AIChE Presentation – Clearwater Florida June 2010

Title: **The Best Data Wins**

Abstract: The production of sulphuric acid is generally a cost centre. The operation has no cash flow and must vie for maintenance resources in a crowded arena of other cost centers arguing strenuously for an equitable share to prevent "imminent failure". Typically acid plants suffer a slow failure process, which permits timely intervention. Anyone can distinguish abject failure of a component and plan its rehabilitation. Within the sulphuric acid plant, it is the tracking of detailed history, non-destructive testing and on-line performance that allows for meaningful prediction and resource allocation. This presentation will highlight some of data collection and collation methods that can be used.

Introduction:

The world is driven by competition for resources. The scarcer the resource, the more hotly contested is that fight.

Sulphuric acid is a world scale commodity but almost none of it is made specifically for that market. The vast majority is produced as a necessary by-product of environmental abatement, as a feed stock for a captive facility or a blend of these two requirements. Basically, the bulk of production is not set by external returns but by environmental legislation and internal consumption.

Sulphuric Acid plants are almost always a cost centre. With the exception of sulphur burning plants, where steam and power can be realized as revenue streams, they generally have no direct profit stream to defray maintenance costs.

Data Base

The fundamentals of an acid plant are that of long term production of a well defined product within the design operating parameters of the plant. Having said this, all acid plants gradually dissolve, wear and age as the time passes. The nature of the beast is a grand collection of compromises and best current engineering judgments making a strongly aggressive acid on a continuous basis.

With the exception of catastrophic failures, truly due to unforeseen forces, most maintenance issue arise over a period of time and can be monitored and planned for corrective action. It is the monitoring and tracking which is the basis for the "Best Data Base Wins".

The cobbling together of the meaningful data and its organization to make a sound case for the winning of resources is fundamental and should be an ongoing goal within the newly commissioned and more dated acid plants.

Electronic Data

The new acid plant is typically blessed with a modern control system. These DCS units permit the tracking and culling of significant data field and comparative trends. Some of this is excellent and expected in the case for resource funding but, it only addresses that which the various and sundry instrumentation units measure and record.

There is no gauge or instrument that will replace the "Shutdown Inspection". The Shutdown is the opportunity to open the doors on the equipment and shown light into their dark recesses. This is the focus of this discussion.

The Shutdown Binder

This is a collection of data that is compiled in advance, during and in summary of the shutdown period. It should be a typical sight in the acid plant engineer's office but appears to be less and less so.

From shutdown to shutdown, they are the holder of the snap shot of the plants status at that time. It is the basis for long term decisions and evidence of trends and needs. What one can expect in such a binder?

Original P&ID'drawings and their updates:

These typically illustrate what are the design points and can be used for noting observations from inspections. They can also be used as a visual aid for scheduled work during the outage. They permit rapid discussion of plans and activities. A simple highlighting of valve positions during a task can be done, discussed and carried to the field on a P&ID. Field notes can also be returned on these drawings.

OEM (Original Equipment Manufacturer) Literature:

This documentation can be invaluable during shutdowns and can quickly supply workers with vital data and procedures for infrequently maintained components or tasks. It can also permit accurate detail notes and highlighted details on copied original OEM drawings or lists.

"As Built" drawings for major vessels

This documentation is a necessary reference for modified or replaced equipment.. It supplies actual dimensions and construction detail in excess of the mechanical specification drawings.

Original Operating Manuals Excerpts

The invaluable data contained in these documents will quickly permit field checks and aid scheduling

Start-up and Shutdown Checklists

Supplied with the original plant construction data, it is still valid or a marvelous basis for the preparation and completion of the turnaround. These check list should typically grow and be modified in time, to reflect the on going changes in the acid plant technology.

NDT (Non-Destructive Test) results and trends

These trends should exist as numerical data on a sketch of the equipment or vessel being measured. Hard copies should be carried to the field by the technician and returned with the recent measurements. The sketch is invaluable in assuring that the measurements are indeed in the same historical site.

Pressure survey

There is typically a trending function available on the newer data recorders which will permit the production of trends for the pressure measurements. These need to end with the highest capacity run rate at the end of the campaign and then have the new values added at the start-up. This will illustrate the effectiveness of the shutdown work and confirm non-retrievable base pressure drop gains. The gradual failure of catalyst beds, tube bundles and packed beds are illustrated by these measurements. When ever possible pressure surveys need to be a fixed design throughput rate or adjusted to that value, before plotting.

Operating Log Book Excerpts and Trends

It is worthwhile to collect the most recent log book entries and trends to have for the binder. This not only for investigation of highlighted issue but, will show the change in the plants operating conditions upon start up. Such items as the drainage rates from various valves, vibration status of pumps or their current draws can be compared to start-up values. This data is excellent to have and include in a turnaround summary report.

Coupon Measurements

Typically there are several sets of coupons used in an acid plant to measure the on going performance of the materials of construction or to evaluate proposed materials of construction. The last physical measurements of these coupons need to be available to compare to and record the new data. It should also be there to confirm that all have been accounted for and measured. There is usually a scant open period for the measurement to be done of some coupons. Do not miss the chance because of insufficient information in ones shutdown binder.

Stick tests, Stack Emission Summary and Trends

The white pine stick test is a quantitative evaluation of the on-line performance of strong acid towers and their demister systems. They need to be taken on a routine basis to a fixed exposure time. The before shutdown and post shutdown sticks are excellent for establishing if a problem exists on line for acid and mist carry over. The post shutdown test will support the success of the turnaround efforts or on going issues. Pressure drop along with a stick test can suggest that candle seal pots were not filled prior to tower closure or gasket re-torquing may have been missed.

Stack emission results are also excellent to include.

Photographs and Thermal Imaging

Despite the non-photogenic nature of an operating acid plant, historical photos are priceless. Such photos as the repairs completed prior to this campaign, typical plant components and interest spots. There are few things a persuasive as a photo journal of the gradual dissolution of a critical plant component. The same is true of before and after repair pictures. Have some of the old shots already present in the binder to spark the need for updates and trend photos. There is nothing as good as a photo and as questionable as memory after a year. Take a note and a shot.

If possible get into the habit of doing an at capacity thermal imaging of the plant components. This can highlight insulation issues, misdistribution of gas or acid and general operating condition changes with age. Long term tracking could give the jump on corrosion or component failure.

Data Sources and Resources

- Maintenance Logs – Non Shutdown
- Vessel and Duct Surveys
- Safety Logs and Walk Throughs
- Product Acid Quality and Trace Element Trends
- Water Treatment Trends

Inspection – Field Equipment

- 25’ (8m) retractable Tape Measure
- 4 Cell or Higher Adjustable Beam Metallic Flashlight

- Non-Metalic Clip Board
- Pocket Notebook
- Disposable Camera – Flash
- Self Seal Baggies
- Small Ruler or Rod With Well Graduated Markings, Scale for photos
- Drawings or reports for mark-up