Environmental data collection: protecting yourself

With regulators taking a harder approach to breaches of consents and permits; the increasing difficulty in obtaining new permits; planning conditions seemingly getting tighter; and with the growing requirement for assessing water footprints, the need for monitoring data gets ever bigger. Cost of installing and managing monitoring systems is significant, with even single point systems costing several thousand pounds to set up, let alone the time spent on managing data. It is therefore critical that as much value as possible is obtained from the data.

Within the water environment there are essentially three basic types of natural water related monitoring that is carried out:

- Artificial discharges (flow and composition)
- Natural surface water flow, chemistry and ecology
- Groundwater level

Each of the above requires a different approach in terms of technology, but each also has the same key issues that need to be considered when designing and specifying a scheme or method.

- Why are you monitoring?
- Field installation
- Survey
- Data collection frequency

Why are you monitoring?

This is a critical issue. The purpose of the monitoring and the users of the data will define how the scheme is implemented. For example, if a rainfall dependent discharge is being monitored for compliance purposes then should the installation be MCerts accredited? Collection of the minimum amount of data will show whether the discharge is compliant or not, but may

not provide any added value. Collecting data at the same location in a different way may provide essentially free added value, by being able to analyse the data scientifically. For instance, obtaining continuous flow measurement would provide essential data for a flood risk assessment or site water management plan. Or the same data would allow settlement or attenuation ponds performance to be reviewed; to be sized appropriately; and to aid maintenance schedules to further reduce the risk of non-compliance.

If the purpose of the monitoring is fundamentally scientific, to support an Impact Assessment, for example; then the scheme must consider the value of the data obtained. Spending money on collecting poor or inappropriate data is obviously a waste

Field Installation

The first question to consider when thinking about the installation is whether it is temporary or permanent. Closely linked to this is how long the equipment will be installed for. Obviously a short test period of a week or so is definitely temporary; but is a year's worth of baseline monitoring? The longevity of the installation will determine the effort put into setting the equipment up and the choice of equipment. Remember, it's not uncommon for a temporary installation to morph into a permanent installation, resulting in lower quality data than is appropriate being collected over a long period of time. Equally, if effort and cost is going to go into the installation of equipment, then it should last as long as is reasonable to give the greatest financial return.

What are we monitoring? While it may seem an obvious question, it is surprising how often it is either ignored, or not thought about. For instance, do we need to monitor discharge flow rate and suspended solids in unison, or are total volumes of discharge and spot quality measurements only required, and where in the system would the best location be? If river flow is being measured; is the interest in flood flows, low flows, or peak flows; is a full hydrograph required or simply spot data; is river stage (water level) important, or just flow? When considering groundwater levels, are we sure which geological horizon is being monitored and does it matter?

If MCerts is a requirement of the monitoring, then specific equipment and installation will be required, which could affect the location due to space and power requirements. If the cost of an MCerts installation is going to be borne, then consideration should be given to maximising the data value by appropriate measurement, data storage, management and reporting.

Survey

Finally, after the time, money and effort that goes into installing the system, there must be an accurate record of the installation details. This must include not only the details of the equipment, but also the position of sensors relative to a fixed datum, which itself should be surveyed relative to ordnance datum. Upstream and downstream pipe diameters, flares, valves and bends are a must. Channel dimensions or weir details must be noted. Calibration data such as water depth, level or quality should be collected and recorded. Such data allows any inconsistent or unexpected data collected from the system to be reviewed and analysed in the context of the as built field installation.

Data Collection Frequency

In the past the only option for data collection was by a person taking a measurement and recording it in a note book. This method has major advantages in that each site is visited, allowing it to be inspected and checked and any physical changes noted and taken into account in the data interpretation. However, it also has major disadvantages, mainly cost and the fact that data can only be collected as frequently as weekly, and more likely monthly, over any significant period of time.

Figure 2 shows a river flow data set with high frequency monitoring, superimposed with monthly monitoring.

The figure shows that this long frequency data misses key events and would lead to completely erroneous conclusions. In this case the monthly data would be worse than useless.

The fact that logging equipment can record at very short intervals, doesn't mean that a short interval is appropriate. An inappropriate short interval results in very large data files, and either time being wasted on post processing; or worse, the data not being reviewed because it becomes too big a job. Thought must therefore be given to the optimal interval. Consideration should be given to:

- Regulatory requirements
- Frequency / wavelength of the data variation
- The level of detail needed for the data analysis.

For example, for background groundwater level monitoring, daily data will normally suffice, if the instrumentation will allow, a period when daily maxima and minima are recorded will allow response to rapid recharge of river flows to be evaluated. When analysing stream flows for runoff characteristics and storm events, then 15 minute intervals will be required. If the interest is in base flow analysis, then hourly data would suffice.

As the data record extends over years, then the recording interval can be increased. At any point, recording intervals can be reduced for a period of time, to study an aspect of the data response in more detail.

In essence, the less time available to draw conclusions – the higher the resolution and the shorter the monitoring interval that will be required.

With or without telemetry?

Electronic data logging has been around for a long time and systems are simple, accurate, relatively cheap and reli-

Secure and cost-effective monitoring of cooling process in nuclear laboratory

Reliable backup is absolutely vital in the nuclear industry including the Culham Centre for Fusion Energy (CCFE), the UK's national laboratory for fusion research, based at Culham Science Centre in Oxfordshire. Owned and operated by the United Kingdom Atomic Energy Authority CCFE hosts the world's largest magnetic fusion experiment, JET (Joint European Torus), on behalf of its European partners.

For more than 30 years JET has used an in-line ultrasonic flowmeter to monitor the flow of the water cooling system for the site. For energy saving reasons the water cooling system operates in two modes, 'Silent Hours' and 'Normal Hours'. During 'Silent Hours' the flow demand is reduced to 700m3/h which means that only one of the four main 160kW pumps is running. The 'Normal Hours' mode is selected at the start of daily operations when the process opens up various valves on the distribution system. This is achieved with a PLC control system, which monitors flow demand from the in-line ultrasonic flow meter to sequentially control the three other pumps over a 20 minute period until all four pumps are running providing a total flow of approximately 3500m^3/h.

Performance of the in-line flow meter was becoming unreliable and a decision was taken to install a backup system. CCFE already used a Micronics Portaflow 300 for portable monitoring and were confident that a Micronics Service Engineer could recommend a suitable fixed clamp-on meter to provide a permanent solution. The Ultraflo 3000 was chosen because it offered a non-invasive, quick and reliable flow measurement solution. With its easy to follow menu and simple set up it proved to be a cost-effective alternative to a traditional in-line meter installation. No installation drain down or pipe cutting was required and in addition dry servicing is possible so that downtime is kept to a minimum, absolutely vital in an industry which is so fast-moving.

David Gear, CCFE Technician, has total confidence in the Micronics product. "It is crucial to have the ability to monitor the cooling process and the flow in the site cooling water circuits supplying cooling to various systems associated with the JET fusion experiment"

The UK has had a thriving industry in the nuclear sector since the 1950's. Nowadays, the industry spans the full nuclear life cycle from the design of new plant through to decommissioning and waste management. And this example demonstrates that there is significant potential for replication throughout the nuclear industry.

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able. The next stage in development is in telemetry. Whilst telemetry systems have also been around for a long time and are frequently used within the plant and building environments, their use within the field of environmental monitoring is less common.

Telemetry offers some major advantages over manually downloaded data collection. The access to live or nearly live data means that problems with equipment; data quality or regulatory compliance can be spotted almost immediately. In fact many telemetry systems will "self report" an equipment or compliance problem via text or e-mail. Monitoring of specific natural events such as floods or recharge; unnatural events such as third party site discharges; and water quality impacts due to site activities can be viewed in "real time", allowing instant analysis and interpretation. Two way communication with monitoring stations allows monitoring intervals to be re-set to allow detailed data collection and recording to take place for a short time, to examine a specific issue. The ability to do all this means that data becomes more focused and the cost of people attending the equipment reduces, as they need only go out when required, as opposed to routinely.

Telemetry also has disadvantages. Cost is certainly one, as is power supply. A telemetry outstation requires more power than a simple measurement and logging device. The performance of long life sealed and rechargeable batteries is improving all the time, but if frequent data transfer is required then power from the mains, or solar/wind recharging will be required. This poses an added security problem as the monitoring station becomes very visible and open to theft or vandalism (or both).

It can be a difficult decision to decide whether telemetry is required, and cost is a big factor. But this must be balanced by the cost of losing or not having the data at the right time to make the right decision.

Summary

Environmental data collection is an increasingly important part of many industries. Long gone are the days when a monitoring system can be a pile of dusty paper in the corner of a back office with pencil scribbles on them. There is too much risk, both financial and reputational, finding out too late that there has been a breach of a condition or regulation. Modern measurement, data logging and telemetry systems allow data to be collected, recorded and distributed efficiently. The flexibility in the systems available means that any site can develop an appropriate scheme and method of monitoring, with an associated management plan that protects both the business and the environment.

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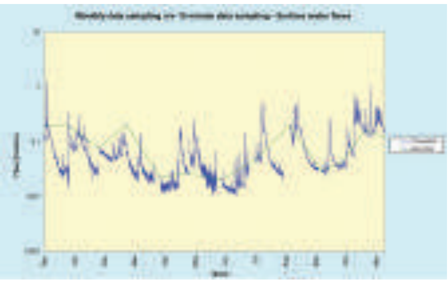

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