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Air Compliance through Pollution Prevention at Air Force Materiel Command Facilities

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ABSTRACT

Options for air compliance through pollution prevention (P2) have been identified at 14 facilities of the U.S. Air Force Materiel Command, ranging from depots with significant light industrial activity to laboratories.

Previous P2 efforts concentrated on reducing hazardous and solid wastes, with any reduction in air impacts generally being a collateral benefit. This work focused on reducing air emissions and air compliance vulnerabilities.

P2 options were identified in three stages. First, potentially applicable P2 options were identified from Internet and published information. Attention was given to identifying the types of sources to which an option could be applied, the option's state of development, and constraints that could limit its application.

Traditional P2 options involving technology or equipment changes and material substitution were considered. In addition, newer approaches based on administrative "controls" were considered. These included inserting P2 into operating permits in exchange for administrative relief, privatization, derating boilers, and reducing an installation's potential to emit and compliance vulnerability by separating sources not under the Air Force's "common control."

Next, criteria and toxic emissions inventories by source category were prepared from inventory data supplied by facilities. The major problems at this stage were differences in the levels of detail provided by facilities and in the categories used by different installations.

Emitting categories were matched to P2 option categories to identify candidate options. Candidates were screened to account for local regulations and technical information about

sources in the inventories. When possible, emission reductions were estimated to help facility personnel prioritize options.

Some options identified are being actively pursued by facilities to determine their site-specific feasibility. Although much work has been done to implement material substitution programs, this work indicates that different priorities and additional opportunities might result from using air emissions and compliance vulnerability as driving metrics.

INTRODUCTION

Argonne National Laboratory (ANL) has completed preliminary evaluations identifying Compliance Through Pollution Prevention (CTP2) options for air program compliance at U.S. Air Force (USAF) installations within the Air Force Materiel Command (AFMC). This paper describes the process used for conducting those evaluations, provides a brief overview of the types of CTP2 options that have been identified, and offers conclusions and recommendations for an effective approach to incorporating CTP2 into existing air quality program compliance strategies.

Since May 1994, the principal drivers for Air Force P2 programs have been Air Force Instruction (AFI) 32-7080 and related Air Force policy directives and Executive Orders.[1,2,3] AFI 32-7080 requires the development of installation-specific P2 plans that must include management strategies for ozone-depleting chemicals (ODCs), the U.S. Environmental Protection Agency's (EPA's) 17 industrial toxics, hazardous waste (HW), municipal solid waste (MSW), affirmative procurement of environmentally friendly products, energy conservation, and air and water pollution reductions. Within AFMC, initial P2 initiatives were primarily in the areas of reducing HW and MSW, eliminating ODCs, increasing affirmative procurement, and eliminating or reducing reliance on EPA-17 industrial toxics. Indeed, EPA's list of 17 environmentally problematic chemicals was expanded to 24 for AFMC installations to address other toxic or environmentally persistent chemicals in widespread, high volumetric use within AFMC. Steady progress has been made toward achieving P2 goals and objectives, and AFMC's P2 investments have been successful in reducing overall costs of operation. And, when P2 efforts were integrated strongly with environmental compliance programs, successful P2 also often resulted in reductions in compliance liability and control of compliance costs in the face of increasing compliance burdens. In this sense, AFMC installations have been practicing regulatory compliance through P2 for some time. Although early attention focused on other regulatory program areas, there have also been some coincidental impacts on air compliance liability. Often, reductions in HW or material substitutions and process and equipment design changes made to reduce or eliminate EPA-17 (or AFMC-24) chemicals and ODCs provided collateral benefits of reduced air compliance liabilities and, in some instances, completely eliminated the applicability of certain air regulations.

AFI 32-7080 is currently undergoing revision, and it is expected that the revised AFI will more explicitly establish P2 as an integral part of the Air Force's environmental compliance strategy. While the Air Force can be expected to continue in its commitment to pursue P2 initiatives that provide for protection of natural resources and attainment of Air Force and U.S. Department of Defense (DOD) P2 goals and objectives, additional emphasis will be applied to the search for cost-effective P2 initiatives that can reduce current and future regulatory burdens. Guidance

issued by the USAF in November 1997 also requires reductions in compliance burdens through the identification and pursuit of CTP2 options.[4] With the recent and ongoing explosion of rules resulting from implementation of the Clean Air Act Amendments of 1990 (CAAA), many of them impacting the aerospace industry, the air quality program offers fertile ground on which to practice CTP2.

Finally, beginning in fiscal year 1999 (FY99), AFMC has been making important changes in its P2 program strategy by altering its P2 investment priorities from "pounds reduced" to "compliance burden reduced" and requiring integration of P2 activities and compliance strategies.[5] Many CTP2 successes have already been realized by AFMC installations, including those that impact air compliance liabilities. These evaluations were designed to ensure that all potential reductions in air compliance liabilities at AFMC installations are identified and that these reductions are not simply the coincidental result of successful P2 efforts undertaken in other program areas but rather the result of a deliberate application of the CTP2 philosophy to reduce each installation's air compliance burden and liabilities.

PURPOSE AND SCOPE AND METHODOLOGY

For some time, USAF installations have regularly used P2 opportunity assessments (PPOAs) as the mechanism by which P2 options are identified. ANL's CTP2 evaluations were devised as precursors to PPOAs, involving a preliminary analysis of immediately available air emission data to identify generic air CTP2 options that may be applicable and strategically important for each installation's further consideration during its next PPOA. As a result, not all supporting circumstantial and operational data that would routinely be factored into a P2 feasibility study were collected in most instances, and interactions with installation personnel throughout the course of these evaluations were limited. While it was important to qualitatively address each option's relevance or potential impact, detailed cost analyses were also beyond the scope of these evaluations. Nevertheless, taken collectively, these evaluations give AFMC Headquarters (HQ)/CEVC insight about existing or emerging air CTP2 options that may have widespread applicability at AFMC installations, allowing for more focused support for future feasibility studies.

All AFMC installations were within the scope of this study. AFMC's weapon acquisition and sustainment missions result in great diversity and complexity among AFMC installations, from large industrial complexes such as the Air Logistic Centers (ALCs) to smaller research and development laboratories. Despite this diversity, the same fundamental approach to CTP2 option identification was possible at all installations. The CTP2 options identified for ALCs were more numerous and offered the potential for greater impacts with successful implementation, but CTP2 options were found to exist for any installation with air compliance liabilities, regardless of its size or complexity.

IDENTIFYING GENERIC CTP2 TOOLS

The first phase of this project involved assembling an array of generic air quality CTP2 "tools" that could be applied against individual installation air compliance profiles. Available information on P2 options was collected from a variety of sources, including Air Force information clearinghouses (including PROACT and other informational materials available through the Air

Force Center for Environmental Excellence [AFCEE]), other DOD P2 information libraries (including the Tri-Service Pollution Prevention Opportunity Handbook and informational materials available through Web sites of other military service branches), U.S. Department of Energy (DOE) P2 information sources (including DOE's National Renewable Energy Laboratory Web site), EPA P2 guidance and information (including Industrial Sector Notebooks), state and local government P2 information clearinghouses, industry association P2 clearinghouses, and P2 information resources provided by regional P2 cooperatives and commercial vendors. Much of this information was available through the Internet and could be accessed via a wide variety of readily available search engines. A partial listing of the government-sponsored Web sites that provided valuable information for these evaluations is provided in Appendix A.

Retrieving information from the Internet was straightforward; however, some precautions were warranted regarding the subsequent application of Internet data. It was reasonable to assume that official Web sites operated by government entities contained legitimate and validated information, albeit not necessarily current. Attempts were made to independently validate any information retrieved from an Internet Web site before applying it in any evaluation through conversations with points of contact named on the site or reviews of the technical data or feasibility studies from which the information was extracted. It is also important to note that information obtained on emerging technologies or new technologies undergoing field verification testing is likely to be very time sensitive, and information available on a Web site is not likely to be the latest or most complete information available. Contact with the principals involved in such testing and development ensured that the latest and most complete data were used in the evaluations.

Although there is a considerable volume of information available on the Internet regarding P2, presentation formats are not standardized and vary greatly. The format as well as the location of the information reflect the perspective of purveyor of the information and the P2 goals or objectives of the anticipated audience. Cross-referencing of this information to other perspectives may or may not exist, and searching for information exclusively from the perspective of CTP2 may be of limited value, even with keyword search capabilities. Many P2 informational databases are organized to address specific chemicals or technologies and present P2 options from the perspectives of waste minimization, cost containment, or increased worker safety. For example, it might be easy to find material substitution opportunities for chlorinated solvents such as perchloroethylene by searching under organizational headings such as "perchloroethylene," "hazardous waste," or "waste minimization." However, the information is less likely to be cross-referenced to a category such as "air compliance," even though the P2 option being presented may also eliminate air compliance requirements applying to the design and operation of equipment that uses perchloroethylene. While few information resources are deliberately structured to address CTP2 goals, many do contain sufficient information to allow the reader to conclude or infer some compliance liability reductions as an anticipated ultimate benefit. To insure that no P2 option was prematurely rejected, the search parameters were kept purposely broad, and the available data were scrutinized to determine the potential for reduced compliance burden, even if the authors of that information did not promote their product or technology in that manner.

In addition to searches of national or organizational databases, particular efforts were made to identify CTP2 successes that already existed within AFMC. Reviews of existing P2 plans and strategies and conversations with P2 and compliance program managers and other installation

personnel provided the best sources of such information. Although each specific CTP2 option so identified had been tailored to the individual installation, its potential transferability to other AFMC installations could be expected to be high. Likewise, CTP2 successes within other military institutions engaging in similar activities or facing the same regulatory burden (especially those installations located within the same air pollution control districts as AFMC installations) were especially important to this study, not only because of the commonality of the regulatory burdens but because of the expectedly high potential for transferability. Air program CTP2 options ultimately selected during these evaluations are discussed later.

DATA ANALYSIS

The second phase of each evaluation involved a review of existing air emission inventory data maintained by each installation. Existing air emission data and associated source data were used to define the initial scope for ANL's search for relevant CTP2 options at each installation. The most recent, validated air emission data were provided to ANL by each installation. AFMC installations initially developed and maintained their air emission inventories in a standardized format known as the Air Quality Utility Information System (AQUIS).[6] However, with the onset of Title V permit requirements (including an expansion of the types of air sources potentially subject to such operating permits), many installations chose to develop independent databases to support their Title V permit applications. In other instances, new or unique air emission data management capabilities were required to remain consistent with inventory and reporting requirements imposed by local air quality management districts or to accommodate unique emission factors contained in local regulations. It was also often the case that air emitting equipment or activities that were not specifically regulated were not included in installation databases. As a result, air emission data across AFMC were maintained in a variety of formats and at various degrees of completeness. While the existing databases were always sufficient for the installation to demonstrate compliance with applicable regulations, they did not necessarily contain the type of information necessary to anticipate or identify CTP2 opportunities.

Regardless of format or completeness, air emission data alone could not provide the full perspective necessary for a determination of which CTP2 options would be of practical or strategic value to each installation. Additional information was therefore gathered from other installation-specific sources such as Environmental Compliance and Management Plan (ECAMP) reports and installation P2 plans or through conversations with each installation's air quality program manager. Complimentary relevant information was also assembled, including circumstantial factors such as the compliance status of an installation's location with respect to National Ambient Air Quality Standards (NAAQS), the installation's status as a major or minor air pollution source, enforcement histories, operational details for certain air emission sources/activities, and specific requirements contained in operating permits. Finally, state and local air quality regulations and programs applicable to each installation were also reviewed. Of particular value in this regulatory review were the identification of exemptions by rule, exclusions, waiver opportunities, and published regulatory interpretations as well as opportunities or benefits extended by the regulatory agency for an installation's participation in environmental partnership programs.

Data analysis involved manipulating air emission data within categories defined by state or local regulation, allowing not only for the identification of the number and type of sources subject to each regulation but also for the arrangement of these sources in descending order of air impacts. When the completeness of the data allowed, such manipulation and ordering were performed for all criteria pollutant sources as well as for sources of volatile organic chemical (VOC) and hazardous air pollutant (HAP) emissions. The resulting ordering of sources implied a priority order for a search of CTP2 options if reduction in air impacts was the primary consideration. Additional factors such as mission criticality and process constraints imposed by military specifications or technical orders might cause a reordering of priority, but because such information was not immediately reflected in air emission inventory data, such factors were not routinely considered in this preliminary analysis phase.

CTP2 PROGRAM GOALS AND OBJECTIVES

Before marrying the generic CTP2 tools assembled in the first phase of this study with the installation-specific air quality compliance profiles that resulted from air emission data analyses, ANL developed a set of hypothetical goals and objectives for air quality program CTP2 initiatives at each installation. The P2 management plans for each installation were also reviewed to ensure compatibility of ANL's hypothetical CTP2 goals and objectives with existing installation P2 program goals. ANL used these hypothetical CTP2 goals and objectives to confirm the relevancy of each CTP2 option and to ensure that P2 options selected for their ability to reduce air compliance burdens did not inadvertently increase regulatory burdens or liabilities in other program areas. Three primary air program CTP2 goals and related objectives were articulated.

Goal 1: Reduce to the Maximum Extent Practicable the Environmental Impacts from Installation Operations

Supporting Objectives:

Although this goal is likely to already be in place as a cornerstone of the installation's existing P2 program, it is nevertheless important to affirm its applicability to (air) CTP2 initiatives and to ensure that each CTP2 option, if successfully pursued, will support this goal. Importantly, this goal commits to reducing all environmental impacts, not just air impacts.

Goal 2: Reduce Regulatory Burden

Supporting Objectives

- Eliminate permit requirements (without retiring equipment/function).
- Restructure permit conditions to be compatible with CTP2 initiatives.
- Reduce/eliminate planning and reporting requirements (in accordance with § 112(r) of the CAAA of 1990 with respect to emergency planning, § 304 of the CAAA of 1990 with respect to chemical process safety assessments, and EPCRA with respect to Toxic Release Inventory [TRI] reporting).
- Pursue and preserve all exemptions, exclusions, and waivers for which the installation is eligible.

Goal 3: Reduce Compliance Vulnerabilities

Supporting Objectives

- Maintain greater margins of safety between actual and allowed emissions (i.e., reduce the mass flow of air emissions while maintaining production levels).
- Reduce regulatory oversight.
- Pursue and preserve eligibility for all waivers, exemptions, and exclusions.
- Transfer compliance responsibilities to others whenever possible.

Each installation might be expected to develop strategic goals and objectives for its air CTP2 initiatives that are variations of those listed above. However, there will be subtle differences, especially regarding the tactics available to each installation and the priorities assigned to each goal, objective, or tactic. These differences will reflect not only each installation's commitments to environmental stewardship but also each installation's unique regulatory circumstance. Examples of how each installation's CTP2 goals and objectives could be expected to influence selection of CTP2 options include the following:

- Installations located in nonattainment areas for ozone or nitrogen oxides might place the highest premium on CTP2 initiatives designed to reduce or eliminate those pollutants, even from sources where such reductions are not now mandated, in order to provide the installation with emission reduction credit bargaining leverage.
- Installations facing significant compliance burdens because of the applicability of aerospace National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations may assign the highest priority to material substitutions and/or technology modifications that can reduce that burden, irrespective of costs associated with such conversions.
- Installations facing significant costs in the preparation and maintenance of risk management plans (RMPs) may select technology changes and/or administrative controls designed to keep their RMP-listed chemicals below formal planning thresholds.
- Installations currently enjoying a status of "minor source" with regard to their overall potential to emit or claiming exemptions due to equipment size or limited operational periods may select administrative and engineering controls as an appropriate investment in order to preserve minor source status or individual equipment exclusions.

INSTALLATION-SPECIFIC REPORTS

Once hypothetical goals and objectives for an air quality compliance P2 initiative had been established, ANL prepared installation-specific CTP2 evaluations. Each of the reports included summary results of air emission inventories and analyses; suggested strategic goals and objectives that would serve to define and control a CTP2 initiative at each installation, including tactics that might be appropriate; and presented potential CTP2 options.

Air quality CTP2 options were arranged into four categories: 1) technology or equipment changes, 2) material substitutions (sometimes also requiring equipment modifications), 3) changes to administrative controls or procedures, and 4) alternative energy strategies. Each identified

option was presented in a standard format that included general background information contained within a narrative "Discussion" section; specific information on the relevance, relative importance, or applicability of the option to the installation presented in a section titled "Applicability/Impact"; suggested general mechanisms for approaching implementation of the option (including identified obstacles) under "Implementation"; and, when appropriate, additional information sources in "Additional Information/Guidance" sections.

It was often the case that many of the activities for which CTP2 options had been identified were currently controlled by military specification (MILSPEC) and/or technical order (TO). In those instances, the installation was reminded of its responsibility to obtain concurrence of the specification or order manager before making any changes (including technology changes or material substitutions). However, there were often instances where CTP2 options that involved changes to administrative controls or procedures or the selection of alternative energy systems could be pursued without amendment to a MILSPEC or TO.

OVERVIEW OF CTP2 TOOLS

A wide variety of CTP2 options were ultimately identified for AFMC installations. Material substitutions and technology modifications have continued to be important strategic pathways for reducing compliance burdens in the air quality program, just as they have been in reducing HW and EPA-17 liabilities and reducing Emergency Planning and Community Right-To-Know (EPCRA) and TRI requirements. It also may be the case that P2 options identified previously and rejected or given low priority because of their inability to dramatically impact HW liabilities or reduce reliance on EPA-17 chemicals deserve reevaluation from the perspective of the air quality program's CTP2 initiative and could gain considerable priority when their potential to reduce the air compliance burden is factored into any cost/benefit analysis. Somewhat surprising is the significant role that could be played by administrative controls and options in reducing or eliminating air compliance burdens or vulnerabilities. Every CTP2 identified had the potential to reduce air impacts. Many additionally could be seen as reducing compliance vulnerabilities by eliminating a rule's applicability or by creating better guarantees of continued compliance with applicable standards. A brief overview of the types of operational areas for which air quality CTP2 options were identified during these evaluations is presented below.

CTP2 options were identified for the following equipment categories: aerospace ground equipment (AGE), internal combustion engines (ICEs) (e.g., power generators), external combustion devices (e.g., boilers), jet engine test cells, classified document incinerators, dry cleaning equipment, anodizing/metal treatment, and water treatment and fuel storage tanks. They were also identified for the following activities: painting and surface coating, cleaning and degreasing, abrasive blasting, and anodizing. In general, CTP2 options for equipment invariably involved modifications to operating parameters to enhance performance or complete replacement with alternative technologies. Long known techniques as well as emerging technologies for improving ICE and boiler performance were identified as potential air quality program CTP2 options and included installing filters for nitrogen oxides (NO_x) and particulates on AGE and other diesel ICEs, replacing diesel ICEs with high-efficiency substitutes, and retarding injector timing on ICEs. Boiler performance enhancements, including the addition of low-NO_x burners or fuel substitutions, were also identified. Enhanced vapor control systems were also identified as

potentially valuable modifications to VOC storage tanks. Replacement technologies cited included replacing some AGE power generating equipment with buried electrical supply cables that provide properly amended power at the point of use, replacing AGE lighting units with battery-powered substitutes, replacing conventional incinerators with mechanical shredders, and replacing chlorinated solvent dry cleaning with wet (aqueous) cleaning technologies. Alternative technologies identified included replacing gaseous chlorine with photocatalytic oxidation using ultraviolet light and replacing conventional heating and power generation with geothermal heat pumps and photovoltaic energy systems, respectively.

CTP2 options for the activities often involved material substitutions, but may also have included technology modifications or substitutions. Examples identified as relevant for AFMC installations included substituting supercritical fluid cleaning, aqueous-based enzyme cleaners, or foam blasting (also known as sponge blasting) for conventional solvent cleaning or abrasive blasting; utilizing relatively new water blasting technology as an alternative to methylene chloride or sodium bicarbonate stripping of aircraft; and substituting aliphatic hydrocarbon solvents for chlorinated solvents in dry cleaning operations.

A review of most state air regulations reveals numerous exemptions (based on equipment size, location, or purpose), waivers, and variance options for avoiding regulatory applicability. As a result, administrative controls designed to attain or maintain eligibility for such exclusions can play a significant role in a CTP2 strategy. Some administrative options found to be available at AFMC installations are discussed below. Derating fuel combustion equipment such as boilers and ICEs can reduce the number and severity of regulatory controls that apply to such equipment or exclude some units from regulation entirely. Amending operating circumstances with administrative controls to remain below levels of regulatory concern for such equipment is also often possible. Since many boilers are not routinely operated at or near their nameplate ratings, such derating will not adversely affect operations. Likewise, controlling hours of operation of some ICEs can help preserve their emergency status, relieving them of most regulatory requirements in many locations. Consolidating activities to limit regulatory applicability to fewer pieces of equipment or activities is also often possible. The hazardous material management systems operative at all AFMC installations, known usually as Hazardous Material Pharmacies, have also been identified as potentially useful administrative tools for establishing inventory and purchase authorization controls sufficient to reduce RMP obligations or simplify RMP requirements. Such pharmacy programs can effectively keep RMP-listed chemicals at quantities below their threshold planning quantities by the application of such tactics as limiting authorized amounts to mission-essential levels, consolidating storage of RMP-listed chemicals used by more than one organization, or establishing "just-in-time" ordering arrangements. Air compliance liabilities can also be potentially reduced by privatizing certain key activities or services, including vehicle maintenance; heating, ventilation and air conditioning (HVAC) servicing; dry cleaning; electric power production; infrastructure maintenance (especially architectural coatings); and water treatment.

Some opportunities also exist to insert P2 commitments into state-issued air operating permits in exchange for a relaxation or elimination of the administrative requirements often also contained in operating permits. Multiple benefits derive from this strategy. Installations may also view such a strategy as a convenient means of demonstrating their environmental stewardship commitment to

their stakeholders while, at the same time, directly reducing their compliance costs and liabilities. Each state regulatory agency can be expected to react differently to suggestions for such permit modifications, but a permitting strategy that would allow P2 to replace certain standard requirements is generally consistent with long-standing state and federal enforcement strategies that reduce penalties in exchange for supplemental environmental projects (SEPs). This approach is likely to be acceptable to the agency, provided the proposed P2 projects are auditable and progress toward the P2 goals is enforceable under the terms of the permits. A more comprehensive discussion of integrating P2 into operating permits can be found in the article "Integrating Pollution Prevention (P2) into Operating Permits."[7]

Administrative opportunities to reduce air compliance burdens also exist within the federal permit program. With the onset of Title V permitting and its application to military installations with a complex array of tenant activities, the EPA has found it appropriate to issue guidance regarding how the "potential to emit" of a military installation should be determined.[8, 9] This guidance suggests that tenant organizations at a military installation not under the same "command and control" as the host command can be addressed separately for the purpose of major source determinations and Title V applicability. A number of AFMC installations, as well as USAF bases within other commands, have successfully reduced their potential to emit (and thus their Title V and other compliance liabilities) by divorcing themselves from the air quality compliance responsibilities of the non-USAF tenants at their installation who operate under a different command and control scenario.[10, 11]

Finally, participation in federal or state environmental protection partnership programs has also been identified as having the potential to reduce compliance burdens. Installations view such participation primarily as a way to demonstrate environmental stewardship and to be officially recognized for the environmental protection commitments and accomplishments they have already made. But membership benefits may also include reduced regulatory oversight, expedited permit and variance processing, reduced permit processing fees, and relaxation of administrative requirements such as record keeping and reporting obligations. It is important to note, however, that there have been disagreements between the EPA and some states on how participation in a federal partnership program such as EPA's ENVEST will be received by the state agency that has primacy for implementing the air quality compliance program. As a result of these disagreements, federal partnership program participation may not ultimately yield as much actual reduction in compliance burden as originally anticipated.

CONCLUSIONS AND RECOMMENDATIONS

ANL's evaluations of the existing air quality programs at AFMC installations have identified a number of CTP2 strategic and tactical options. Because these evaluations were preliminary, designed to be completed quickly at minimal cost, they could identify the potential for CTP2 but invariably could not address the ultimate feasibility of any identified CTP2 option to the extent necessary to support an installation's commitment to pursue the option. However, although traditional PPOAs are still a necessity, the preliminary evaluations can nevertheless be an effective screening tool and provide valuable insights into the wide variety of CTP2 tools available and the manner in which they can be incorporated into air quality program compliance strategies.

CTP2 has revealed itself to be an enhancement to existing P2 programs rather than an entirely new stand-alone initiative. Despite its relationship to existing P2 programs, however, CTP2 is still deserving of separate decision making with respect to strategic goals and objectives. The exercise of reviewing existing P2 goals and objectives and defining CTP2-specific goals and objectives when necessary provides the opportunity to identify all the strategic and tactical tools available and to assign a relative value to each within existing or expanded compliance strategies. Such restructuring of strategic goals and objectives is also necessary to ensure that CTP2 becomes an integral part of the overall compliance effort and not a coincidental activity.

Finally, these evaluations clearly established the importance of a broad approach to air quality compliance using P2. Conventional P2 options such as material substitutions and process changes can be expected to be of continued value. Even P2 initiatives taken in response to compliance requirements in other program areas may provide collateral air compliance benefits. Likewise, P2 options previously identified but not pursued are deserving of another look for their potential value to the air compliance program. In addition, less conventional approaches to P2 may also play a role in an air quality program CTP2 strategy. More than for any other regulatory program, the air quality program's compliance strategy makes itself available to the application of CTP2 options involving administrative controls and negotiated operating permits. In addition, many state regulatory programs welcome the introduction of P2 initiatives as an integral part of an installation's air quality compliance strategy and are willing to relax administrative requirements to promote and support such approaches.

The following recommendations are offered as supportive of integrating CTP2 fully into existing air quality program compliance strategies.

- Spend the time and resources necessary to review existing P2 strategic goals and objectives, amending or adding goals and objectives as necessary to help define and support subsequent air program CTP2 initiatives.
- Identify current as well as future compliance responsibilities, incorporating them all into the CTP2 strategy.
- Identify circumstantial factors, such as nonattainment of NAAQS, to help anticipate the priority that will be assigned by regulators to complying with specific regulations and to identify where negotiating leverage can best be established.
- Modify existing air emission inventories to create an "air compliance profile" as well as an emission profile, identifying those activities or sources having the greatest impact on current or future compliance burdens.
- Search for CTP2 opportunities in both conventional and nonconventional areas.
- Recognize that available P2 technical resources may not be arranged in the most convenient manner for identifying CTP2; maintain broad search parameters and be prepared to extrapolate from the presented data to unspecified CTP2 benefits in the air quality program.
- Revisit previously identified P2 options that may now offer a better return on investment when considered against newly established CTP2 goals and objectives.

- Recognize administrative controls as offering significant potential for CTP2.
- Make use of "generic" tools to the fullest extent possible, but recognize that air compliance burdens are defined largely by local conditions, often making generic tools less applicable or less valuable than similar generic tools might be in other program areas.

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APPENDIX A

SELECTED GOVERNMENT INTERNET RESOURCES FOR CTP2

- Envirosense (operated jointly by EPA, DOD, and DOE): http://es/inel.gov/
- EPIC (operated by DOE): http://epic.er.doe.gov/
- Air Force Center for Environmental Excellence: http://www.afcee.brooks.af.mil/pro_act/
- CAGE (expert system for paints and coatings substitutions): http://CAGE.rti.org
- SAGE (expert system solvent substitutions): http://clean.rti.org
- Joint Services Pollution Prevention Opportunity Handbook: http://enviro.nfesc.navy.mil/p2library/8-12_497.html
- Standard Protocol for Selecting General Cleaning Agents and Processes (U.S. Army Draft Protocol): http://es.epa.gov/ssds/army/sspdftfn.htm
- Joint Services P2 Technical Library: http://enviro.nfesc.navy.mil/p2library
- DOE's National Renewable Energy Laboratory: http://www.nrel.gov
- Navy P2 Equipment Book: http://www.lakehurst.navy.mil/p2/MASTER/
- Joint Group on Acquisition Pollution Prevention Technology Survey for Alternatives for High-VOC Primers and Topcoats: http://www.jgapp.com/tits.htm
- EPA's Design for the Environment (DfE) Program: http://www.epa.gov/opptintr/dfe/
- State of North Carolina Office of Waste Reduction: http://owr.ehnr.state.nc.us/search/ (keyword search)
- Ohio EPA: http://www.epa.ohio.gov/dhwm/
- Integrated Solvent Substitution Data Base (developed and maintained by EPA): http://www.es.EPA.gov/issds/
- Naval Facilities Engineering Service Center: http://enviro.nfesc.navy.mil/p2library
- U.S. Army Corps of Engineers Construction Engineering Research Laboratories: http://www.cecer.army.mil