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Air Pollution Abatement Technology

Catalytic Products
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Preventative Maintenance Solutions for Air Pollution Control Equipment

A Catalytic Products International White Paper

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Table of Contents

| | |
|------------------------|----------|
| Introduction | 3 |
| The Challenge | 4 |
| Background | 5 |
| Moving Forward | 6 |
| A Success Story | 7 |
| Solutions | 9 |

Introduction

Air Pollution Control Equipment maintenance solutions provide lower costs and meet EPA compliance needs

The Challenge

Ensuring control systems operate reliably and economically

Background

Compliance problems and solutions

Moving Forward

Ensuring continuous compliance

A Success Story

How preventive maintenance adds to the bottom line

Solutions

Summarize the benefits of preventive maintenance.

Introduction: Balancing production and operating costs



Manufacturing facilities are constantly under pressure to meet production forecasts at the lowest possible cost. These two goals; production output and cost control, can be difficult to obtain consistently in any manufacturing operation. Additional frustration to meet these goals can be exaggerated in today's lean manufacturing climates that have trimmed budgets and reduced workforce. Further complicating any Plant Manager's responsibilities are EPA compliance requirements and working within the demands of EPA operating permits.

To make life even more difficult, many plant operators have human and material limitations. Human errors include unintended adjustment or plain old lack of understanding that end up shutting down a production operation. Equipment fatigue and failure can leave a device shut-down or operating in unsafe conditions. Timely resolution to any of these problems is very difficult without the proper planning procedures in place.

A control device is any air pollution abatement system such as:

- Catalytic Oxidizer
- Regenerative Thermal Oxidizer
- Thermal Oxidizer
- Concentrator
- Scrubber/Stripper/Condenser

Required as part of an EPA issued Operating Permit

Avoiding equipment shut-down is the primary responsibility for any maintenance department. Once production machinery or the associated control device unexpectedly shuts down, the whole maintenance department moves into scramble mode.

In this white paper, we describe one facility's experience with installing and maintaining a Volatile Organic Compound (VOC) control system. This is a typical example of how a preventive maintenance plan can ensure the control system operates with 100% reliability, how such a plan can be designed so implementation does not interfere with production, and how the low cost of a preventive maintenance plan makes sense for every plant's bottom line.

This paper also examines the challenges and benefits of establishing an appropriately designed preventive maintenance program for the operator's of a VOC abatement device. These systems can include: catalytic, thermal, regenerative oxidizers or concentration devices designed to destroy VOC/HAP emissions and satisfy state or federal clean air act permit requirements. It's the kind of challenge that thousands of Plant Manager's face every day and meeting it means lowest operating costs with highest uptime reliability and assured EPA permit compliance, thus meeting the primary goal of production output at the lowest cost!

The Challenge: Ensuring Control Systems Operate Reliably and Economically



The ideal control system is one the facility operator never has to think about and that uses the least amount of energy possible. If a control device fails, most permits require the plant to shut down operations until the unit can be repaired. A control system failure then leaves the Plant Manager with a difficult choice: Follow the requirements of the permit and shut down, thus losing valuable production time, or ignore the permit and risk paying a big penalty to EPA. Any unplanned shut-down of a control device may be allowed a variance to operate, depending on the permit in place. But to do so requires immediate notice to the appropriate EPA compliance department and an action plan to restore the system to permitted operating status.

Even worse is discovering a control system has not been performing properly. At most, a regulatory agency requires a facility to test for control device efficiency once per year. More commonly, however, control devices are tested once every five years or whenever the process it is responsible for controlling is modified. If a device fails to meet the control requirements listed in a permit, a monetary penalty demand is sure to follow. In calculating the amount of the penalty, EPA assumes the control system has been functioning improperly every day since the date of the last successfully completed stack test. A leaking heat exchanger, faulty valves, inaccurately calibrated thermocouples, and the degradation of catalyst are just some of causes that can result in a control device not meeting permit requirements.

In addition to avoiding penalties, keeping a control device running at optimum conditions is important to the bottom line. A properly tuned system reduces energy costs, both in terms of the amount of electricity used to operate blowers and valves and in terms of natural gas usage. Sometimes optimizing the system is a simple matter of preventive maintenance. Sometimes it's a matter of keeping up with process changes. There is no reason, for example, to use all of the capacity of a blower if changes upstream result in less air to control than the original design required. As is the case with every piece of production equipment, a thoughtful, intelligently designed maintenance plan more than pays for itself.

Finally, most state regulations require facilities with air pollution control systems to have a maintenance program in place and to keep records of their program. The record keeping requirement is often overlooked and can be a way for an EPA inspector to assess a penalty for non-compliance, even if the control system is functioning properly and has in fact been maintained correctly.

EPA Operating Permits routinely place requirements on Facilities to prove the control device is in operation when the production equipment is in operation and place demands to prove proper maintenance has been performed.

Background: Compliance Problems and Solutions

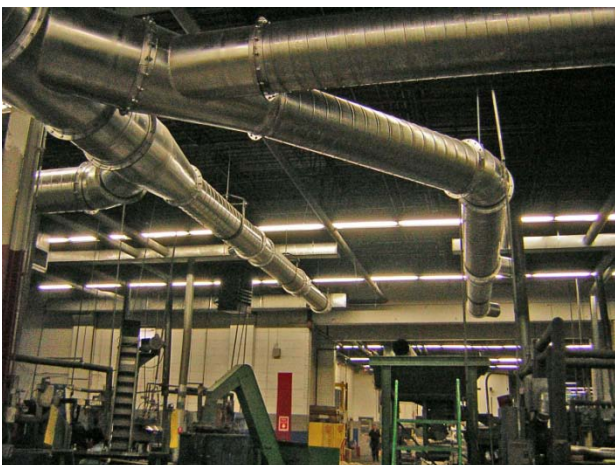


Permanent Total Enclosure or PTE is a method of collecting fugitive emissions from sources that do not have ducted exhaust points. The benefit of using a PTE is realized in many operations because:

- A properly designed PTE will be EPA approved to provide 100% capture.
- Eliminates costly fugitive emissions testing methods
- Simplifies operator access
- Eliminates safety hazards
- Proper design is necessary to meet OSHA exposure limits when solvents are used in the area

The operator of a metal coating facility in the Midwest experienced a period of rapid growth, expanding operations from four lines to 14 in a very short period of time. Management was unaware that the increased VOC emissions associated with the expansion crossed a regulatory emissions threshold that required control. When the state EPA inspected the facility and examined the plant's records, they discovered the oversight and initiated an enforcement action. As part of the plant's settlement with EPA, it had to pay a large monetary penalty and install an oxidizer to control VOC emissions from the 14 coating lines.

Catalytic Products International designed and installed the new air pollution control system. As part of the plan, the coating lines were relocated into a common room which was designed as a Permanent Total Enclosure, or "PTE". EPA regulations give a facility credit for 100% capture of VOC emissions when a PTE that meets the Agency's official engineering criteria is used. A series of close capture hoods were designed to meet OSHA exposure limits and improve the "solvent smell" traditionally found around all the coating machines. VOC emissions were vented into a 15,000 scfm Regenerative Thermal Oxidizer, or "RTO". An RTO is the ideal choice when the concentration of VOCs in an air stream is relatively low because RTOs are extremely efficient. Without an RTO's high thermal efficiency – typically 95 to 98 percent depending on the application – the amount of natural gas needed to control a low VOC air stream would be very high.



The project was completed on time and within budget and the control system successfully passed a stack test, demonstrating that it met all of destruction efficiency requirements contained in the facility's permit and in underlying regulations.

Moving Forward: Ensuring Continuous Compliance



Having run afoul of the EPA once, management wanted to make sure that such a situation could not happen again. They turned to Catalytic Products International for help, to design and implement a maintenance program that would keep the control system running at optimum efficiency. The program put into place includes the following features:

- A list of recommended spare parts to keep at the facility. This store of spare parts ensures that if a critical component in the system is damaged or fails, it can be replaced in a minimum amount of time.
- Implemented a schedule of monthly inspections. These routine inspections take about one hour to complete and are performed during scheduled down time at the plant, and thus do not interfere with productions.
- During all inspections, technicians perform typical preventive maintenance functions, such as lubricating parts, dressing belts, and replacing any worn components that are found. Technicians also tune the system, measuring air flow and adjusting the blower motor if necessary to keep electrical draw to a minimum.
- More detailed and rigorous semi-annual and annual inspections were scheduled. These inspections take longer than the routine monthly inspections (three hours for a semi-annual and a full day for an annual) because technicians delve much more deeply into the inner-workings of the system. Adjustments are made to the combustion system to ensure efficiency.
- Finally, technicians record the results of each inspection and any maintenance actions taken electronically and provide the file to the plant. This serves as the maintenance log that is required under the facility's operating permit.

A Success Story: How Preventive Maintenance Adds to the Bottom Line



Adjusting the combustion system is a more complex adjustment that requires special training. By precisely tuning air and gas ratios, the proper temperature can be maintained with the least amount of natural gas. Additional adjustments can also be made to insure NO_x or CO emissions requirements are being met. This procedure requires sophisticated combustion analyzers and an onsite printed report of the emissions can be included in the PM documentation.

CPI has been maintaining the control system under a series of annual contracts for more than five years at a cost of \$9,500 per year. During that time, technicians have replaced fatigued parts, tuned the system, and ensured that it is always running at optimum efficiency: both in terms of VOC destruction and energy usage; and provide refresher training for the operators and maintenance staff. In a typical monthly visit a technician performs the following actions:

- Inspect bearing for wear and replace and lubricate as needed.
- Tune the RTO's burners to ensure the flame is burning efficiently and gas use is kept to a minimum.
- Look for unusual conditions that could be related to unexpected process changes. At another facility, for example, a build-up of silicone was observed, leading the facility manager to discover a worker had improperly introduced an unauthorized silicone-containing lubricant into the process upstream.
- Check blower motors and tune to the minimum required airflow.
- Check the timing on the valves controlling the system to ensure cycle times are correctly matched to VOC loading.
- Clear sensing lines that when plugged can lead to inaccurate readings and nuisance shut-downs.
- Use a portable VOC analyzer and provide a "quick check" of VOC emissions to insure the system is within recorded values.
- Provide "refresher training" to operating and maintenance personnel to insure their understanding of the system and its effect on the company's operations.

These and similar actions have a noticeable effect on the cost of operating the system. Consider these recorded instances:



The RTO is rated to a maximum of 15,000 scfm. At the time the RTO was validated to meet both capture and control, the unit was recorded to operate at 13,000 scfm. Prior to instituting the service contract, production operators had made several unauthorized damper adjustments. At the first service call the technicians conducted an air volume measurement to insure the exhaust entering the RTO was at least at 13,000 scfm, as this was the permitted total volume necessary to insure the PTE is kept at the proper negative pressure. The technicians actually measured 15,900 scfm of exhaust being drawn into the RTO. After showing this to the environmental manager, it was decided to re-balance the system back to the original permitted operating condition of 13,000 scfm. This resulted in the following operating cost savings:

Reduction of 2,900 scfm of 80 F air entering the RTO will provide natural gas savings and electricity savings:

| | | |
|----------------------|------------------|---------------|
| Natural Gas Savings: | 140,000 BTU/hr = | \$ 7,200/year |
| Electrical Savings: | 15.3 Kwh = | \$ 9,700/year |

TOTAL SAVINGS REALIZED: \$ 16,900

Resulting ROI was immediate

Once the company realized the benefit of a well designed Preventive Maintenance program, the same format was duplicated for all equipment at the plant and a thorough Preventive Maintenance program was instituted.

Several months afterwards the company was involved in an insurance audit where a presentation about the maintenance program was provided to the insurance carrier. The company reports that their insurance premiums were lowered due in part to the Preventive Maintenance Program and its proven ability to add to a safer work place and properly trained employees.

Solutions: Catalytic Products International



Annual catalyst testing is a simple and effective way to provide verification to EPA that the catalytic oxidizer is operating to permit standards. While the testing is not typically a permit requirement or a substitute for EPA approved testing methods, it does provide validation of maintenance and shows the EPA you take compliance seriously.

Catalytic Products International maintenance programs are available to everyone, not just facilities that have installed our products. The experienced technicians have optimized the performance of other VOC abatement systems and relieved in-house maintenance personnel of the burden of keeping their systems running efficiently. With many maintenance staffs stretched to the breaking point as facilities struggle to cut costs, the CPI Technical Service Solutions make more sense than ever.

A properly conducted preventive maintenance service call includes fine tuning of the combustion system. Proper adjustment of gas air ratios result in similar gas savings as noted above. These are critical points as many gas/air control valves rely on mechanical linkages that very easily loosen and get out of adjustment. This is normally the first point of inspection for any service plan and in almost every case, minor adjustments are made that result in some amount of gas savings.

Catalytic oxidizers can benefit from our extensive testing capabilities. We maintain the capability to conduct catalyst activity tests, contaminate identification, surface area evaluation, and precious metal dispersion analysis. This allows us to assist operators of catalytic oxidizers with insuring catalyst activity to meet EPA compliance needs as well as identifying any unknown contaminants before it's too late.

Inspection of critical components of any oxidizer can provide immediate and critical information. Consider that many thermal oxidizers operate above 1,400 F. The materials inside thermal oxidizers generally have a 15-20 year useful life before material embrittlement begins to show. Knowing where to look inside these systems can avoid costly and lengthy downtime by being able to properly plan for repairs in advance and can provide untold savings to any thermal oxidizer operator.

Properly designed and implemented Preventative Maintenance programs are proven to provide these benefits:

- Uptime reliability –
- Increased production throughput
- Lower cost of operations
- Ensure EPA compliance
- Assist with meeting OSHA regulations
- Avoid catastrophic failures
- Increase long term equipment life
- Benefit to insurance audits and premium costs

About Catalytic Products International

Catalytic Products International is a worldwide leader in the design and manufacture of custom air pollution control systems. Other products include: Catalytic Oxidizers, Thermal Oxidizers, (recuperative or regenerative heat recovery) Concentrators, Particulate Control, Energy Conservation Systems, and special services to meet a multitude of needs.

YOUR APPLICATION IS UNIQUE

CATALYTIC PRODUCTS INTERNATIONAL OFFERS THE *RIGHT* ANSWERS

For more information about any of the VOC abatement systems designed and manufactured by Catalytic Products International, please contact us at:

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