The Chromium NESHAP & EPA's Focus on Operation & Maintenance Plans: Avoiding the Hidden Pitfalls

By Susan A. Murphy

Plating shop personnel and environmental staff have been preparing for the Chromium NESHAP since the final rule publication date of January 1995. Much of the focus has been on upgrading and/or adding control equipment by the compliance date of January 25, 1997. Another compliance concern exists, however. A facility's written and performed work practice standards are subject to enforcement and inspection, beginning on the same date. The recording of a scrubber pressure drop, for instance, is no longer strictly a shop concern, because record keeping is enforceable and must be maintained as specified in the regulation. The Operations and Maintenance (O & M) Plan must ensure that equipment or process malfunctions resulting from preventable conditions do not occur. Although required as part of the NESHAP compliance, the Plan is an operations and maintenance manual and is to be utilized as such. Practical suggestions for lessening the paperwork burden and improving the use of the Plan are discussed, and solutions to the environmental compliance vs. operating personnel responsibility issue are presented.

Regulatory Background

Since the 1970s, concern for chromic acid exposure in the workplace has been a consideration during chromium electroplating and anodizing shop design. The Occupational Safety and Health Administration (OSHA) established worker exposure limits, which led to installation of sizable ventilation systems to reduce indoor air concentrations of hexavalent chromium. In some instances, abatement systems, such as scrubbers and composite mesh pad systems for the removal of chromium from the exhaust air were also installed, but often were not mandatory.

Title III of the 1990 Clean Air Act Amendments increased the number and types of businesses regulated. It included a list of Hazardous Air Pollutants (HAPs) which must be regulated under the air toxics program. Title III is structured to regulate HAPs by industry category, thus the listing of chromium electroplating and chromic acid anodizing for their use of the HAP chromium compounds. On January 25, 1995, the Chromium NESHAP was published, with a compliance date of January 25, 1997 (Fig. 1).

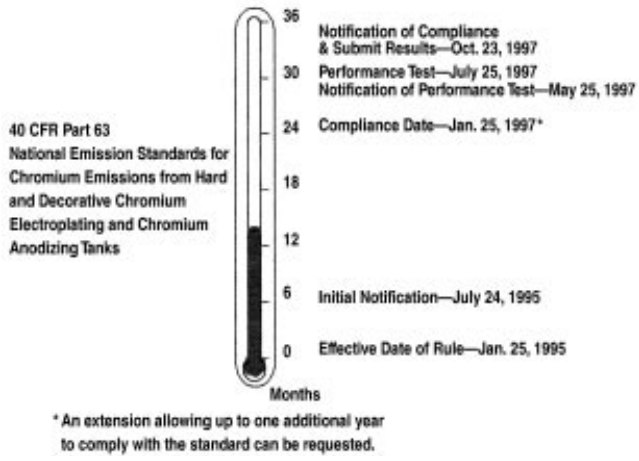

Fig 1—Regulatory timeline.

The final rule applies to hard chromium and decorative chromium electroplating tanks and chromium anodizing tanks. It does not apply to tanks containing chromium solutions in which there is no external current applied, used to deposit chromium compounds. The chromium plating industry is faced with a limitation on chromium emission concentrations (either total chromium or hexavalent chromium) to the atmosphere from each affected tank (Table 1).

The rule does not specify which control system a facility must utilize, nor does it require continuous emission monitoring of each control device stack. Rather, a performance test demonstrating that the operations are in compliance with the applicable limit and work practice standards, such as abatement equipment parametric monitoring, is required.

Parametric monitoring is the monitoring of operational parameters, such as velocity, pressures, differential pressures, or surface tension, depending on the abatement technique utilized by a shop. To ensure that a facility will keep operational equipment in good condition, air abatement equipment and monitoring devices must be inspected and flushed in accordance with manufacturer's specifications. Minimum equipment inspections found in the rule must be performed and documented. Required records must be maintained for a specified number of years.

Preparation of a specific Operations and Maintenance Plan is required; a shop can be deemed in noncompliance if the O&M Plan is not adequate or followed, regardless of whether or not the air emission standard is being met.

Required Elements of the Operation & Maintenance Plan

To prepare an O & M Plan that meets the Chromium NESHAP requirements, three interacting equipment groups must be included:

1. The affected sources (the chromium electroplating and anodizing tanks),
2. The add-on control system, and
3. The monitoring devices used to perform the parametric monitoring, such as pressure gauges and surface tension measurement devices.

A common error is to assume that the rule applies only to the operation and maintenance of the add-on control system and not to the tanks or pressure gauges. All three equipment groups must be in the Plan to demonstrate that all three are well-maintained and operate as required to achieve a low

Table 1—Emission Limitations

Type of Tank or Equipment	Existing, E or New, N	Emission Limitation, mg/dscm
Small* Hard Chromium Electroplating Tanks	E N	0.03 0.015
Large* Hard Chromium Electroplating Tanks	E N	0.015 0.015
Decorative Chromium Plating Tanks (Chromic Acid Bath)	E,N	0.01**
Chromium Anodizing Tanks	E,N	0.01**

* Small is a maximum cumulative shop rectifier capacity less than 60 million amp-hr/yr; all other facilities are large

** Or demonstrate the surface tension is less than 45 dynes/cm using a fume suppressant containing a wetting agent

emission rate to the atmosphere. Each of the requirements discussed in the following paragraphs must be met for all three equipment groups.

Procedures to Ensure that Equipment/Process Malfunctions Resulting from Poor Maintenance or Other Preventable Conditions Do Not Occur

No specifics appear in the rule for the ways a facility can accomplish this. Many facilities already have a preventive maintenance program in place where gauges are calibrated, scrubbers and mesh pads are cleaned, strainers are pulled, fans are balanced, and pump seals are replaced. Some facilities replace control device scrubber water, based on chromium concentration, while others replace the water on certain days, regardless of concentration. These programs can be included in the Plan by photocopying work orders generated, and describing the steps taken to maintain the equipment. Do not forget to include maintenance of the tanks, such as voltmeter calibration, or tank inspection and lining programs.

Of course, monitoring and work practice standard inspections qualify for such procedures as well and should be referenced. Any type of operator observations can also be described, but remember to include only things you are certain happen, and happen consistently.

Work Practice Standards

For facilities using add-on air pollution control equipment to comply with the Chromium NESHAP emission concentrations, the O & M Plan must incorporate the applicable work practice standards, as shown in Table 2.

If a device different from one included in Table 2 is utilized, a facility must have the device and associated proposed work practice standard approved by the regulatory authority. The O & M Plan must be submitted for approval in this case.

Monitoring

Table 2 summarizes the monitoring requirements for the most commonly used control techniques. In the event a facility proposes a different system, then a monitoring scheme must be proposed as well.

Identification of Malfunctions & Implementation of Corrective Actions

The O & M Plan must include a systematic procedure for identifying malfunctions of the three equipment groups and for implementing corrective actions. This is an important component of the Plan because, if a malfunction occurs which was not foreseen when the Plan was written, the Plan must be updated within 45 days of the event. Also, if corrective actions taken were inconsistent with those specified in the Plan, the differing actions must be recorded and reported to the regulatory authority within two working days.

It would be wonderful to be able to identify every specific malfunction that could possibly occur, and to write a specific corrective action for each, but this is not practical by any means. Instead, the following approach is suggested:

1. Involve operating personnel and brainstorm to develop a list of common (and even some unusual) malfunctions that could occur at the tanks, control devices, and monitoring equipment. Examples include tank overflow, voltmeter failure, fan imbalance, magnahelic failure, air line rupture, power failure, etc.
2. Develop a simple list of reactive measures, such as switch scrubbers, call maintenance, flush unit, fill out reports, etc. It may be possible to develop six action plans that will fit most malfunction situations. One of the six can then be matched to different categories of malfunctions.

Record Keeping Associated with the Plan

Although not found in the discussion of O & M Plan requirements in the rule [40 CFR 63.342(f)(3)], most of the record keeping requirements are best kept with the O & M Plan unless other provisions for maintaining a specific record have already been established at a facility. Record keeping requirements are found in 40 CFR 63.346 of the rule, and can be summarized as follows:

- *Inspection Records of Add-on Control Devices and Monitoring Equipment*
  This must include the inspection date, the device inspected, a description of the working condition at the time of inspection, and any actions taken to correct any deficiencies found.

The practical concern with such an inspection is that often operations personnel may find a problem with a scrubber fouling, a spray nozzle not functioning, or a pressure gauge

Table 2—Summary of Work Practice Standards

Control Device	Action	Frequency
CMP	1. Visually inspect device for proper drainage, buildup, chemical attack 2. Visually inspect pad closest to fan 3. Ductwork visual inspection 4. Perform flush of mesh pads	1. Quarterly 2. Quarterly 3. Quarterly 4. Per manufacturer
PBS	1. Same as 1 above 2. Visually inspect back portion of chevron blade 3. Same as 3 above 4. Add fresh water makeup as specified*	1 Quarterly 2. Quarterly 3. Quarterly 4. As Needed
PBS/ CMP	1. Same as 1-4 of the CMP	See CMP
Fiber-Bed Mist Eliminator	1. Same as 1 for all 2. Same as 3 for all 3. Perform element washdown	1. Quarterly 2. Quarterly 3. Per manufacturer
Pitot Tube or Stalagmometer	Specific pitot tube inspection requirements in rule. Stalagmometer inspection follows manufacturer's recommendations.	Quarterly

* CMP - Composite Mesh Pad, PBS - Packed Bed Scrubber

** If more than 50% of scrubber water must be replaced, water can be added to basin rather than the "top" of the packing media.

problem. A maintenance work order will be filled out, however, and the completed maintenance record is kept elsewhere. A facility may decide to reference a separate maintenance record on an inspection form instead of requiring the cause of the problem and corrective action to be described on the form itself. This can create problems later for the environmental compliance person when trying to determine the cause and corrective actions taken to remedy a deficiency—both of which are initially required to be submitted to the regulatory authority semi-annually.

Monitoring

Control Type*	Parameter	Frequency
CMP	Pressure drop	Daily
PBS	Pressure drop & velocity pressure	Daily
PBS/CMP	Same as CMP	Daily
Fiber-bed	Two pressure drop	Daily
Wetting agent	Surface tension	4 hrs (initially)
Foam blanket	Foam thickness	Hourly

* CMP—Composite Mesh Pad
PBS—Packed Bed Scrubber

- *Records of All Maintenance Performed on the Tanks, the Add-On Control Equipment and the Monitoring Equipment*

  A facility must be sure that there is a formal procedure for this record. The environmental manager may want to review the maintenance print-out of the preventive maintenance schedule for each of the three equipment groups, if it is available. While it may be impractical to keep all maintenance records with the Plan, it may be possible to route the preventive maintenance reports to environmental compliance. Sometimes the name of individuals requiring a certain report can be specified in a computerized maintenance program, and a copy of all maintenance performed on certain items can be automatically printed, then routed to the environmental person. It always helps to have such records readily available in the event of a regulatory inspection.

- *Records of the Occurrence, Duration, and Cause of Each Malfunction of Process, Add-on Control Equipment, and Monitoring Equipment; and The Date, Starting and Ending Times of Each Period of Excess Emissions, Both for Excess Emissions Caused by Malfunctions, and Those Caused by Reasons Other than Malfunctions of Process, Add-on Control Equipment and Monitoring Equipment*

  In other words, if a tank overflows into the ductwork leading to a mesh pad control device, and the control device differential pressure is then outside of the acceptable operating range as a result of pluggage, the duration of the malfunction (unacceptable pressure differential) would have to be recorded.

  What about malfunctions that do not cause a violation of the air emission standard? Do these specific records need to be kept for minor maintenance items? During the control system performance test, the operating range of a parameter such as pressure drop across the mesh pads is established. Operation within that range constitutes compliance with the air emission standard. What if a fan motor kicks out temporarily? The rule does not include the definition of a malfunction, but it seems the most *practical* definition is *an equipment failure or problem that causes a violation of the air emission standard.* Rules, unfortunately, do not

Monitoring Data For the Year of: _____

Allowable Pressure Drops:
Scrubber X ___ - ___ inches water
Scrubber Y ___ - ___ inches water

Pressure Drop Across System
(**To Be Recorded Daily**)

Month: _____		Inches of H_2O		Initials of Inspector
Day	Time	Scrubber X	Scrubber Y	
1				
2				
3				
□				
31				

Fig. 2—Sample monitoring form.

always take on a practical flavor, so it is suggested that this approach be presented in writing to the regulatory authority if a facility decides to report only malfunctions related to an excessive emission.

The Chromium NESHAP also requires that the dates and times (commencement and completion times) be recorded, probably to determine whether the facility has had multiple common malfunctions that could have been avoided. How is this data record best generated? It seems simple to keep the data on an excess emissions form, but maintenance and operations personnel must work together to provide the required documentation. Facilities with more than one control device may have the luxury of shutting one down indefinitely until the problem has been fixed. It is important to inform the regulatory agency that another control device was operating during this period (no violation of air standards).

- *Records of Actions Taken During Periods of Malfunction When Such Actions are Inconsistent With the O & M Plan*
  It should be noted that for a given type of malfunction, a certain set of steps will be performed, and as long as those steps are included in the O & M Plan, the actions taken do not have to be recorded. A well-written O & M Plan can make this record keeping requirement obsolete.

- *Test Reports from Control Equipment Performance Tests*
  This is one of the records a facility may not want to keep with the O & M Plan on the shop floor. It is suggested that these documents be kept in an appendix of the Plan in the environmental office. The shop copy can include an appendix fly sheet referencing the location of the original, in the event a regulatory inspector visits the facility in the absence of the environmental officer.

- *Records of Monitoring Data, Including the Date and Time of Each Entry*
  Monitoring data includes those items shown in Table 2. In the case of the shop where computer terminals are not accessible, or electronic equipment readings cannot be fed directly into a personal computer, it is suggested that a form be kept in the O & M Plan for use by shop personnel. The completed original forms should be forwarded to environmental compliance, and a copy be kept in the shop's copy of the Plan.

- *The Total Process Operating Time of the Affected Source During the Reporting Period*
  This requires the recording of the total operating time of each tank. Because this result is required to be reported initially on a semiannual basis, a facility must develop a way to keep this record. Most shops have a card system fastened, in some fashion, to each meter while a part is in a specific cell of the tank. This card is used to record the amperage setting and the start and end times of the plating process for that part (tank cell operating time). Other than electronically recording this information directly from the rectifier, no practical way of recording this information exists in a shop with multiple tanks (and multiple cells per tank). The only apparent use of such data is to enable enforcement agency calculation of fines for excessive violations of the air standard. It is suggested that approximate information be recorded on a monthly basis for each tank and the regional Environmental Protection Agency office be contacted for concurrence.

- *Records of Actual Monthly Cumulative Rectifier Capacity of Hard Chromium Electroplating Tanks (A Total) and the Total Capacity Expended to Date*
  This record is required only for those facilities using the actual cumulative rectifier capacity to obtain the classification of a small plating shop. It is assumed that this record is available if required. This record is also part of the semiannual report to be submitted to the regulatory authority.

- *Records of the Date and Time Fume Suppressants are Added to the Electroplating or Anodizing Bath*
  This record is easily kept by the shop personnel.

- *Records of the Bath Components Containing Wetting Agents, for Decorative Chromium Electroplating Tanks Using a Trivalent Chromium Bath*
  The wetting agent must be identified, and records of purchases must be kept.

- *Any Other Demonstration of Agreements Reached with the Regulatory Authority That are Conditions of a Granted Waiver*
  In the event the facility has met the conditions for receiving a waiver of a specific requirement of the rule, records that were agreed upon should be kept.

How to Facilitate the Multiple Reporting Requirements of the Rule

Many reports are now required to be submitted to the regulatory authority about chromium operations. Reports associated with notifications and submittal of performance test results are most easily completed by the environmental

Quarterly Operation and Maintenance Checklist for Scrubbers

Date of Inspection: _____

Tanks Ducted to Control Devices:

Tank ID	Type of Tank	Scrubber ID

Inspection/Maintenance Checklist (insert inspector's initials in boxes):

Control Devices:	Scrubber X	Scrubber Y
Visually inspect device to ensure there is proper drainage, no chromic acid buildup on the pads and no evidence of chemical attack on the structural integrity of the composite mesh pad scrubber.		
Visually inspect the back portion of the mesh pad closest to the fan for evidence of breakthrough of chromic acid mist.		
Visually inspect ductwork from the tank to the control device for evidence of leakage.		
Record General Operating Condition (Good/Poor)		
Other (Specify; such as replaced nozzles, adjusted fan motor, replaced recirculation pump, etc.):		
Monitoring Equipment: Remove pitot tubes from the duct and rinse with fresh water.		
Check pitot tube ends for damage. Replace pitot tube if cracked or evidence of fatigue is visible.		
Replace pitot tubes in the duct and rotate 180 degrees, checking to verify that a zero reading is obtained.		

Corrective Actions:

Describe actions taken and maintenance performed, including dates, to correct deficiencies.

_____

_____

_____

_____

Fig. 3—Sample quarterly checklist.

person most familiar with the air permitting agency. These include the initial notification report, performance test reports, and notifications of compliance status.

All other reports that must be submitted rely very heavily on the records kept by shop and maintenance personnel. If the appropriate records are not kept on a real-time basis, the burden on all involved can be extreme and the resulting data will be weak at best.

As previously discussed, when a computer terminal is not accessible in the shop, or electronic equipment readings cannot be fed directly into a personal computer, it is suggested that forms be kept in the O & M Plan for use by shop personnel. The completed original forms should be forwarded to environmental compliance, and a copy kept in the shop. If adequately prepared and completed, the forms provide almost all of the information necessary to fulfill reporting requirements. Figures 2 and 3 are examples of forms that may be used to keep the required records.

The environmental officer can maintain and use the computer versions of all forms and use these files to perform required calculations, such as duration of equipment failures, operating hours, etc.

Writing an O & M Plan That Works

Here is a summary of suggested items to include in the Operations and Maintenance Plan:

1. The O & M Plan can be utilized to store blank forms and to store completed forms for further use.
2. A facility should consider incorporating specific air permit requirements of the state and internal company record keeping requirements when putting together the Plan format. It might be best to keep all requirements in the O & M Plan to avoid duplicating or accidentally omitting a requirement.
3. Standard Operating Procedures for the affected tanks, control devices, and measurement devices.
4. Equipment Maintenance descriptions and preventive maintenance requirements for each of the three equipment groups.
5. A copy of the Work Practice Standards taken directly from the Chromium NESHAP.
6. Equipment Failure Action Plans that are not too restrictive or specific.
7. Agency Notification Records, and copies of Performance Tests and Performance Test Reports. A facility may elect to keep these documents in a separate copy of the Plan in the environmental department, and to insert an appendix fly sheet in the shop copy of the Plan, stating where the documents are kept for inspection purposes.
8. A copy of the state or local air operating permit, or portions of the permit that apply to the shop. The facility may want to keep this copy in the environmental department, similar to Item 7. The permit conditions could be summarized in an appendix in the shop copy of the Plan if desired.
9. It is not recommended that a facility rely too heavily on other external documents to meet the O & M Plan requirements of the rule unless those documents are part of the same review process as the O & M Plan. This includes separate Standard Operating Procedure manuals, or other action plans. Even manufacturer's recommended practices found in maintenance manuals are often brief (or nonexistent, in some cases) and it is far

easier to photocopy a few pages and keep them in the Plan appendices than to search for this information during an inspection. Even a telephone memo with the manufacturer's recommended cleaning instructions can be easily inserted in an appendix.

10. Be certain to involve all personnel—environmental, maintenance, and shop operations—in the writing and editing of the Plan.

Plan Revisions Requirements

The O & M Plan must be made available for inspection upon request of any agency representative. Whenever the Plan is amended, all superseded versions of the Plan must be made available for inspection for a period of five years after each revision. This requirement is best met by keeping the Plan on computer. Only the pages that have been replaced or omitted need to be kept, and a "Date of Last Update" blank can be kept in the top or bottom corner of every page in the Plan. A complete set of completed forms and reports can be retained in the environmental department files, and an annual purge can be made of the shop's version of the Plan.

Other, more immediate, revisions to the Plan, including providing a written report of the revision, are required if the O & M Plan is discovered to be inadequate to respond to a malfunction. This situation was discussed in a previous section.

It is likely that the facility has a different record retention policy. If it is more than five years, a facility may elect to keep records from the excess years in a separate file away from the environmental compliance records accessible during environmental inspections.

A Word About Your State Permit
Title V Operating Permits

While most states and local agencies will not require the O & M Plan to be sent in for review as a condition of receiving an air operating permit, the Plan is to be incorporated by reference into a facility's Title V permit, if applicable. In some instances, Title V permit applications have already been submitted without reference to the O & M Plan. A facility should take the additional steps to be certain the permitting authority includes a reference to the Plan in the issued operating permit.

Reducing the Burden of Obsolete State or Local Recordkeeping Requirements

With the publication of the Chromium NESHAP and the compliance date of January 25, 1997, many state and local agencies may consider dropping the current set of air regulations pertaining to chromium electroplating and anodizing. In San Francisco, CA, for instance, shops are required to keep monthly reports of actual amp-hrs per tank to demonstrate compliance with "Regulation 11." This regulation established a limit to the amount of hexavalent chromium allowed per amp-hr of electrical current applied to the tank(s). If the Bay Area Air Quality Management District decides to replace Regulation 11 with the NESHAP requirements, this record keeping burden may be made obsolete. As with anything that is not "broken," the rule won't be "fixed" without the regulated community's expression of concern and interest. The best way to facilitate change is to get involved, either individually or through a trade organization, such as an AESF local Branch.

Summary

Compliance with the Chromium NESHAP extends beyond the normal assignment of completing annual reports for regulatory agencies. It is easy to assume that the regulation is an environmental compliance concern; however, the O & M Plan, the cookbook to compliance, must describe how a facility is maintaining, inspecting and operating chromium electroplating and anodizing emission control systems. The Plan should become the data source for preparing environmental reports, but should not be prepared to "rent shelf space."

Compliance with the O & M Plan requirement of the Chromium NESHAP takes some coordination between environmental compliance, maintenance and shop personnel. The O & M Plan, when prepared by all three groups, can be a workable document for maintaining and recording invaluable information about chromium operations and pollution abatement equipment. It is recommended that the Plan be reviewed at least annually, and the data gathered be used to develop and/or adjust a preventive maintenance schedule. Timely data collection assistance provided by shop operations can greatly reduce the burden placed on environmental compliance personnel.

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Reference

National Emission Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks, Federal Register, Vol. 60, No. 16, January 25, 1995; p. 4948. For further information, contact Mr. Lalit Banker, U.S. Environmental Protection Agency, 919/541-5420.

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