



ENVIRONMENTAL SERVICES DEPARTMENT

AIR QUALITY DIVISION

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OPTIONAL COMPLIANCE DEMONSTRATIONS PROCEDURE

A GUIDELINE

FOR

SEMICONDUCTOR INDUSTRY

Part I, Acid/Base Emissions & Wet Scrubber Performance Test

May 4, 2001

GENERAL

The purpose of this "Optional Compliance Demonstrations Program" is to illustrate a standard permit condition format for performance tests, and further to present different options as needed for a semiconductor source to demonstrate compliance. This Guideline is established to recognize concerns that were typically experienced by the semiconductor industry to meet the performance test requirement imposed by Maricopa County Environmental Services Department (MCESD).

Semiconductor fabrication facilities commonly produce very dilute emission streams, which are typically a result from the high ventilation airflow used in a clean room environment. Because of the very dilute pollutant concentrations, the source often finds it is difficult, sometimes even impractical, to demonstrate compliance by conducting a traditional performance test.

Since late 1999, a study team was formed and representatives from semiconductor industries have initiated a series of meetings with MCESD to address the above concerns and the subsequent compliance issues. Many options were proposed and evaluated by the team members. This Guideline summarizes the findings and presents what the semiconductor industry and MCESD believe is a viable alternative to demonstrate compliance.

The first step, as accomplished in the Guideline, Part 1, is to address "Acid/Base Emissions and the Wet Scrubber Performance Test". MCESD plans to extend these efforts to other areas such as performance tests on other types of air pollution abatement equipment, control devices, point of use control devices, exhaust conditioners and Operations and Maintenance Plan (O & M Plan) related issues.

As stressed in the following sections, participation in this program is strictly voluntary for the semiconductor source. MCESD as usual is seeking ways to communicate with industries to improve and update our regulatory and enforcement policies. Therefore, feedback and comments for MCESD's review are always welcomed.

NOTES

US EPA makes a distinction between Exhaust Conditioners and Point of Use Control Devices

Definition: Exhaust Conditioner (EC)

In semiconductor manufacturing, a number of different process tools are used to perform the various operations needed to make the final product. Some of these tools contain devices inherent to the equipment which treat or condition, the exhaust gases as they leave the process chamber. There are a variety of such exhaust conditions used, but the primary intents are the same in all cases:

- The exhaust conditioners remove solids from the exhaust stream, which prevents them from deposition later in the exhaust duct. Since downstream exhaust problems can actually impact the manufacturing process, these devices improve process quality and reliability.
- Use of these conditioners improves equipment uptime. Without the exhaust conditioner, process exhaust pumps will eventually fail.
- Removal of the solids reduces the amount of system maintenance needed and avoids safety hazards related to blocked exhaust ducts.
- Exhaust Conditioners (EC) are used for safety and/or industrial hygiene purposes, and are always interlocked to the process equipment and/or feed materials.

Definition: Point of Use (POU) Control Device

- A Point of Use (POU) Control Device is installed in close proximity to the process equipment and is installed for the purpose of abating regulated pollutants.
- Normally, a POU is not interlocked with the associated process equipment.

INTRODUCTION

This program is intended to be a voluntary program.

The pilot program applies only to a source that meets all of the following criteria:

- Semiconductor Industry
- Non-title V Operations
- Acid/Base Emissions
- Performance Test in conformance with EPA Test Methods(40 CFR 60, Appendix A)

STANDARD PERMIT CONDITION FOR PERFORMANCE TEST

To be consistent to all applicable sources on emissions testing requirement, the following standard permit condition is developed and will be used in future permits.

STANDARD PERMIT CONDITION

The Permittee shall conduct a test for the constituent emissions within 60 days after the equipment has achieved the capacity to operate at its maximum production rate on a sustained basis. The tests shall demonstrate a minimum removal efficiency of 90% by weight of the appropriate constituent.

The time frame may be extended by the Control Officer for good cause, but in no case shall the testing period extend for more than 180 days after the initial startup of the equipment. The testing shall be conducted in accordance with USEPA approved test procedures.

The Permittee shall submit a test protocol to the Department for review and approval at least 30 days prior to the emissions test. A fee for each stack to be tested, as required by Rule 280, shall be submitted with the test protocol.

The Permittee shall notify the Department in writing at least two weeks in advance of the actual time and date of the emissions test so that the Department may have a representative attend.

The Permittee shall complete and submit a report to the Department within 30 days after completion of the emissions test. The report shall summarize the results of the testing in sufficient detail to allow a compliance determination to be made.

AFTER THE COMPLETION OF THE PERFORMANCE TEST, SHOULD THE SOURCE FIND THE REQUIRED PERFORMANCE TEST INADEQUATE TO DEMONSTRATE COMPLIANCE, THE FOLLOWING "OPTIONAL COMPLIANCE DEMONSTRATIONS" ARE AVAILABLE TO THE SOURCE AS A SUPPLEMENT TO THE EXISTING PERMIT CONDITIONS.

The following Optional Compliance Demonstrations section will be available to the source as an alternative to the above standard permit condition. It is on an "upon request" basis and a written request must be submitted from the source. Once requested, these alternate conditions will be used by the MCESD Compliance Section as a Guidance to review the subsequent submittals and to make a determination of the source compliance status.

OPTIONAL COMPLIANCE DEMONSTRATIONS

Option A: Install new or like-kind house abatement equipment. After the above performance test is completed, if necessary the source may choose from the following options to perform a demonstration as described below:

A-1 VENDOR PERFORMANCE CURVE (VPC)

- Conduct a standard performance test as specified above.
- If necessary, compare results to the Vendor's Performance Curve. (To be acceptable by MCESD, the VPC shall at a minimum demonstrate a 90% removal based on an inlet concentration of 10 ppmv or more of HCl emission, for example).
- If the corresponding test result is on or above any part of the curve for a measured inlet concentration, then submit all supporting data and the latest, revised O&M Plan to MCESD.

- If necessary, permit conditions will be revised upon source's request per Rule 220, Section 400 to reflect the option demonstrating compliance.
- O&M Plan parameters can be revised in two phases: Initial (before the test) and sustaining (after the test).

OR

A-2 MASS EMISSIONS

- Conduct a standard performance test as specified above.
- Calculate mass emissions using data (outlet concentration) from the above performance test.
- Use this data to conduct a Modeling/Risk Assessment Study based on models negotiated with MCESD.
- As an interim measure, MCESD will accept a Modeling/Risk Assessment Study based on the Screen air dispersion model (latest version) or other case by case MCESD acceptable air dispersion model and the Arizona Ambient Air Quality Guidelines (AAAQG, May 11, 1999 version) or other case by case MCESD acceptable health based guidelines until further notice.
- If modeled concentrations are less than AAAQG at property line, submit all supporting data.
- If necessary, permit conditions will be revised upon source's request per Rule 220, Section 400 to reflect the option demonstrating compliance.
- O&M Plan parameters can be revised in two phases: Initial (before the test) and sustaining (after the test).

OR

A-3 NON-DETECT

- Conduct a standard performance test as specified above.
- If the test results show that the constituent is not detected in the stack at the test method detection limit, submit all supporting data.
- As an interim measure, MCESD will accept an outlet concentration of 1 ppmv or less as "Non-Detect" for a single constituent from one stack. For multiple stacks, a "Non-Detect" may be determined as an averaged concentration for the same constituent from all stacks tested.
- If necessary, permit conditions will be revised upon source's request per Rule 220, Section 400 to reflect the implementation of the option demonstrating compliance.
- O&M Plan parameters can be revised in two phases: Initial (before the test) and sustaining (after the test).

IF THE SOURCE MEETS ANY ONE OF THE FOLLOWING OPTIONS, THE SOURCE IS ELIGIBLE TO REQUEST AN EXEMPTION TO THE PERFORMANCE TESTING REQUIREMENT.

Option B: The source may not be required to conduct a performance test if the following situations apply:

B-1 LIKE-KIND ABATEMENT EQUIPMENT: If installing Like-Kind Abatement equipment, and a performance test has been completed and accepted in accordance with Option A for the initial abatement equipment, then calculate emissions using MCESD approved emission estimating techniques (EETs) and/or with material balance. Submit all supporting data and an O&M plan to MCESD. If necessary, permit conditions/equipment list will be revised per Rule 220, Section 400 and reissued. This option can be used for either installing an additional scrubber or a scrubber as a stand-by unit.

OR

B-2 ABATEMENT EQUIPMENT INSTALLED FOR:

- Non-production emission sources, or
- Emergency release system, as defined in Section 112(r), or
- Emission sources for which emission reductions are not claimed and whose inlet concentration does not exceed 1 ppmv for a single constituent prior to abatement equipment.

The source shall calculate emissions before control using MCESD approved EETs and/or with material balance. The source must perform a pre-approved Modeling/Risk Assessment Study. If modeled concentrations are less than the AAAQG or other MCESD case by case acceptable health based guidelines at the property line, submit all supporting data.

As discussed above, MCESD will accept a Modeling/Risk Assessment study based on the Screen air dispersion model (latest version) or other case by case MCESD acceptable air dispersion model and the Arizona Ambient Air Quality Guidelines (AAAQG, May 11, 1999 version) or other case by case MCESD acceptable health based guidelines.

OR

B-3 CONTINUOUS EMISSIONS MONITORING: If the source proposes to install and operate Continuous Emissions Monitoring Equipment on the exhaust of the scrubber to measure HCl or HF emissions or other MCESD approved constituent, a requirement for a performance test could be exempted. However, the source must perform a pre-approved Modeling/Risk Assessment study. If results are that modeled emissions are less than the AAAQG or other MCESD case by case acceptable health based guidelines at property line, submit all supporting data.

OR

B-4 UNREGULATED AIR POLLUTANTS: If the source installs abatement equipment for unregulated air pollutants, MCESD will not require a performance test.

OR

B-5 POINT OF USE (POU) UNIT and/or EXHAUST CONDITIONER: Normally a POU unit or an exhaust conditioner would not be required to conduct a performance test. This is due to the size and configuration of relatively small piping to the unit. EPA test methods are neither feasible nor applicable to these types of devices due to the piping size constraint.

However, the source may submit manufacturer test data or other documents for MCESD's review to support the claim of emission reduction.

NOTES FROM MCESD

1. **Vendor's Performance Curve (VPC)** may be based on any MCESD approved constituent. To be acceptable by MCESD, the VPC shall demonstrate at a minimum of 90% by weight removal efficiency at an inlet concentration of 10 ppmv or more of HCl emission, for example.
2. **Modeling** must show no exceedence of any parameter (concentration) for any regulated air pollutant at the property line.
3. **Initial startup** should be determined as the earliest occurrence of one of the following dates:
 - The date that maximum (or permitted) production capacity occurs; or
 - The date that a marketable product has been produced; or
 - The date that sustained product manufacturing occurs; or
 - The date that the production line(s) or production processes, exhausted to the air pollution abatement equipment that require the test, have been qualified to produce product that meets customer requirements.
4. **Like Kind Abatement Equipment:** Upon request, pollution Abatement Equipment that meets the following criteria usually will not be required to conduct performance testing for the purpose of demonstrating compliance with permit conditions.

Applicability:

- Installed to replace existing equipment, or
- Installed as a standby unit to make existing equipment redundant, or to be used as additional equipment, or
- Installed to treat permitted emissions described in the original equipment's vendor performance curve or source test protocol, or
- Modified only by changing the packing as long as the packing meets the criteria of the Vendor's Performance Curve.

5. Definition of Like Kind Equipment:

- The abatement equipment is "Functionally Similar" (i.e., packed column counter-current, or packed column co-current, or packed column counter-flow, or plate column scrubbers) unless changes in technology are pre-approved by the MCESD, and
- The abatement equipment is monitored by at least the same parameters as were approved for the original abatement equipment. Additional parameters may be required to "monitor" to support the key operational parameters, and
- The abatement equipment has the same or better water dispersion (e.g. more nozzles or more efficient packing material): has equivalent or greater removal efficiency for a known approved constituent as demonstrated by the Vendor's Performance Curve or previous performance test, and
- The airflow of the abatement equipment is within 50% of the original AFCM and the water flow is within 10% of the manufacturer's recommended flow.

Deliverables

- Like kind equipment replacement or installation notification in writing to the County.
- Latest, revised O&M Plan, and

- Vendor's Performance Curve, or
- County approved Performance test data for equipment it is replacing or duplicating.

6. Functionally Similar

"Functionally Similar" means that there is no increase in emissions that is more than 10% of the appropriate major source threshold and there is no new regulated air pollutant to be treated or controlled per each control device other than those previously permitted or

Abatement equipment that is functionally similar to abatement equipment already compliance tested on similar processes usually will not require compliance testing.

7. Regulated Air Pollutants (RAP)

RAP is any compound as defined in MCESD Rule 100, Section 200.90.