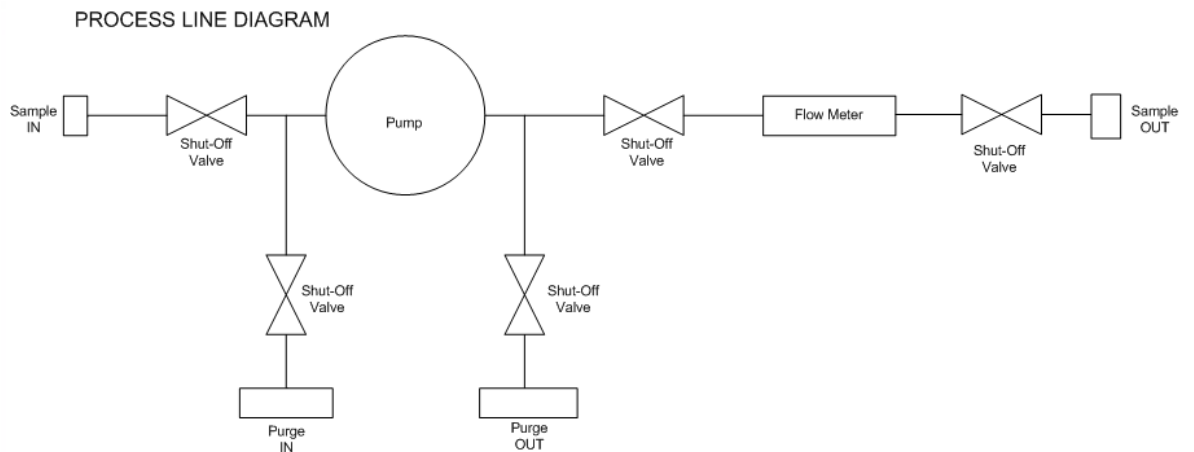
High Safety Integrity

As an added benefit, the CMS Continuous Monitoring Station can be provided with additional hardware for high safety integrity.

This hardware, called the SSM (SIL Safety Module) conforms to Safety Integrity Level 2 (SIL2) in accordance with the IEC 61508 standard. The SSM independently monitors the detector output with a simple, separate, scaler circuit. Detector counts are evaluated in this way, and the SSM will activate alarms in the event of a high detector count. No software is used with the SSM and each component on the circuit has been evaluated for potential failure mode and effects analysis. Although the SSM is resident within the CMS, the board is fully isolated and possesses its own power supply, power backup, and output relays for driving the CMS audio and visual alarms.

By offering users SIL2, the OFLEM gives added protection over conventional systems. The SSM provides a safeguard in the event the main CMS processor fails and reduces the overall risk of 'fail to alarm' scenarios. This is especially important when a failure of the system could indirectly expose people, the process or equipment to radiological or other hazardous conditions.

Further details on the LIS SSM module are available on request.



Optional Items

In addition to the SSM circuit, many additional optional items can be included with the OFLEM, including:-

High Range Operation: Chamber modification hardware for $1 \times 10^{-5} \mu\text{Ci/ml} - 1 \text{ uCi/ml}$ measurement range

High Temperature Process: Optional Heat exchanger for sample cooling prior to measurement

Grab Sample Measurement: Additional hardware and logic to allow the OFLEM to operate as grab sample system (take sample, count, purge chamber, take sample)

Automatic Check Source: For repeatable system checks



OFLEM Chamber and Detector

Performance Specifications

Chamber Volume: 2.7 Litres (with optional U-Tube for high range applications)

Shielding: 4 inch, 4 pi, with slide top section for easy detector / chamber access

Detector: 2x2 NaI (tl), (50 keV – 2.5 MeV)

Sample Flow: Normally 2 – 20 litres/m

Sensitivity: 2.2×10^8 cpm/ $\mu\text{Ci/ml}$

Measuring Range: $< 1 \times 10^{-8} \mu\text{Ci/ml} - 1 \times 10^{-3} \mu\text{Ci/ml}$

Temperature Range: 0°C to 50°C (32°F - 122°F)

Pump: Centrifugal Type

Dimensions: 700 mm x 700 mm x 950 mm
(28" x 28" x 38")