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Best Available Control Technology (BACT) Guidance

Air Pollution Control Requirements for Construction, Substantial Reconstruction or Alteration of Facilities that Emit Air Contaminants

June 2011

This guidance document is intended for general reference only and does not represent a full and complete statement of the technical or legal requirements associated with applicable regulations.

Introduction

This document includes:

- Background on the definition and regulatory context of best available (air pollution) control technology (BACT).
- An overview of the process for determining BACT and information to aid you in complying with it.
- Descriptions of and links to a compilation of Top-Case BACT Guidelines that you may propose in lieu of performing a Top-Down BACT analysis.
- Information on how you may be able to cap volatile organic compounds (VOC) or hazardous air pollutants (HAP) emissions from the facility and avoid having to evaluate add-on air pollution control equipment. Note: You will still need to employ pollution prevention, best management practices or other methods to minimize emissions such as low-VOC coatings and cleanup solutions, or high transfer efficiency coating techniques.

Background

As a condition of issuing a written Plan Approval to you for your Non-Major or Major Comprehensive Plan Application (CPA) under 310 CMR 7.02(5) or Limited Plan Application (LPA) under 310 CMR 7.02(4), the Department of Environmental Protection (MassDEP) must determine BACT for your proposal[1]. To achieve this, your plan application must include:

- Top-Down or case-by-case analysis of BACT; or
- Top-Case BACT (BACT as defined by MassDEP in previous relevant decisions or guidelines); or
- A proposed cap on emissions – less than 18 tons Volatile Organic Compounds (VOC)/ Halogenated Organic Compounds (HOC) and total Hazardous Air Pollutants (HAPs) and 10 tons of a single HAP – with the use of pollution prevention, best management practices and/or a limit on hours of operation or raw material use.

For equipment/operations that are eligible to comply with performance standards as an alternative to Plan Approval (310 CMR 7.03 or 310 CMR 7.26), MassDEP has already made BACT determinations and adopted them as performance standards.

BACT Definition & Regulatory Context

The Massachusetts Air Pollution Control Regulations (310 CMR 7.00 et seq.) define BACT as:

> *An emission limitation based on the maximum degree of reduction of any regulated air contaminant[2] emitted from or which results from any regulated facility which the Department (MassDEP), on a case-by-case basis taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques for control of each such contaminant. The best available control technology determination shall not allow emissions in excess of any emissions standard established under the New Source Performance Standards, National Emissions Standards for Hazardous Air Pollutants or under any other applicable section of 310 CMR 7.00, and may include a design feature, equipment specification, work practice, operating standard or combination thereof.*

[1] See the MassDEP Plan Approval Overview & Applicability Tables document for a description of how BACT fits into the plan approval process.

[2] The term air contaminant and pollutant are used throughout this document. Air contaminant is the term used in MassDEP regulations and is more inclusive than the term "pollutant" which is used by EPA in its regulations. Noise and other air contaminants that may result in a condition of air pollution (e.g. nuisance) are not regulated under the federal Clean Air Act, but are included in the Massachusetts NSR Program.

BACT was first incorporated into the Massachusetts regulations in 1982. As specified in the definition, it is determined on a case-by-case basis and must be at least as stringent as any applicable emission limitation contained in either MassDEP Air Pollution Control Regulations (310 CMR 7.00) or U.S. Environmental Protection Agency (EPA) New Source Performance Standards (40 CFR 60) or National Emissions Standards for Hazardous Air Pollutants (40 CFR 61 or 63).

In 1984, EPA approved the Massachusetts State Implementation Plan (SIP) to include BACT as a key component of the state's Minor New Source Review (NSR) Program.[3] As EPA explains:

> *Minor NSR is for pollutants from stationary sources that do not require Prevention of Significant Deterioration (PSD) or nonattainment NSR permits. The purpose of minor NSR permits is to prevent the construction of sources that would interfere with attainment or maintenance of a National Ambient Air Quality Standard (NAAQS) or violate the control strategy [to restore or make "reasonable further progress" towards attainment] in nonattainment areas. Also, minor NSR permits often contain permit conditions to limit the sources emissions to avoid PSD or nonattainment NSR.*
>
> *States are able to customize the requirements of the minor NSR program as long as their program meets minimum requirements. The permit agency's minor NSR program is part of the State Implementation Plan (SIP).*

In reviewing and approving a plan application, MassDEP needs to ensure that your facility and its air contaminant emissions will not cause violation(s) of National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM10), fine particles (PM2.5) or sulfur dioxide (SO_2) , or hinder the state's progress in attaining the NAAQS for ozone.

Presumptive BACT by Regulation

For some categories of commonly installed equipment, MassDEP has established performance standards at 310 CMR 7.03 (Permits-by-Rule) and 310 CMR 7.26 (Environmental Results Program or ERP) that a facility may comply with in lieu of obtaining a 310 CMR 7.02 Plan Approval. These performance standards provide a presumptive determination of BACT and MassDEP may revise them from time to time by amending its regulations.

Regardless of these alternative pathways to compliance, you are required to apply for a Plan Approval if your facility's emissions would make it subject to PSD or NA NSR, your facility holds or requires an Air Quality Operating Permit, or it falls within a category for which no exemption is available.

As discussed in more detail below under Top-Case BACT, MassDEP has compiled emission limits that you may propose in lieu of performing a Top-Down analysis. In general, these are limits that we have approved previously and represent BACT.

Note: You should contact the appropriate MassDEP Regional Office early in the process of preparing a plan application. A pre-application conference can save you time, spare you frustration, and often result in faster processing of your application by the agency. If you submit your application without scheduling such a meeting, MassDEP may require one, anyway, before it can determine whether your application is administratively complete.

[3] In addition to the Massachusetts Minor NSR program, EPA has NSR regulations for larger sources. These regulations are divided into two programs: (1) Prevention of Significant Deterioration (PSD) for criteria pollutants (pollutants or their precursors for which EPA has adopted National Ambient Air Quality Standards (NAAQS) for an area classified as attainment or unclassified and other pollutants regulated under the federal Clean Air Act. MassDEP implements the federal PSD program under 40 CFR Part 52, Section 52.21, pursuant to a delegation agreement with EPA. (2) Nonattainment NSR (NA NSR) for criteria pollutants and their precursors for an area that is nonattainment. MassDEP adopted its own regulations to implement the NA NSR program (see 310 CMR 7.00 Appendix A).

Top-Down BACT

MassDEP needs to balance the many impacts of a project while reviewing its proposed emission limits. You must use a top-down procedure to determine BACT. This requires you to identify the best methodology, technique, technology or other means for delivering the cleanest air quality outcome for one or more specific contaminants, while factoring environmental, energy and economic considerations into the analysis.

In brief, the Top-Down process is a ranking of all available control technologies in descending order of control effectiveness. You must first examine the most stringent ("Top-Case") alternative. MassDEP will presume this represents BACT unless you can demonstrate – and we agree – that it is not feasible for technical, energy, environmental or economic reasons. If you eliminate the most stringent control alternative in this fashion, then you must consider the second best, and so on. This procedure is modeled after the EPA December 1987 Top-Down BACT Policy. It was further described in the June 1991 NESCAUM BACT Guideline and October 1990 draft EPA New Source Review Workshop Manual.

Using Top-Down BACT gives MassDEP flexibility to be responsive to new advances in air pollution control, fosters technology transfer, encourages pollution prevention and entrepreneurship, and rewards innovation by creating an “incubator” for new air quality control strategies. It would also be difficult for MassDEP to set emissions limits for all the various types of sources that have been, or will be, proposed in Massachusetts without using Top-Down BACT.

In preparing your plan application and BACT analysis, you will need to identify all demonstrated and potentially applicable control technology alternatives. You can learn more about these from the following resources:

- EPA BACT/LAER Clearinghouse & Control Technology Center
- State and Other Permitting Agency Control Technology References:
  - MassDEP BACT Web Page
  - California Air Resources Board
  - South Coast Air Quality Management District
  - Texas Commission on Environmental Quality
- Control Technology Vendors
- Federal and state/local new source review permits and associated inspection/performance test reports
- Environmental Consultants
- Technical Journals, Reports (e.g., Air & Waste Management Association and McIlvaine reports), Newsletters and Seminars
- EPA New Source Review (NSR) Bulletin Board

Environmental Impacts

You should give preference to a technology or technique that achieves the required reduction in air contaminant emissions with the greatest degree of pollution prevention. For example, if both using either a low VOC coating and a high VOC coating along with an end-of-pipe air pollution control device would yield the same emissions, it is still better for the environment to use the low VOC coating.

With regard to environmental impacts, the cleanest outcome is required unless it can be eliminated based on technological or economic infeasibility. You cannot “model out of BACT” by simply showing that the modeled results of an inferior-to-Top Case air quality control technique will not result in a NAAQS violation.

Your environmental impacts analysis should also consider the effect of a particular air pollution control technology or technique on other environmental media. For example, if a water-based air pollution control device would be the Top Case to deliver BACT for a given process, but the water supply serving your facility is stressed, then a "dry" control alternative – if technically feasible – might be determined to be the preferable means of delivering BACT.

Energy Impacts

You must also weigh the energy impacts of a given control technique or technology by estimating its direct energy consumption compared with that of alternatives. As a matter of course, energy impacts and costs are considered in the economic impacts assessment of Top-Down BACT.

Economic Impacts

The economic impacts portion of your Top-Down BACT analysis begins with the establishment of "baseline emissions" of a given proposal. The EPA New Source Review Workshop Manual defines baseline emissions as "…essentially uncontrolled emissions, calculated using realistic upper boundary operating assumptions."

For example, to calculate baseline emissions for VOC-emitting processes, typically surface coating or similar processes, take the worst-case (highest) VOC-containing coating's hourly emissions rate and multiply it by the maximum number of hours the process will operate. Federally enforceable limits on hours of operation can be used to lower projected emissions below a baseline predicated on 8,760 hours per year of operation.

The baseline emissions rate is an important variable in calculating the economic cost effectiveness of a particular control technology. MassDEP may require you to calculate cost effectiveness based on different baseline emissions rate values to determine whether or not the selection of a particular baseline emissions rate is a deciding factor in the BACT determination.

EPA's New Source Review Workshop Manual instructs that primary consideration should be given to quantifying the cost of control and not the financial standing of an individual facility owner/operator. This simple precept goes a long way toward ensuring a level playing field for similar types of processes. In other words, if similar processes have been built and are operating with an established level of BACT, you may not argue that you cannot afford to provide the same level of air pollution control that they do.

Economic feasibility is measured in terms of the annualized cost of a particular control technology or technique divided by the annual emissions reduction achieved by using it relative to baseline emissions. The annualized cost includes the capital cost of the control technology or technique amortized over its expected lifetime, plus annual operating and maintenance costs.

In preparing your economic impacts analysis, you must use appropriate cost assumptions. Some sources of cost data include:

- Control Technology Vendors
- EPA's Cost Control Manual
- Trade Literature
- Actual Costs from Case Studies
- Input from Independent Experts

Particularly when your economic analysis concludes that a particular control technology would cost too much to be economically feasible, the burden is on you to prove that your analysis and conclusion are reasonable. MassDEP will scrutinize (and may request justification) of each line item, as well as your assumptions relative to:

- Equipment and system design and sizing consistent with good ventilation and air pollution control engineering practices
- Fuel and electricity costs in line with current and forecast pricing at the particular location
- Maintenance, tax and overhead factors
- Life expectancy of equipment and media
- Interest rates
- Costs of expendable supplies and reagents

Incremental control cost differences can be used in some special cases (e.g., when comparing two control techniques or technologies with very similar levels of reduction for the same air contaminant). The Case Study below illustrates this concept and others (such "technology forcing," "pollution prevention" and "other environmental impacts") discussed in this document.

> ***Case Study:*** *In the recent past, boiler manufacturers have developed "ultra-low NOx burners" (ULNBs) which can achieve an oxides of nitrogen emission rate of 9 parts per million (ppm[4]). Before the advent of ULNBs, BACT for NOx for boilers with capacity above approximately 50 million British thermal units per hour was achieved by the use of Selective Catalytic Reduction (SCR) to reduce NOx emissions to 5 ppm, accompanied by a 5 ppm ammonia (NH_3) slip. When analyzing the incremental cost of using SCR to reduce the 9 ppm NOx emission rate attained by ULNB to reach a 5 ppm NOx emission limit, it became readily apparent that requiring SCR with added NH_3 emissions would be economically infeasible, on a dollar-per-ton-of-pollutant-removed basis. Therefore, NOx BACT for this category of emission units is now 9 ppm, with no NH_3 emissions.*

Since 1990, MassDEP has used two ranges of annualized dollars per ton of pollutant controlled. For "attainment" pollutants, such as CO and SO_2, we have used an upper bound range of $4,000 to $6,000 per ton of pollutant controlled. For "nonattainment" precursor pollutants, such as NOx and VOC, the range is $11,000 to $13,000 per ton.

While these ranges are helpful in putting the economics of BACT into context, MassDEP's experience has shown that submitting a detailed, exhaustive Top-Down BACT analysis – which is necessary to justify less-than-Top-Case control on the basis of excessive cost – is the exception rather than the rule. Most applicants choose to employ Top-Case BACT and a typical upper bound, nonattainment pollutant BACT economic assessment seldom exceeds $4,500 per ton of pollutant removed.

Top-Case BACT

Given MassDEP's history of determining BACT, it may not be necessary for you to "reinvent the wheel." Under 310 CMR 7.02(8)(a)2.a., you may consider our past BACT determinations for similar emission units/processes and potentially use them to define BACT for your own proposal. See http://www.mass.gov/dep/air/approvals/bact.htm for additional information.

MassDEP will update our past BACT determinations to reflect advances in technology that result in lower emissions than shown and represent BACT, but we may still opt to require you perform a complete BACT analysis for your proposed project if our determinations for similar emission units/processes have not been updated recently. This underscores the importance of scheduling a pre-application conference with MassDEP as early in the process as possible.

[4] These concentrations for boilers are all corrected to 3% oxygen.

Emissions Caps

It has been MassDEP's experience that for VOC or organic HAP emissions, add-on air pollution control equipment has not proven to be cost effective if aggregate emissions are less than 18 tons per year. You are not required to evaluate add-on controls for these processes. Instead, under 310 CMR 7.02(8)(a)2.b., you may propose a combination of best management practices, pollution prevention, and limitations on hours of operation or materials usage.

Given your facility's circumstances, however, you may decide to propose add-on controls for this sort of activity on your own initiative, or if you become aware of a particular air pollution control technology or technique that is economically feasible for the level of emissions you are proposing. However, you must still employ pollution prevention measures, such as low-VOC and low-HAP coatings, surface preparation compounds, and high transfer efficiency application methods.
