

(Revised 1/18/06)

AB02.5

COST JUSTIFICATION OF CONTINUOUS MONITORING AND CONTROL OF DISSOLVED OXYGEN

Over the years, the justification of purchasing continuous monitoring dissolved oxygen (DO) instrumentation for a pond growout aquaculture operation has continually been questioned. There is seldom any argument in intensive or closed system growout facilities for the need of this type of automation, as the dynamics of such a facility are so dependent on the immediate control of all water quality parameters. But, in pond growout operations, dissolved oxygen automation has been considered too costly. The purpose of this bulletin is to illustrate the fact that it is too costly not to have dissolved oxygen management instrumentation in your pond growout operation.

By giving the pond grower the formulas to use and the benefits of automation, it is our desire to assist them in understanding how inexpensive this type of equipment can be. Needless to say, there are many possible variables, dependent upon the specific pond growout operation; so we have attempted to give enough detail below that any grower, of any species, in any size pond might be able to use these formulas.

The first thing that must be addressed is the automation equipment being considered. No matter which manufacturer you are pondering, there are specific considerations that must be made when making your system decision:

- (1) Does the parent instrument (instrument in charge of the sensors) have the built-in intelligence to control all of the functions that must be managed, such as probe self-cleaning, aerator control, automatic and continual self-diagnostics, automatic sensor recalibration, and pond-side readout; as well as, varied analog and/or digital communications for sending data to a computer, etc?
- (2) How much maintenance will the DO/temperature sensors require? Are they self-cleaning? How often will they require calibration? How often will they require recharging? In other words, how much manpower must you have to support this automation system.
- (3) How reliably manufactured are the components of the system being supplied? Are the components made to withstand the environmental rigors of your area? Are the sensors capable of maintaining the correct temperature-to-DO relationship if your ponds see a dramatic swing in temperature change? Is the system capable of being operated by one of your people or is it necessary to have electronic or computer literate personnel on hand at all times?
- (4) What level of technical support is available? Are there local support people and do they "speak your language" - the language of pond aquaculture?

All of the above are very important. The DO monitoring and control system you are considering should have been designed with your type of operation in mind, without cutting corners because the manufacturer felt "you probably won't ever have that situation happen!" The day that you purchase some manufacturer's DO monitoring system where corners have been cut, is the day you have bet your entire operation on a savings only the manufacturer will gain from - is that type of savings worth it for the grower? So, heed the above questions, and remember - in the pond aquaculture business, the product dies if a mistake is made, there is no bringing it back for rework. Spend the necessary money to get reliability, this is no place to go with low bid!

ASSUMPTIONS

As in any hypothetical situation, certain assumptions must be made. Listed below are a number of assumptions, as well as a few formulas that will be important in determining the value of this equipment for your specific operation. For purposes of example only, numbers have been "plugged in" based on a hypothetical situation in a specific pond growout industry.

Energy Costs

A continuous monitoring instrument for remote outdoor applications usually uses at least 110V AC electricity, but it quickly converts this energy to DC electricity inside the instrument. So, analytical equipment will not use enough operational energy to be of concern. However, if you use aerators in your ponds, one of the main reasons to consider automation equipment is to save energy, so energy usage becomes important.

Consider a hypothetical catfish pond in the southeastern U.S. sized at fifteen acres. This 15-acre catfish pond has two 10-hp paddle-wheel aerators in it. Through field testing in actual catfish production ponds, it has been found that by controlling aerators automatically, they were, on average, required four (4) hours less each night. (This is due mainly to the schedules of personnel who would manually turn on aerators, feeding times, and daily weather and water quality circumstances. How much time one is able to stand by the ponds, ready to activate aeration, only when it's necessary, will make the calculations vary.)

Most energy bills are reported in "cents per kilowatt Hour" or \$/kWh. In our example we will use .08/kWh for our cost of electricity. The formula to calculate the cost of energy save is:

$$\text{\$} = \text{hp} \times .746 \times \text{\$/kWh} \times \text{Hrs less that aerators are running}$$

where hp is the total horsepower of all aerators combined, and .746 converts hp to kW.

With two aerators per pond, running an average of 10 hours per night each, the electricity cost saved would be:

$$(2 \times 10\text{hp}) \times .746 \times \$0.08/\text{kWh} \times 4 \text{ hrs} = \$4.77 \text{ per night} \\ \text{or } \$143 \text{ per month per pond.}$$

Personnel and Asset Use Costs

If a pond grower has at least 10 ponds, during the warm months of the year he will probably have at least 1 all-night "DO checker" for the ponds. The number of people and the number of hours will differ from grower to grower, but one should be honest in figuring the cost and value of these people. The DO pond monitoring and control system is not being promoted as a replacement of this all-night checker; however, between the actual wage, the administrative and tax burden (typically 20 to 25% of the wage), and the cost of buying and maintaining the vehicle that this person typically requires for his rounds, it is easy to find other productive ways to utilize that labor beyond monitoring the DO of ponds manually.

Occasional Oxygen Depletion Losses

It is a fact of life that an occasional pond's productivity is lost due to oxygen depletion. Actually, this is exactly what this monitoring and control instrumentation is being purchased to stop. These types of losses can be expected until it is decided to take the step into DO automation.

A number of variables can lead to this loss, but never can one predict when it will happen or in which pond the loss will occur. To be honest with this assessment these losses must be figured into the calculation. We are assuming that in a standard 12 pond operation, at least 1 pond's production can be expected to be lost once every 5 years.

In determining this loss, one must assume the market value of the product in that pond at the time of full maturity, whether the product had reached that point or not. We believe that most will agree that pond losses are almost always at the pond's full maturity stage, primarily because the pond is near maximum load at that time.

In our hypothetical example we will assume a stocking density of 8,000 fish per acre in a 15 acre pond. The total loss in that mature pond following a DO depletion crash would be 120,000 fish. Assuming a market size of 1 pound and a pond-bank market price of \$0.70/lb, the loss would amount to \$84,000! An automated DO monitoring and control system, properly maintained, could prevent this loss.

Of course, it is very difficult to argue that this cost is representative to real life on a catfish farm. However, it is relevant to your PEACE OF MIND. Whether or not you have actually experienced fish losses at all, let alone at this rate, you will definitely have some notion of the value of a good night's sleep in the summer production season.

DO Monitoring and Control Equipment Costs

The Royce Instrument Pond Monitoring System will cost a normal pond user approximately \$4500 per pond, or per monitoring system. This price includes the analyzer with full microprocessor control, independent set point controls for 2 to 4 aerators per sensor, the self-cleaning/self-calibrating sensor buoy assembly, and cable. The major variable that will increase this price is the method of communication to a central data collection computer, if that option is desired.

There are many ways to pay for capital equipment, outright cash payment, a bank loan, a lease, or even a rental. No matter what method of payment is chosen, make certain that system maintenance is considered. Some companies offer Service Agreements on their equipment, while others do not make that offer. But the grower should recognize

that placing over \$4000 worth of electronic equipment in and around his pond is a sizeable investment, and it should be protected with some consideration of how he will best maintain the system.

One variable that enters the picture, if the equipment is financed, leased or rented, is the ability of the grower to write off equipment payments as an Operating Expense, right off the bottom line, if he is profitable.

THE FINAL ANALYSIS - CAN DO AUTOMATION AND CONTROL BE JUSTIFIED?

In considering the viability of moving into automated pond DO monitoring and control, the following questions should be asked:

- 1 - Continuous, automatic DO monitoring and control systems, when they are in control of aeration will reduce, and probably eliminate, oxygen depletion fish losses.
- 2 - What night labor is actually needed? Certainly there should be someone around, but an automatic monitoring and control system frees them to perform other important tasks. More savings.
- 3 - Electricity is one of the most expensive components of raising catfish. It has been proven that a pond monitoring system will reduce electricity costs. In fact, this savings alone will pay for the monitoring system within 2 years
- 4 - If a grower is able to obtain better control over his water quality could he support more productivity in his pond? There is always a limit, but we know that most have not reached it yet.
- 5 - With monitoring and control instrumentation on his ponds a grower has the ability to capture historical data for 24 hours per day in each pond. Historical trends can be collected and used to make decisions in the future - better pond management.
- 6 - Is there a value on PEACE OF MIND? You bet there is!! There is also a value on a full night's sleep, or maybe we should call it QUALITY OF LIFE!



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