Biological treatment for Ballarat

Ballarat South waste-water treatment plant.

A collaborative biological waste treatment project between CSIRO and the Ballarat Water Board has saved the board an estimated $5 million in capital expense and $350 000 in annual operating costs.

The board operates two sewage treatment plants: one small and one large. Sewage is naturally high in phosphorus (about nine parts per million). Regulations controlling phosphorus discharge therefore have a significant impact on sewage treatment plants.

In the early 1980s, the Victorian Environmental Protection Authority (EPA) imposed a discharge restriction of 2 ppm of phosphorus on the smaller plant. To comply, the board adopted a chemical treatment process in which Ferric chloride and Alum precipitate the phosphorus as insoluble phosphates. These are then removed in the sludge.

The board's chief chemical engineer, Bruce Price, says it seemed likely that the larger plant would soon face similar restrictions. But chemical removal of phosphorus would be too expensive. Other methods therefore had to be investigated.

In 1983, Price and a CSIRO senior principal research scientist, Bill Raper, came together on this problem after a chance meeting. Raper suggested biological removal of phosphorus and a joint presentation by Raper and Price was made to the board's then engineer-in-chief, Alan Howard.

The proposal was for CSIRO to finance and build a pilot plant at Ballarat. Supervision of the plant would be the responsibility of the board. The proposal also allowed for some chemical removal of phosphorus should the biological treatment not meet the target level of 2 ppm.

Price says biological removal of phosphorus was developed in the 70s in South Africa. The process relies on uptake of large amounts of phosphorus by bacteria when they are subjected to alternating anaerobic and aerobic conditions. The phosphorus is ultimately removed in the sludge. After the process, the level of phosphorus discharged to the waterways is low, while the sludge has enhanced value as a fertiliser because of its high phosphorus content.

The pilot plant was built by the Division of Chemicals and Polymers workshop. It demonstrated that biological phosphorus removal was feasible and the capital and operating costs of a full-scale plant would be low compared with the alternatives. The board has since built a full-scale plant. Price says a conventional chemical plant would have cost the board an extra $5 million in capital and $300 000 to $400 000 annually in chemical costs.

Some time after the joint project began, the EPA did restrict phosphorus discharge from the larger plant to 2 ppm. So far the biological removal process has reduced the phosphorus level from 9 ppm to 3 ppm.

Capital works have been implemented by the board to help reach the regulation level of 2 ppm. They found the detention time of the bacteria in the aerobic tanks was not long enough for the required phosphorus removal. New tanks are being constructed and will be operational by about October, 1993. The board is aiming for 1 ppm phosphorus discharge. Price says this target should be achieved by the biological process alone, without the need for precipitating chemicals.

Bill Raper: project developed after a chance meeting.

The board's present engineer-in-chief, Bob Ford, says a number of factors contributed to the success of this collaborative project. He says both organisations had a basic willingness to embark upon joint research and close co-operation ensured the project was kept 'on track'. The potential for financial benefit to the board was also important.

Had Raper and Price not met by chance the biological treatment project may never have taken place. This highlights a need for a better flow of information between CSIRO and local authorities.

Also, to secure research and development assistance of this kind, local governments will often be required to contribute a measure of funding. In this case the initial project proposal included no significant capital or operational costs to the board. In future CSIRO will require full cost recovery for this kind of work, Raper says.

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Fiona Douglas

Solar-powered water monitor

A solar-powered, submersible water quality analyser that operates unattended at monitoring sites for long periods is being developed by CSIRO's Division of Water Resources and Queensland firm, Greenspan Technology Pty Ltd.

The analyser, called AquaLab, measures a range of physical and chemical water-quality parameters such as temperature, conductivity, turbidity, reactive phosphate, nitrate, ammonia, chloride, pH, dissolved oxygen, divalent cations and flouride. An on-line data logger stores all measurements and functional information, which can be accessed continuously from a land-based site or office.

The system is already earmarked for use in a number of research and development projects by bodies such as Wyong Shire Council, the Sydney Water Board and the Queensland Water Resources Commission.

An AquaLab prototype is being built by Greenspan with commercial production planned for early 1994. It is likely to cost between $20 000 and $30 000.

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