Division of McNish Corporation

Dedicated to the
Water and Wastewater
Industry

Walker Process Equipment
840 North Russell Avenue
Aurora, Illinois 60506-2853
E-Mail: walker.process@walker-process.com
Website: www.walker-process.com
Phone: 630-892-7921
Fax: 630-892-7951

A Discussion about Rotating Biological Contactors (RBC's)

As a manufacturer of RBC equipment for over 30 years we believe this technology continues to offer a viable alternative to other processes for BOD removal and Nitrification applications. This paper discusses some of the topics that we hear from our customers who are either cautious about or dismiss entirely consideration of an RBC process in their WWTP process design. We hope these thoughts encourage you to reconsider this energy efficient and robust treatment process in your upcoming WWTP projects; and welcome your comments.

1. Some people in the WWTP industry believe that the Federal EPA has classified RBC's as 'failed technology', is that true?

No, the EPA continues to list RBC's as one of several possible viable process alternates and continues to approve, when appropriate, RBC installations.

The 'failed technology' myth comes from a section in the 1985 revision of the Federal Water Pollution Control Act (Clean Water Act). Sub Chapter II of the current CWA defines the manner and extent of funding the construction of treatment works through Grants and section 202 defines the Federal Share of those Grants. In that section it says the Federal EPA can grant the funds for all costs for modification or replacement of any facility originally built with Grant money if that facility has not met design performance specifications and that failure has caused increased operating expenses; assuming that these conditions were not caused by negligence. Yes, that same section goes on to mention RBC's as qualifying for the same replacement funding, but the intent of the legislation is clearly to fund the replacement of ANY facility that was built to EPA performance standards, was originally funded with Federal money and is shown to not meet the design standards the EPA themselves set.

2. What about the Individual State Standards; do they allow RBC's?

Illinois, for example, repealed mid-'80's regulations that while not actually banning RBC usage, effectively accomplished that with design redundancy and shortened maximum service life requirements. This Illinois reaction was no doubt in response to installed RBC designs which resulted in multiple failures of a particular RBC shaft design (see FAQ on Shaft Failure). Illinois repealed their pseudo 'ban' and replaced it with language that specifies reasonable design criteria. They made these changes based upon WWTP Engineers who submitted evidence that the standards, while relevant to the RBC design which resulted in shat failure, were not relevant to modern RBC designs.

The Ten State Standard, for another example, does not place RBC's in any special class; they specify a 'blanket' requirement that "…processes and equipment or applications have a reasonable and substantial chance of success…"

We do not know of any individual states which do not allow RBC technology to be considered in a WWTP process design, for appropriate water treatment duty.

3. How about industry respected agencies and consultants, outside of the government; what are they saying about RBC's?

There are many examples of continued interest in and science being applied to the successful design and operation of RBC processes. The highly regarded Water Environment Federation has recent Manuals of Practice (MOPs) that discuss RBCs at length and not in a way as if that technology is anything but a viable option for the right applications. Consider the recently published MOP 11, 6th edition, 2007, Chapter 21 that deals at length with RBC design and operation, as does MOP 8, 5th edition, 2009, Chapter 13 and MOP 35 from 2010.

We invite you to read the accompanying paper *Reconsidering Rotating Biological Contactors,* written by Steve Williams, PE. Williams & Works in January 2011 for his take on the viability and inherent energy and operating cost advantages of this technology.

4. Shaft failure has always been considered the nemesis of RBC's; why should this history of mechanical failure be ignored?

It should not be ignored; there were many instances of early RBC shaft designs which prematurely failed structurally, due to the operating weight exceeding the shaft design. We believe the key to understanding the issue of RBC mechanical failures lies in the history of RBC's and in the proper process design and operation of an RBC process.

Here is some of the history. The first commercial RBC process was installed in 1969, based on a small diameter round central shaft design. About 3 years later, the leading RBC manufacturer evolved the shaft design to a square central tube design. In the following years, up to about 1978, other manufacturers joined the marketplace and an inordinate number of structural failures were experienced.

One independent survey of RBC experience notes that: *Many references use 1979 as the turning point in solving the shaft failure problem.*[1] That same reference notes that: *The…equipment designed, built and operated during an almost 2-decade period* (from the 1960's) *experienced exceptionally high failure rates…fractures…often occurred within months. Over a 5-year period about 5% of all machines* (from 1 manufacturer) *had failed …though a 20-year life was contemplated."*

In short, we believe that the historical mechanical failure problems of the past are just that; in the past. Modern RBC structural design has, does and will provide the opportunity to operate safely and soundly at the design conditions.

Having said the above, of course there is the potential for overloading an RBC shaft, or media set. Excessive biological growth adds weight to the RBC and the strength of any machine has limits. This category of risk is common to any process equipment. It is of ultimate importance that the design basis for an RBC process be as accurate as is practical, that the RBC supplier use proven design standards in selecting not just the correct overall RBC media area but in selecting the optimal media density and the judicious use of processing aids like RBC aeration to allow the Operator to keep the biochemistry of the application in control to allow safe and effective processing.

5. If we accept that RBC's continue to be a viable BOD reduction/Nitrification process option, what are its advantages?

Let's start with ENERGY. There is quite a lot of published material concerning the energy consumption of an RBC process vs. alternatives; they use a combination of actual plant data, operating costing software and other calculations and they each define 'energy limits' differently. But they all point to the same conclusion; RBC processes consume less energy. Here is a sample of results.

Process	Energy Consumption kWh/1,000 gal Treated	Plant Loading	Annual Elec. Cost $0.1/kWh	Year of Analysis	Reference
RBC		7 MGD	$50,000	1986	3.
CAS		7 MGD	$245,000		
RBC	Avg. 1.04	2 MGD	$76,000	2007	4.
CAS	Avg. 1.88	2 MGD	$137,000		
RBC		30 MGD	$29,000	2011	2.
CAS		30MGD	$60,225		
MBR AS		30MGD	1.5 to 3 times CAS		

We at Walker Process are interested in 'real life' energy comparisons, based on existing plant audit analysis. Currently we are conducting, through and independent Engineer, a study of 2 similar approximately 1 MGD WWTP's. One uses RBC and the other CAS. The results from this study are forthcoming; please contact us and we will be pleased to provide the energy comparison results when they are available.

As persuasive an advantage that Energy Conservation gives to RBC's, long time operators of these processes provide other, meaningful reasons they consider important to the RBC process. Here are some Operator comments:

In a recent survey of hundreds of RBC process users, 95% of those replying said they were very satisfied with that wastewater treatment process.

Additionally more than 95% added that RBC's were meeting effluent requirements.

Here are quotes from some RBC Operators:

"….ease of maintenance, ease of operation, (no) unpleasant odor".

" (have been) running for over 20 years…a good, simple, low energy usage system, requiring low operational attention."

"Our first RBC's were commissioned in 1980. It's a great process. They flat-out work."

6. Summary:

The industry reality of RBC installations in the U.S. includes that more than half of users operate RBC designs which have been discontinued by the original manufacturer. This fact combined with the age of many installations quickly reaching their useful life means there will be many projects coming up for upgrade/replace of RBC BOD/nitrification processing.

If you are operating aging RBC equipment and looking for economical RBC replacement, are designing a process replacement or upgrade project and believe in the RBC technology or are open to considering it, we welcome the opportunity to speak with you about your needs.

Thank you for your time and interest in reading the above comments. We hope to have the opportunity to work with you.

Arn Johnson
Walker Process Equipment
October 2011

References:

1. Ross, Lange, Barrett, Inordinate Failures of Rotating Biological Contactors (etc.), Failure Analysis Associates, 1994.
2. Williams, Reconsidering Rotating Biological Contactors (etc.), Williams & Works, Inc., 2011
3. Dugan, Takiguchi, Rotating Biological Contactor Pilot Study (etc.), Water Resources Research Center, 1986
4. Monteith, Kalogo, Louzeiro, Achieveing Stringent Effluent Limits Takes A Lot of Energy, WEFTEC, 2007