

COAL, May 1991, pp. 70-71.

EFFECTIVE HEAVY MEDIA PROCESS CONTROL

M. C. (Mike) Albrecht

Heavy medium process control is measuring and adjusting the amount of magnetite in the circuit. The key questions in heavy media process control are how closely and how quickly can you control the media specific gravity. Using computerized process control systems and on-line analyzers allows very close control of the gravity (+/- 0.05 specific gravity units). But using their inherent speed can cause yield losses. These systems have the ability to measure product ash and make set point changes in 30 second increments or less.

Measuring the product and adjusting the process by changes in the product is a feedback control system. The feedback control concept has to be carefully thought out to prevent constant set point changes. Constant changes in separating gravity set point can cause circuit instability. This instability is due to the time it actually takes a cleaning circuit to respond to these changes. This is called system response.

System Response is an often overlooked area of process control. When a change occurs in a system, whether by changing feed characteristics or process variables, the system does not respond immediately, but rather takes a period of time. System Response is how long it takes the total system to respond to a change and reach equilibrium again.

System response consists of:

- Initial change
- Constant rate change
- Final change
- New Stability

Changes are not immediate, but take a significant period of time. System response time is unique for each system.

A Heavy media cleaning circuit, as with any cleaning circuit, is a dynamic system. The addition of the medium increases the control factors.

- Amount of magnetite (Media to coal ratio and media gravity)
- Amount of circulating solids (coal)
- Feed rate (t/hr)
- Raw coal ash and washability

When a change is made in the separating gravity, by changing the media specific gravity, the system will change until the new specific gravity is beyond the new set point. This is due to system response time to identify what the new gravity is. This over correction will then need to be corrected; again with a slight over correction. This

cycling will continue until the media gravity is within the set point dead band. Because of this, it takes a period of time for the system to reach equilibrium at the new media gravity.

Figure 1 shows a typical 100 T/hr heavy media cyclone circuit. Media volume is entirely dependent on circuit layout, feed size, and engineer preference. Normal ranges are from 3:1 to 5:1 media to coal. For this example, at a separating gravity of 1.50, with a two and a half (2.5) minute circuit retention and 3.75:1 media to coal ratio, media volume is 2500 gallons.

Normal balance conditions has a constant loss plus bleed to dilute media of 980 pounds/minute of magnetite. This requires a constant make-up of this 980 pounds of magnetite and 260 gallons/minute of water. Maximum changes, for efficient design, would be +/- 25 percent of normal balance or 700 to 1200 pounds/minute of magnetite and 195 to 325 gallons/minute of water.

To change the separating gravity from 1.50 to 1.45 requires the removal of 900 pounds of magnetite and the addition of 110 gallons of water. At maximum change this would require over 3 minutes for the magnetite, and 2 minutes for the water. Allowing the bulk of the changes by made by magnetite removal, a normal change rate of 3.5 minutes could be expected.

Figure 2 shows the graphical representation of this change. Line A is the actual change in the system. Due to where the gravity is measured, line M is the measured gravity change. Point 1 is where the change is initiated (Initial Change), point 2 is where the system starts measuring the change. Point 3 is where the system stops the change, with point 4 the actual gravity at that time (Constant Change). Point's 5 & correspond to 1 & 2 for the correction of gravity. This repeats (Final Changes), with lower and lower amplitude, until the system is stable at the new gravity (New Stability). For this example it takes 6 minutes for the gravity to become stable at the new set point.

Normal changes in feed, can cause ash fluctuations of +/- 3 % over short periods of time. In making changes, it is necessary to consider time average of product ash and use a two (2) hour or greater average. Make changes, only when the average is above the set point for double the system response time (e.g.; if system response time is 10 minutes, the ash needs to be above the set point for 20 minutes).

Some large plants have reported system response times of over 30 minutes for a specific gravity change of 0.1 specific gravity units.

It is possible to control a circuit too quickly and too closely. Effective control must consider the overall system. A stable system, is much preferable to one in constant change. By allowing for the normal variations in the coal, and adjusting based on the average from several hours of operation, rather than immediate or current values a smoother operation can be achieved.

Any system that controls based on what happened in the past, typical feedback control, is reactive. A better way would be to plan ahead, an control based on what will happen, a proactive system. At this time the best available systems are reactive, and knowledge of the system response time to allow for maximum stable operation is very important.

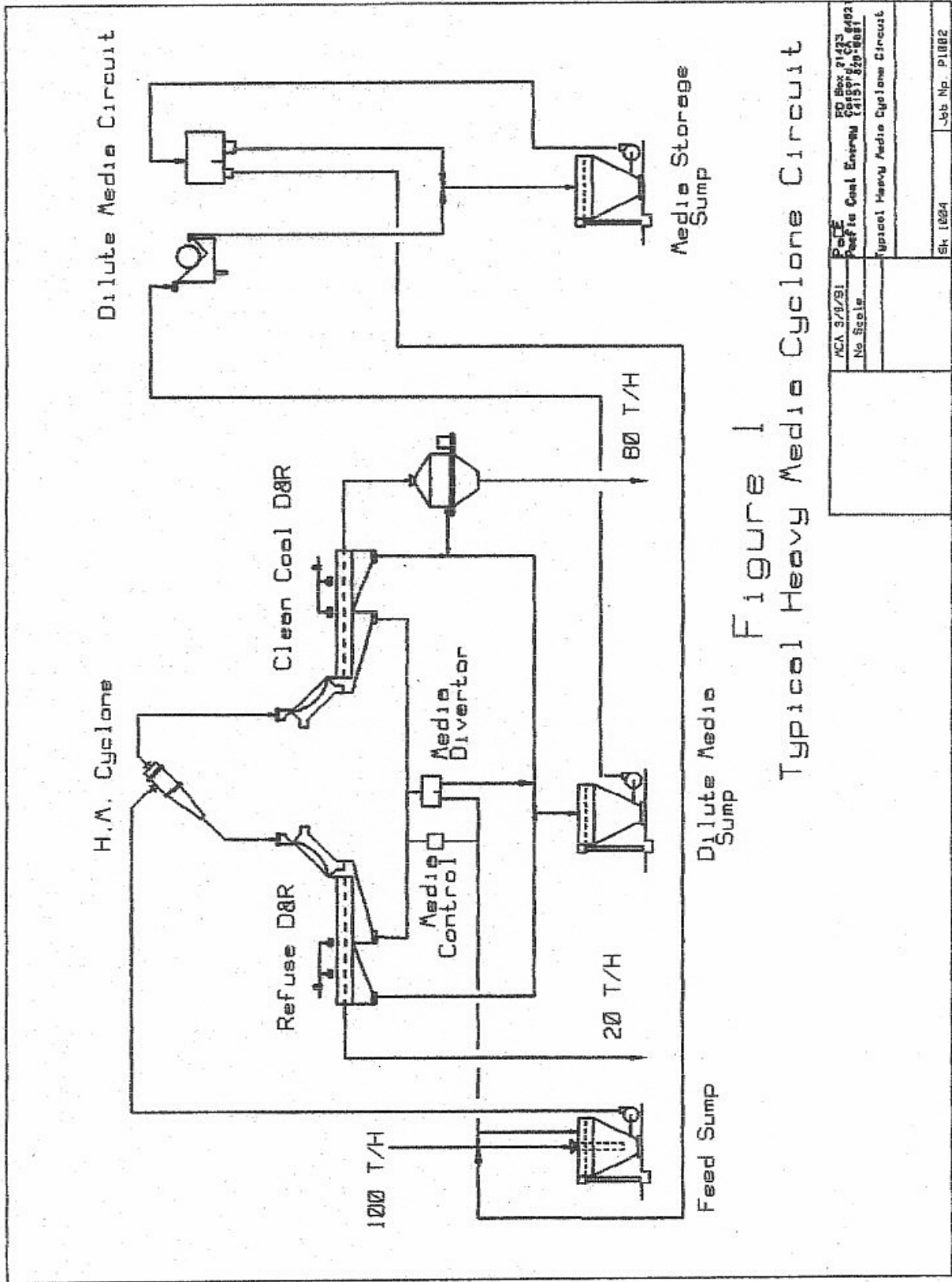


Figure 1
 Typical Heavy Media Cyclone Circuit

ACA 3/8/91	Perce	PO Box 21423
No Scale	Perce Coal Entry	Denver CO 80202
		(303) 825-3081
		Typical Heavy Media Cyclone Circuit
		Sh. 1024
		Abb. No. P1082

**Figure 2 Typical System Response Time
For Set Point Change
of 0.05 S.G. Units**

