

Environmental Protection Internal Report

WATER QUALITY INSTRUMENTATION IN TIDAL WATERS

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TECHNICAL NOTE TWU/92/09

1. INTRODUCTION

Water quality monitors are used extensively by the Tidal Waters Investigation Unit which operates in the Water Quality Planning Section of the Environmental Protection Department.

The unit currently uses, or is developing the use of, monitors for use in three types of application:

- i. Portable hand-held monitors for obtaining spot values in shallow to medium depth water (0 - 20m).
- ii. Multi-parameter units for continuous near-surface monitoring, either static (i.e. fixed location) or dynamic (from a moving vessel).
- iii. Multi-parameter units for continuous monitoring at depth or remote from the shore.

All three types of monitor can be used for obtaining water quality profiles.

The hand-held monitors are the most frequently used at present, primarily because they are simple to operate, reliable, and give good results. The two types of recording multi-parameter instrument are at different stages of appraisal, and are not yet routinely used.

2. INSTRUMENT DETAILS

2.1 Hand-Held Monitors

The following hand-held monitors are used:

| | | No of Instruments |
|----------|------------------------------------|-------------------|
| WTW | - Salinity and Temperature | 4 |
| | - Dissolved Oxygen and Temperature | 5 |
| | - pH and Temperature | 4 |
| Alec | - Turbidity | 2 |
| Valeport | - Salinity, Temperature and Depth | 1 |

The instruments are used regularly for all types of survey, primarily from boats, but also on beaches and in fresh waters.

2.2 Continuous Near-Surface Monitoring

DMP Multi-Parameter Monitors have been appraised over a period of 18 months and it is anticipated that these instruments will soon be used routinely once additional development modifications have been completed.

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These instruments monitor the following:

- Temperature
- Salinity
- Dissolved Oxygen
- pH
- Turbidity

Significant problems were encountered with the instruments originally purchased (Mk III), and these were exchanged for Mk IV instruments in 1991. These are proving to be capable of good quality measurements, although there still remain a few problems. The multi-parameter sonde transmits information to a 'deck unit' which controls the sonde and stores the data. Two of these units were installed over a period of several weeks at the entrance to Restrouquet Creek, in order to monitor the quality of water entering Carrick Roads, as part of the impact assessment of the Wheal Jane tin mine. They were deployed from a moored vessel, and made measurements at depths of 0.5m and 1.5m below the surface. The data obtained are proving to be of value, despite there being some problems, such as unidentified spikes and long-term drift.

In addition to the collection of data from one location (static), the unit is currently developing a PC-based system to allow dynamic monitoring of the surface or near-surface water quality from small vessels. In this mode, water will be continuously pumped past the monitoring sonde, which will be on-board, and the data collected by the sonde will be passed to a notepad personal computer where it will be merged with continuously updated position information. This will allow the water quality parameters to be measured whilst the boat is underway, and subsequent processing in the office will enable the data to be manipulated in a number of ways, such as the production of contour maps.

2.3 Continuous Monitoring at Depth

For continuous monitoring at depth in tidal waters, two Applied Microsystems (AML) 'Aquamates' were purchased. These are self-contained units which can be moored at depth for a period of about a month.

The variables measured are:

- Temperature
- Salinity
- Dissolved Oxygen
- pH
- Turbidity
- Current Speed
- Current Direction

These are extremely sophisticated instruments at the forefront of technology, with complex software enabling them to be used in a number of different modes. There have been some significant hardware and software problems with these instruments, and their evaluation is on-going. We are currently negotiating with the manufacturers regarding significant equipment enhancements, and we are confident that the problems will be overcome over the next few months.

3. QUALITY ASSURANCE

The hand-held monitors measuring Dissolved Oxygen (DO) and pH are always calibrated according to manufacturer's instructions prior to undertaking a survey. In the absence of any laboratory service in respect of chemical analysis for DO, there is no way of further checking the accuracy of DO. This lack of requirements is being raised at the Water Quality Monitoring Liaison Group meetings. The pH measurements are routinely checked against samples returned to the laboratory for analysis.

The hand-held temperature and salinity monitors are supplied 'factory-calibrated' and they cannot be field calibrated. However, this does not guarantee accuracy, and a formal performance check procedure is being implemented. The accuracy of the probes will be checked routinely against an accurate mercury thermometer and using standard solutions of sea-water.

It is anticipated that calibration and check measurement records of all hand-held monitors will be kept as from August 1 1992.

The measurement of turbidity is an imprecise science, since the value obtained is dependent on particle size, shape and colour. Measurements are usually made in conjunction with the collection of a number of samples for suspended solids, and therefore a turbidity - suspended solids relationship is obtained for each individual survey.

With respect to the automatic monitors, quality assurance procedures are being developed concurrent with the instrument appraisal, and will be in place once the instruments are routinely used. The DMPs installed in Restronguet Creek showed some drift in all parameters, but particularly pH and DO. Corrections for this drift were made on the assumption that it was linear, and were based on spot measurements made on site with the hand-held WTW meters.

4. FUTURE REQUIREMENTS

The envisaged requirements of the Tidal Waters Investigation Unit for Water Quality monitoring instrumentation over the next two years lie with the systems already being used and developed. To branch out into further new technologies at this stage is considered to be the wrong approach.

The scope of the instruments already described is extremely broad, and the main requirement is to consolidate the reliability, accuracy, and effectiveness of these instrument packages.

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