Air Quality Procedures For Civilian Airports & Air Force Bases

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Air Quality assessments for proposed Federal actions are required for compliance with the National Environmental Policy Act, the Clean Air Act and other environment-related regulations and directives. This handbook is a comprehensive guide intended to assist the air quality analyst in assessing the air quality impact of Federal Aviation Administration and United States Air Force actions at airports and air bases. It provides guidance, procedures and methodologies for use in carrying out such assessments.

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PREFACE

Air quality assessments for proposed Federal actions are required for compliance with the *National Environmental Policy Act*, the *Clean Air Act* and other environment-related regulations and directives. This handbook is a comprehensive guide intended to assist the air quality analyst/environmental specialist in assessing the air quality impact of Federal Aviation Administration and the United States Air Force actions at airports and air bases. Furthermore, it provides guidance, procedures and methodologies for use in carrying out such assessments.

This section presents a glossary of terms and definitions. Section One provides general background information, including a brief discussion of Federal and State regulations. Section Two describes the assessment process including information on the various agencies involved in airport and air base studies. Emissions and dispersion assessments are presented in Sections Three and Four. Section Five covers both general and transportation conformity. Section Six addresses mitigation/control measures. The appendices provide additional supporting information including a summary of environmental documents, a project reviewer's checklist, analyses, and calculations.

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GLOSSARY

This section discusses basic terms and definitions used in assessing the air quality impacts from airport actions. It also includes some key conversion factors, which are used in analyzing aviation data.

Advisory Council on Historic Preservation (ACHP)	An independent Federal agency that is responsible for regulations implementing the National Historic Preservation Act, reviewing agency compliance, commenting on agency undertakings and their effects and reporting to Congress.
Affected Environment	The section of an environmental document (e.g. Environmental Impact Statement or Environmental Assessment) which describes the resource categories (e.g. air, water, flora, fauna, historic sites, etc.) that are affected or potentially affected by the proposed action and any alternative.
Air Quality	Ambient pollutant concentrations and their temporal and spatial distribution.
Air Quality Control Region (AQCR)	An EPA designated interstate or intrastate geographic region that has significant air pollution or the potential for significant air pollution and, due to topography, meteorology, etc., needs a common air quality control strategy. The region includes all the counties that are affected by or have sources that contribute directly to the air quality of that region.
Air Quality Data Base	A collection of information on the ambient air quality that existed within an area during a particular time period. This data is usually collected and published by the State Air Pollution Control Agency.
Air Quality Model	An algorithmic relationship between pollutant emissions and pollutant concentrations used in the prediction of a project's pollutant impact.
Air Quality Monitor	A device for measuring pollutant concentrations. One such device is a Non-Dispersed Infrared Analyzer used to record carbon monoxide concentrations.
Air Quality Standard	A legal requirement for air quality, usually expressed in terms of maximum allowable pollutant concentration, averaged over a specified interval.
Ambient Concentrations	Initial concentration sensed/measured at a monitoring/ sampling site.

Ambient Monitoring	Systematic measurements of characteristics (e.g. pollutant concentration and wind velocity) of the air at a fixed location.
Area of Potential Effects	Under Section 106 of the National Historic Preservation Act, area in which undertaking may affect any historic or cultural resources.
Area Source	The agglomeration of many sources that have low emission rates spread over a large area that are too numerous to treat individually. An example of this type of source would be a parking lot.
Atmospheric Stability	The resistance to or enhancement of vertical air movement related to vertical temperature profile.
Attainment Area	An area that meets NAAQS for a particular pollutant.
Averaging Time	A period over which measurements of air quality parameters are taken. Air quality standards are specified for averaging times of one, three, eight and twenty four hours, as well as one year.
Background Concentration	Pollutant concentrations due to (1) natural sources, (2) nearby sources other than the one(s) currently under consideration and (3) unidentified sources.
Calm	For purpose of air quality modeling, calm is used to define the situation when the wind is indeterminate with regard to speed or direction.
Carbon Monoxide (CO)	A colorless, odorless, toxic gas produced by the incomplete combustion of organic materials used as fuels. CO is emitted as a by product of essentially all combustion. Idling and low speed mobile source operations, such as aircraft taxiing are the most prevalent CO emission sources commonly found at airports.
Categorical Exclusion (CE or CATEX)	A category of actions that do not individually or cumulatively have a significant effect on human environment based on agency experience. CE's have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations (40 CFR 1507.3) and do not require preparation of an environmental assessment (EA), a FONSI, or an EIS.
CFRs	Code of Federal Regulations.
Clean Air Act (CAA)	The Federal law regulating air quality. The first Clean Air Act (CAA), passed in 1967, required that air quality criteria necessary to protect the public health and welfare be developed. Since 1967, there have been several revisions to the CAA. The Clean Air Act Amendments of 1990 represent the fifth major effort to address clean air legislation.

Clean Air Act Amendments of 1990 (CAAA)	The Clean Air Act Amendments of 1990 (CAAA) represent the fifth major effort to address clean air legislation. Revisions include significant strengthening of Clean Air Act, especially by adding detailed requirements for Federal actions to conform to State Implementation Plans (SIP), expanding the list of hazardous air pollutants from eight to 189, and strengthening the operating permit program.
Complex Terrain	Terrain exceeding the height of the stack being modeled.
Conformity	The act of meeting Section 176(c)(1) of the CAAA that requires Federal actions to conform to the SIP for air quality. The action may not increase the severity of an existing violation nor can it delay attainment of any standards.
Connected Actions	Actions that are closely related and therefore should be discussed in the same environmental document. Actions are connected if they automatically trigger other actions which may require an EIS; if they cannot or will not proceed unless other actions are taken previously or simultaneously; and if they are interdependent parts of a larger action and depend on the larger action for their justification.
Control	The ability to regulate, in some way, the emissions from a Federal action. The ability to regulate can be demonstrated directly through the use of emissions control equipment on a boiler or indirectly through the implementation of regulation or conditions in the nature of activity that must be established in permits of approvals or by design of the action. An example of indirect control is limiting vehicle emissions by controlling the size of a parking facility.
Control Strategy	A combination of limiting measures designed to achieve the aggregate reduction of emissions.
Cooperating Agency	A cooperating agency may be any Federal agency that has jurisdiction by law or special expertise with respect to any potential environment impact involved in a proposal for legislation or Federal action that significantly affects the quality of the human environment. A cooperating agency may also be a state or local agency of similar qualifications or, when the effects influence a reservation, an Indian Tribe. By agreement with the lead agency, an Indian Tribe may become a cooperating agency.
Criteria Pollutants	The six pollutants listed in the CAA that are regulated by the EPA through the NAAQS because of their health and/or environmental effects. They are: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM-10) and lead (Pb).

Cumulative Impact	Impacts on the environment which result from the incremental impact of the action when added to other past, present and reasonable foreseeable future actions regardless of what agency (Federal or no-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.
Day	Calendar day.
De Minimis	So small as to be negligible or insignificant. If an action has de minimis emissions (Conformity Rule 40 CFR part 93.153c), then a conformity determination pursuant to the CAA of 1990 is not required.
Description of the Proposed Action and Alternatives (DOPAA)	The first Air Force document required by the proponent of an action to initiate the EIAP. The DOPAA is documented with AF Form 813 and is the basis for all follow-on environmental analyses.
Diffusion	The gradual mixing of molecules of two or more pollutants as a result of random thermal motion.
Direct Effect	An effect that is caused by the implementation and/or operation of an action that occurs at the same time and place. These type of effects are also often referred to as primary effects.
Direct Emissions	Direct emissions are those caused by or initiated by the implementation and/or operation of an action, and that occur at the same time and place as the action.
Dispersion	The process by which atmospheric pollutants disseminate due to wind and vertical stability.
DOD	Department of Defense.
Driving Cycle	A profile of velocity versus time, specified for determining vehicular emission rate. This cycle would include periods of stopping, acceleration, cruising and deceleration.
Emission Factor	The rate at which pollutants are emitted into the atmosphere by one source or a combination of sources.
Emission Inventory	A complete list of sources and rates of pollutant emissions within a specific area and time interval.
Enplanements	The number of passengers on departing aircraft.
Environmental Assessment (EA)	A concise public document that provides sufficient data, evidence, and analysis to determine if Federal agency should prepare an EIS for an action or issue a FONSI. An EA is not necessary in cases where the Federal agency has decided to prepare an EIS. An EA can be prepared at any time to aid agency decision making.

Environmental Impact Analysis Process (EIAP)	The Air Force process for complying with NEPA and CEQ regulations.
Environmental Impact Statement (EIS)	An EIS is a detailed, concise public document required for major Federal actions likely to have significant effects on the human environment. The document may be directly prepared, without first doing an EA, if the action will have significant environmental impacts. An EIS provides the public and decision makers with clear, written documentation of potential significant environmental effects of the proposed action, and reasonable alternatives including the no action alternative.
Environmental Planning Function (EPF)	The Air Force organization at the base, major command or field operating agency that manages the EIAP including evaluation and completion of Air Force environmental forms, identifies environmental quality standards that relate to the action being evaluated, and prepares environmental documents and related logistical information.
Environmental Protection Committee (EPC)	The Air Force organization at the base, major command, air staff or field operating agency that implements the requirement to monitor, attain and maintain compliance with environmental regulations; ensures the training of appropriate personnel in the EIAP; reviews environmental policy; facilitates coordination; and serves as a steering group to monitor the overall conduct of the environmental protection program. The EPC also evaluates environmental concerns raised by proposed Air Force actions and ensures that they are addressed in any decision-making process including NEPA and EIAP.
EPA	U.S. Environmental Protection Agency.
FBO	A private operator that may conduct refueling, aircraft or ground support equipment services for others at the airport.
Federal Action	Actions with effects that may be major and potentially subject to Federal control and responsibility. Federal actions tend to fall into four categories: adoption of official policy, adoption of formal plans, adoption of programs and approval of projects, whether approved by permit or other regulatory decision. See 40 CFR 1508.16 for additional information.
Finding of No Significant Impact (FONSI)	A FONSI is a document which briefly presents evidence of why Federal agency has determined that a proposed action, not otherwise categorically excluded, will not have a significant impact on the environment. The FONSI justifies why the preparation of an EIS is unnecessary. The FONSI must include the EA or be attached to the EA, or a summary of it, and reference any other associated environmental documents. The FONSI should state all mitigation that will be undertaken, if any.

Frequency Distribution	A curve of the percentage frequency of occurrence of each value that a variable may take on.
Fugitive Dust	Dust discharged to the atmosphere in an unconfined flow stream such as that from unpaved road, storage piles and heavy construction operations.
Gaussian Model	A pollutant dispersion model based on the Gaussian dispersion equation, which assumes a constant fractional decrease in concentration per unit distance in the crosswind and vertical direction from a stationary or moving center of dispersion.
Hydrocarbons (HC)	Total hydrocarbons excluding methane and ethane. These gases represent unburned and wasted fuel. They come from incomplete combustion of gasoline and from evaporation of petroleum fuels.
IAS	Indicated air speed.
Indirect Control	Control of air quality by altering activities that influence the rate and distribution of emissions (e.g., traffic patterns, land use). Indirect control contrasts with direct control at the source of emissions (e.g. devices on automobiles or smoke stack).
Indirect Effect	Effects that are caused by the implementation and/or operation of an action, that occur later in time or are further removed by distance from the action, but which are still reasonable foreseeable. Often referred to as secondary effects.
Indirect Emissions	Indirect emissions are those caused by the implementation and/or operation of an action, are reasonably foreseeable, but which occur later in time and/or are farther removed in distance from the action itself. Under General Conformity, indirect emissions are further limited to those indirect emissions that the responsible Federal agency can "practicably control and will maintain control over due to a continuing program responsibility of the Federal agency."
Indirect Source	Any structure or installation which attracts an activity which creates emission of pollutants. For example, a shopping center, an airport or a stadium.
Inventory	See "Emission Inventory".
Inversion	A thermal gradient created by warm air situated above cooler air. An inversion suppresses turbulent mixing and thus limits the upward dispersion of polluted air.
Lead (Pb)	A heavy metal that, when ingested or inhaled, affects the blood forming organs, kidneys and the nervous system. The

	chief source of this pollutant at airports is the combustion of leaded aviation gasoline in piston-engine aircraft.
Lead Agency	The agency preparing or having taken primary responsibility for preparing the EIS.
Line Source	A long, narrow source of emissions such as roadway or runway.
Local Meteorology	The weather conditions, temperature, wind velocity, mixing height, cloud cover, etc. that exist in a particular area.
LTO	LTO refers to an aircraft's landing and takeoff (LTO) cycle. One aircraft LTO is equivalent to two aircraft operations (one landing and one takeoff). The standard LTO cycle begins when the aircraft crosses into the mixing zone as it approaches the airport on its descent from cruising altitude, lands and taxis to the gate. The cycle continues as the aircraft taxis back out to the runway for takeoff and climbout as its heads out of the mixing zone and back up to cruising altitude. The five specific operating modes in a standard LTO are: approach, taxi/idle-in, taxi/idle-out, takeoff, and climbout. Most aircraft go through this sequence during a complete standard operating cycle.
Macroscale	Large scale analysis involving distances starting from 100 to several thousand kilometers and averaging times of one to several days.
Maintenance Area (MA)	Any geographic area of the United States previously designated nonattainment pursuant the CAA Amendments of 1990 and subsequently redesignated to attainment.
Memorandum of Agreement (MOA)	A MOA is prepared to document commitments for mitigating adverse impacts on properties eligible for or listed in the National Register of Historic Places.
MAP	MAP refers to the number of million annual passengers for a facility (counted as enplanements and deplanements, including transfers but excluding through passengers).
Mesoscale	Medium scale analysis involving distances of 1 to 100 kilometers and averaging times of one to twenty-four hours.
Meteorological Variables	Wind speed and direction, mixing height temperature, pressure, degree of turbulence, sunlight intensity, humidity and precipitation.
Microscale	Small scale analysis involving distances up to approximately one kilometer and averaging times up to several tens of minutes.
Mitigation	This term is defined in 40 CFR 1508.20. It includes: (1) avoiding the impact altogether by not taking a certain

	action or parts of an action or finding a new site; (2) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (5) compensating for the impact by replacing or providing substitute resources or environments.
Mixing Height	The height of the completely mixed portion of atmosphere that begins at the earth's surface and extends to a few thousand feet overhead where the atmosphere becomes fairly stable. See also "inversion".
Mobile Source	A moving vehicle that emits pollutants. Such sources include airplanes, automobiles, trucks and ground support equipment.
Modal Emissions Factors	Vehicular emissions factors for individual modes of operation. For aircraft, these modes are takeoff, climbout, approach and taxi.
Model	A quantitative or mathematical representation or simulation which attempts to describe the characteristics or relationships of physical events.
Monitoring Site	A location of a measurement device in a monitoring network.
MSL	Mean Sea Level.
$\mu g/m^3$	Micrograms per cubic meter.
National Ambient Air Quality Standard (NAAQS)	Air Quality standards established by the EPA to protect human health (primary standards) and to protect property and aesthetics (secondary standards).
National Environmental Policy Act (NEPA)	An Act established to declare a national policy that will encourage productive and enjoyable harmony between society and the environment; to promote efforts that will prevent or eliminate damage to the environment and the biosphere, and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the nation.
Nitrogen Oxides (NO_x)	A poisonous and highly reactive gas produced when fuel is burned at high temperatures causing some of the abundant nitrogen in the air to burn also. At airports this pollutant is emitted by automobiles, aircraft engines, electric power plants and other combustion equipment. Takeoff and climbout are the significant NO_x producing modes of aircraft operation.

Nonattainment Area (NAA)	Any geographic area of the United States that is in violation of any NAAQS and therefore has been designated as nonattainment under the CAA.
Notice of Availability (NOA)	A notice printed in the *Federal Register* announcing that an EIS is available for public comment.
Notice of Intent (NOI)	A brief notice placed in the *Federal Register* by the Federal agency noting that the agency will prepare an EIS. The NOI describes the proposed action and possible alternatives, details the proposed scoping process (i.e., location and time of meetings), and provides the name and address of a point of contact within the Federal agency to answer questions about the proposed action and the EIS.
Ozone (O_3)	A colorless, toxic gas formed by the photochemical reactions in the atmosphere of VOCs with the oxides of nitrogen. Ozone commonly is referred as "Smog". Ozone is not emitted directly by any airport.
Pasquill Stability Classification	A method of classifying atmospheric stability based on incoming solar radiation and wind speed. The stability classifications range from A stability (extremely unstable conditions) to F stability (moderately stable conditions).
Plume	The spreading pollutants emitted by a fixed source such as a smokestack.
PM-10	PM-10, a criteria pollutant, are fine particles less than 10 micrometers in diameter. PM-10 includes solid and liquid material suspended in the atmosphere formed as a result of incomplete combustion. Aircraft are the primary source of PM-10 emissions at airport.
Point Source	A pollutant source that is fixed to the ground and that releases pollutants through a relatively small area. Common stationary sources at airport include boilers, heaters, incinerators and fuel storage tanks.
PPM	Parts per million (10^6) by volume.
Precursor	A chemical compound that leads to the formation of a pollutant. HC and NO_x are precursors of photochemical oxidants.
Preferred Model	A refined model that is recommended for a specific type of regulatory application.
Prevention of Significant Deterioration (PSD) Area	A geographic area that contains air which is relatively clean and not in violation of NAAQS. The emissions in these area are regulated to prevent degradation of its air quality.
Primary Pollutant	Chemical contaminants which are released directly to the atmosphere by a source.

Primary Standard	A NAAQS set to protect human health.
Receptor	A location at which ambient air quality is measured or estimated.
Record of Decision (ROD)	The decision document, prepared after the EIS, that states what the decision is, identifies all alternative considered by the lead agency in reaching its decision, and states whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why not.
Regionally Significant	Under General Conformity Rule, when a Federal action's direct and indirect emissions exceed 10 percent of the total emissions inventory for a particular criteria pollutant in an nonattainment or maintenance area.
Scoping	An early and open process (that invites the participation of affected Federal, state and local agencies, any affected Indian tribe, the proponent of the action and other interested persons) that determines the issues to be addressed in an environmental document and identifies relevant and/or significant issues related to a proposed action.
Screening Technique	A relatively simple analysis technique to determine if a given source is likely to pose a threat to air quality. Concentration estimates from screening techniques are conservative.
Secondary Pollutant	Atmospheric contaminants formed in the atmosphere as a result of such chemical reactions, as hydrolysis, oxidation and photochemistry.
Secondary Standard	A NAAQS set to protect human welfare.
Similar Actions	Actions, when viewed with other reasonably foreseeable or proposed actions, that have similarities that provide a basis for evaluating their environmental consequences altogether (in one document), such as common timing or geography.
Simple Terrain	An area where terrain features are all lower in elevation than the top of the stack of the source.
Simulation Model	A mathematical description of a real physical and/or chemical process. The responses of the model to input parameter variations are analogous to those of the real processes.
Smog	A common term for ozone.
Stability	A property of the atmosphere which determines the amount of vertical mixing.

State Historic Preservation Officer (SHPO)	A person appointed by a governor, under an ACHP approved historic preservation program, that provides expert advice to Federal agencies.
Stable Layer	A layer of air in which very little mixing takes place.
State Implementation Plan (SIP)	The strategy to be used by a state to control air pollution in order that the NAAQS will be met. EPA regulations require that each state devise such a plan or the EPA will impose its own plan for that state.
Stationary Source	A source of pollutants which is immobile. Such sources include power plants, individual heater, incinerators, fuel tanks, ARFF training, facilities and solvent degreasers, among others.
Sulfur Dioxide (SO_2)	This is a corrosive and poisonous gas produced mainly from the burning of sulfur containing fuel. Very little SO_2 is emitted from any aviation sources.
Surface Layer	The layer of air near the ground, generally 1 to 100 meters high, where surface features (e.g. trees, buildings) affect atmospheric turbulence and diffusion.
Thrust	A measure of the power generated by turbine engines. Thrust is measured in pounds (force) or kiloNewtons (kN). 1kN = 4,450 lb.
Tiering	Already published environmental analyses (EAs and EISs) of broader scope that are incorporated by reference in support of a specific project assessment or statement as a method of reducing paperwork to the best advantage of the NEPA and EIAP process.
Total Organic Gases (TOG)	This term includes all hydrocarbon compounds in an emission sample. See also HC and VOC. These terms are <u>not</u> interchangeable.
Total Suspended Particulate (TSP)	These are solid or liquid particles small enough to remain suspended in air. They range widely in size from particles visible as soot or smoke to those too small to detect except with an electron microscope.
Tribal Historic Preservation Officer (THPO)	A person appointed by a tribal government, under an ACHP approved historic preservation program, that provides expert advice to Federal agencies.
Transportation Control Plan (TCP)	A plan specifying measures to regulate the emission of pollutants from mobile sources.
Turbulence	Unsteady and irregular motions of air in the atmosphere.

Undertaking

Under the National Historic Preservation Act, any Federal action that may affect properties eligible for or listed in the National Register of Historical Places.

Vehicle Miles Traveled (VMT)

The sum of distances traveled by all motor vehicles in a specified region. VMT is equal to the total number of vehicle trips multiplied by the trip distance (measured in miles). This sum is used in computing an emission inventory for motor vehicles.

Volatile Organic Compounds (VOCs)

VOCs are created when fuels or organic waste materials are burned. Most HCs are presumed to be VOCs in the regulatory context, unless otherwise specified by the EPA.

Conversion Factors for Common Measures of Organic Air Pollutants

The aircraft engine emissions data referred to throughout this report exclude methane and ethane and are designated "total hydrocarbon" or HC. When methane and ethane are included, this is commonly referred to as "total organic gases" (TOG) or "total organic compounds" (TOC). These differences are artifacts of the different analytical techniques used to measure the pollutants. Neither measure is equivalent to EPA's commonly used "volatile organic compounds" or VOC. The following factors should be used to convert between these terms. The TOG and VOC equations may be reversed to convert from TOG to VOC and VOC to HC.

	Air Taxi & Commercial	Military	General Aviation
TOG =	VOC*1.1167	VOC*1.1147	VOC*1.1347
VOC =	HC*1.0947	HC*1.1046	HC*0.9708

1. INTRODUCTION

The air quality handbook was first published in 1982 by the Federal Aviation Administration (FAA) and the United States Air Force (USAF). This handbook provides additional and updated guidance to the air quality analyst/environmental specialist in assessing the air quality impact of a Federal project.

The procedures in this handbook are consistent with all current Federal air quality laws and regulations affecting aviation including the *National Environmental Policy Act*, Council on Environmental Quality regulations, *Clean Air Act* , as amended, and other related statutes, regulations, directives and orders. Most of the procedures and analyses discussed in this handbook apply to both airports and air bases. This handbook only addresses airport and air base actions within the U.S., its territories and possessions. Although this handbook does not cover actions abroad, many of the calculation methodologies and resources are still applicable. In addition, many of the references identified do address actions abroad and can be consulted for further information.

1.1 Regulatory Context

Air quality assessments for proposed Federal actions may be necessary for compliance with the requirements of the *National Environmental Policy Act*, the *Clean Air Act*, and other environment-related regulations and directives. There are Federal regulations and orders that establish air quality requirements applicable to both airports and air bases, as well as U.S. Department of Transportation (DOT)/FAA- or U.S. Department of Defense (DOD)/USAF-specific regulations and orders that cover aspects of air quality at airports or air bases, respectively. DOT and FAA orders can be obtained from the DOT Warehouse (Reference 56). DOD and USAF documents can be obtained from the National Technical Information Service (NTIS) (Reference 31). In addition to Federal requirements, many states and/or local areas have air quality requirements that may address airports and air bases. Relevant general, DOT/FAA-specific, and DOD/USAF-specific Federal requirements and documents are summarized below, along with a brief discussion of possible state and/or local requirements.

1.1.1 Federal Requirements and Documents- General

National Environmental Policy Act of 1969 (NEPA) - *NEPA* and its amendments, establish a broad national policy to protect the quality of the human environment and provide for the establishment of a Council on Environmental Quality. The act provides polices and goals to ensure that environmental considerations are given careful attention and appropriate weight in all decisions of the Federal Government. The *NEPA* environmental review process addresses impacts on the "natural world," such as air and water quality. It also addresses impacts on the human environment, such as noise, induced socioeconomic impacts, and land uses that result from Federal actions. It should reflect a thorough review of all relevant environmental factors, utilizing a systematic, interdisciplinary approach. Federal actions potentially subject to *NEPA* include grants, loans, contracts, leases, construction, research, rulemaking and regulatory actions, certifications, licensing, and permitting.

NEPA encourages and facilitates public involvement in the decisions by the Federal Government which affect the quality of the human environment. Federal agencies must assess and disclose the potential environmental impacts of proposed Federal actions.

NEPA requires all agencies of the Federal Government to:

I. Utilize a systematic, interdisciplinary approach in planning and decision-making that will ensure the integrated use of natural and social sciences,

II. Identify and develop methods and procedures in consultation with CEQ to ensure that environmental amenities and values may be given appropriate consideration in decision-making, use ecological and scientific information, disclose information to public and respond to public comments, and

III. In every recommendation or report on an action that affects the quality of the human environment include a detailed statement on

   A. the environmental impact of the proposed action,
   B. any adverse environmental effects that cannot be avoided should the proposal be implemented,
   C. alternatives to the proposed action,
   D. the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
   E. any irreversible and irretrievable commitments of resources should the proposed action be implemented.

Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA - The CEQ regulations implement the procedural provisions of NEPA.

In general, the CEQ regulations require a Federal agency to evaluate the potential environmental effects of a major action prior to its implementation and notify and involve the public in the agency's decision-making process. The regulations emphasize the importance of integrating the *NEPA* process into early project planning, and of consulting with the appropriate Federal, State, and local agencies early in the proceeding. The regulations also identify and describe the appropriate environmental documents (e.g., Environmental Assessment, Finding of No Significant Impact, Environmental Impact Statement) that serve to document compliance with *NEPA* requirements.

Executive Orders - There are several Executive Orders relating to *NEPA* that are general in nature, but should be consulted as they may affect an action's impact analysis. The following are examples of these orders *Executive Order 11514: Protection and Enhancement of Environmental Quality* (Reference 17) and *Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Reference 18*). Executive Order 11593: Protection and Enhancement of the Cultural Environment* (Reference 93*).*

Clean Air Act (CAA) - In 1967, the first *CAA* provided authority to establish air quality standards. Since the original act, subsequent efforts have established revisions that are more stringent and comprehensive, culminating in the *Clean Air Act Amendments of 1990 (CAAA)*. Principal features of the *CAAA* include a comprehensive strategy to achieve and maintain National Ambient Air Quality Standards (NAAQS) for specified criteria pollutants (ozone, carbon monoxide, particulates, sulfur dioxide, nitrogen dioxide, and lead, which are discussed in more detail below), further reductions in mobile source emissions, regulation of air toxics (e.g., hazardous air pollutants (HAPs)), establishment of a new acid rain control scheme, the phase-out of production and sale of ozone-depleting chemicals (e.g., chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)), and new enforcement sanctions.

Ambient air quality standards represent a critical element in the national environmental regulatory structure, and many of the most conspicuous environmental issues in the public arena relate to efforts on the part of regulators and the regulated community to attain these standards. Ground-level ozone, for example, poses a significant concern in many locations. Extensive regulations govern air emissions of so-called "ozone precursors," including nitrogen oxides and volatile organic compounds, in these regions. Each state with an ozone nonattainment region has developed a State Implementation Plan (SIP) with regulations that range from limiting industrial emissions of specific pollutants to regulations governing emission sources from manufacturing, transportation, and other sectors. Typically, a SIP addresses other nonattainment pollutants in a manner similar to that described for ozone.

The CAA and its amendments and its associated regulations are largely implemented by the States state level. Many states, as well as local jurisdictions, have additional State requirements pertaining to air pollution. As a result, air pollution control regulations can be quite complex and site- or area-specific.

The *CAA* and its associated regulations address air pollution control in two ways: an air quality-based approach and a technology-based approach, with the former being the most important for the purpose of this discussion. EPA has implemented the air quality approach by establishing a set of national ambient air quality standards for six "criteria pollutants:" ozone, carbon monoxide (CO), particulate matter (PM-10), sulfur oxide (SO_x), nitrogen dioxide (NO_x), and lead. States must identify geographic areas, termed "nonattainment" areas, that do not meet these air quality standards.

For nonattainment areas, the affected state must develop a state implementation plan (SIP) that includes a variety of emission control measures that the state deems necessary to ensure attainment of the standards in the future. Although developed initially by the state and local air pollution control officials, SIPs must be adopted by municipal and state governments and then approved by EPA. Once a SIP is fully approved, it (and any emissions control measures) is legally binding under both state and federal law, and may be enforced by either government. Many states have designated nonattainment areas and, subsequently, have adopted a SIP. If a SIP already exists, it must be revised as necessary to include and address emission control measures necessary to ensure attainment. An area previously designated nonattainment pursuant to the *CAA Amendments of 1990* and subsequently re-designated to attainment is termed a "maintenance" area. A maintenance area has a "maintenance" plan, or revision to the applicable SIP, to ensure attainment of the air quality standards.

General Conformity Rule - A key component of the *CAAA* strategy to achieve and maintain the NAAQS is the concept of "conformity," required in Section 176(c)(1) of the *CAAA*. Conformity is intended to ensure that the Federal government does not take, approve, or support actions that are in any way inconsistent with a State's plan to attain and maintain the NAAQS for criteria pollutants. The *CAAA* define conformity to a SIP as demonstrating consistency with the SIP's "purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards." For example, from a practical standpoint this means that emission increases that result from an airport project should not exceed the emission forecast or budget included in a SIP for that airport.

A transportation conformity determination is required for any highway or transit project which is proposed to receive funding assistance and approval through the Federal-Aid Highway program or the Federal mass transit program, OR requires Federal Highway Administration (FHWA) or Federal Transit Administration (FTA) approval for some aspect of the project, such as connection to an interstate highway or deviation from applicable design standards of the interstate system. 40 C.F.R. Part 51, Subpart T. This includes any facilities serving regional activity centers and other regional needs and regionally significant airport access projects.

Some additional regulations emanate from the National Historic Preservation Act of 1966, as amended (NHPA). This act requires Federal agencies to comply with provisions of the NHPA as well as with other historic preservation laws.

The requirement to consult the NHPA is triggered when a Federal undertaking may affect properties eligible for inclusion into or listing on the National Register of Historic Places. Consultations occur with the State and tribal Historic Preservation Officers and other interested parties. Air pollution can significantly affect historic properties. Therefore, compliance with historical preservation laws should be anticipated.

If eligible or listed properties occur in the area of potential effects and the undertaking is likely to adversely affect these properties, then an MOA is negotiated to mitigate. Otherwise, the Federal agencies must obtain concurrence from the SHPO and TPO for a "no effect" or "no adverse effect" determination.

1.1.2 Federal Requirements and Documents - DOT/FAA-Specific

DOT Order 5610.1C: ***Procedures for Considering Environmental Impacts*** - This order (Reference 55) establishes procedures for consideration of environmental impacts, including those affecting air quality, in decision-making on proposed DOT actions. It provides instructions for implementing *NEPA*, supplementing the CEQ regulations by applying them to DOT programs, which include FAA actions. The order also provides instructions for implementing relevant environmental laws and executive orders (e.g., the *Clean Air Act*, the *Department of Transportation Act of 1966*, the *National Historic Preservation Act of 1966*, Executive Order 12114).

49 U.S.C. 47106(c)(1)(B) as amended (formerly sections 509(b)(5) and (b)(7) of the *Airport and Airway Improvement Act of 1982* as amended) - This code (Reference 1) provides that a grant application for an airport project involving the location of the airport, runway, or major runway extension, will not be approved unless the State certifies that there is reasonable assurance that the project will be located, designed, constructed, and operated in compliance with applicable air quality standards.

49 U.S.C., Subtitle I, Section 303 (formerly DOT Section 4 [f]) -Section 4(f) of the *DOT Act* establishes the policy that "special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites." This act only applies to DOT agencies. It requires that the DOT cooperate and consult with States and other selected Federal departments to develop transportation plans and programs that include measures to maintain or enhance the natural beauty of lands.

FAA Order 5050.4, and any subsequent amendments, *Airport Environmental Handbook.* This order establishes guidance for FAA procedures for processing environmental assessments, findings of no significant impact, and environmental impact statements for airport development proposals and other airport actions as required by various laws and regulations. It is recommended for airport personnel, sponsors, and others involved in airport actions when considering environmental impacts, because it contains detailed guidance on preparing the

technical assessment of individual environmental impacts including air quality (Reference 63). Compliance with the order constitutes compliance with FAA order 1050.1 for airport actions.

FAA Order 1050.1, and any subsequent amendments: *Policies and Procedures for Considering Environmental Impacts* - This order (Reference 62) provides FAA policies and procedures for implementing *NEPA*, DOT Order 5610.1C, and other environment-related statutes, directives, and orders. The order clarifies the *NEPA* process in terms of planning, procedures, content and format, and public participation. It provides an overview of the various *NEPA* assessment documents, including Categorical Exclusions (CEs), Environmental Assessments (EAs), Findings of No Significant Impact (FONSIs), Environmental Impact Statements (EISs), and Records of Decision (RODs), as well as *NEPA* processing requirements.

Air quality is one of the environmental areas covered in this document. The discussion on air quality addresses relevant statutes, regulations, oversight agencies, requirements, FAA responsibilities, thresholds, and analysis of significant impacts.

When airport personnel, sponsors, and others involved in airport actions are considering environmental impacts, this order recommends using FAA Order 5050.4: *Airports Environmental Handbook*, which constitutes compliance with FAA Order 1050.1 for airport actions.

1.1.3 Federal Requirements and Documents - DOD/USAF-Specific

DOD Directive 6050.1: ***Environmental Effects in the United States of DOD Actions* -** This directive (Reference 45) implements the CEQ regulations discussed above and provides the policy and procedures for including environmental considerations in the decision-making process on DOD actions within the United States. The directive includes policy, responsibilities, how to determine if an Environmental Assessment (EA) or Environmental Impact Statement (EIS) is needed, EA content and format, and categorical exclusions.

U.S. Air Force Policy Directive (AFPD) 32-70: *Environmental Quality* - This directive (Reference 42) establishes the Air Force's policy in achieving and maintaining environmental quality and compliance with *NEPA* and Executive Order 12114. It addresses development and implementation of an Air Force Environmental Quality Program, establishes environmental authorities and responsibilities, and lists directives and laws implemented by this policy.

U.S. Air Force Instruction (AFI) 32-7061: *Environmental Impact Analysis Process (EIAP)* - This instruction (Reference 41), formerly Air Force Regulation (AFR) 19-2, implements AFPD 32-70 and describes specific tasks and procedures for the EIAP both within the United States and abroad. This instruction also identifies directives and instructions with further environmental requirements.

Environmental Impact Analysis Process*: Desk Reference* - This document (Reference 43), a guide prepared to assist Air Force staff in complying with the requirements of the *NEPA*, provides helpful reference materials that discuss these requirements in more detail. Sample documents are provided in attachments. Appropriate use of the reference helps to ensure that the environmental effects of proposed actions are considered in accordance with applicable requirements.

1.1.4 State and/or Local Requirements

In addition to Federal requirements, there often are state and/or local air quality requirements applicable to airport. These requirements vary widely from location to location, and are more appropriate to address on a project-by-project basis. Examples of state and/or local air quality requirements applicable to airport projects are state indirect source thresholds, state-level environmental assessments, approved state general conformity rules, and state and local ambient air quality standards. The analyst/specialist is directed to review state and local regulations at various points throughout the handbook and as early in the assessment process as possible.

2. AIR QUALITY ASSESSMENT PROCESS

As Federal agencies, the FAA and U.S. Air Force are required under the *NEPA* to prepare an environmental document(e.g., EIS, EA, or categorical exclusion) for major federal actions that have the potential to effect the quality of the human environment. An air quality assessment prepared for inclusion in a NEPA environmental document, or as a separate reporting document, (e.g., conformity determination), should include an analysis and conclusions which addresses the attainment and maintenance of established air quality standards (e.g., National Ambient Air Quality Standards, air toxic requirements).

In addition to Federal requirements there may be State and local air quality requirements to abide by. These requirements can include, but are not limited to, provisions such as state indirect source regulations, environmental policy acts, and local ambient air quality standards[1].

This section discusses the key steps, the agencies and individuals, and the screening thresholds involved in the air quality assessment process. The procedures discussed in this section are consistent with those provided in FAA Order 1050.1, and any subsequent amendments: *Policies and Procedures for Considering Environmental Impacts* and U.S. Air Force Instruction 32-7061: *EIAP*. These procedures ensure compliance with *NEPA*, *CAAA*, and 49 U.S.C. 47106(c)(1)(B). There are recommended and required time periods associated with many steps (for example, mandatory public comment periods); consult the appropriate agency document (i.e., FAA Order 1050.1/5050.4, and any subsequent amendments or USAF Instruction 32-7061) for more information.

2.1 Assessment Process Steps

The process for assessing the air quality impacts of FAA and USAF proposed actions involves the following key steps*:

- Project definition,
- Inventory of emissions,
- Indirect source review,
- Assessment of transportation and general conformity with SIP, and
- Assessment of NAAQS.

Fortunately for the air quality analyst/environmental specialist, not all of the steps are required for every action. Many projects at airports and air bases are too small to require detailed air quality analysis and only a few projects are both broad enough in scope and located in nonattainment or maintenance areas such that the full complement of analyses described in this handbook would be required. Screening techniques that streamline the process for many air quality assessment actions are available and discussed later in this section (Section 2.3). Figure 1 provides a detailed look at the assessment process and includes some decision points that may allow a particular project to bypass certain steps. As Figure 1 indicates, analysis of projects located in nonattainment and maintenance areas is more complex than for projects in attainment areas.

[1] This handbook only discusses state and local requirements in general terms. Actual requirements must be considered on an individual project basis.

* These key steps have various "sub-steps" that are performed, including evaluating applicable screening thresholds and dispersion modeling. The second key step, inventory of emissions, may be a separate analysis or "sub-step" under another key step (e.g., conformity or NAAQS Assessment).

The following sub-sections discuss the key steps of an air quality assessment process. Figures 1 & 2 summarize the types of air quality analyses often required for airport and air base projects and indicates the different projects that require each type of analysis.

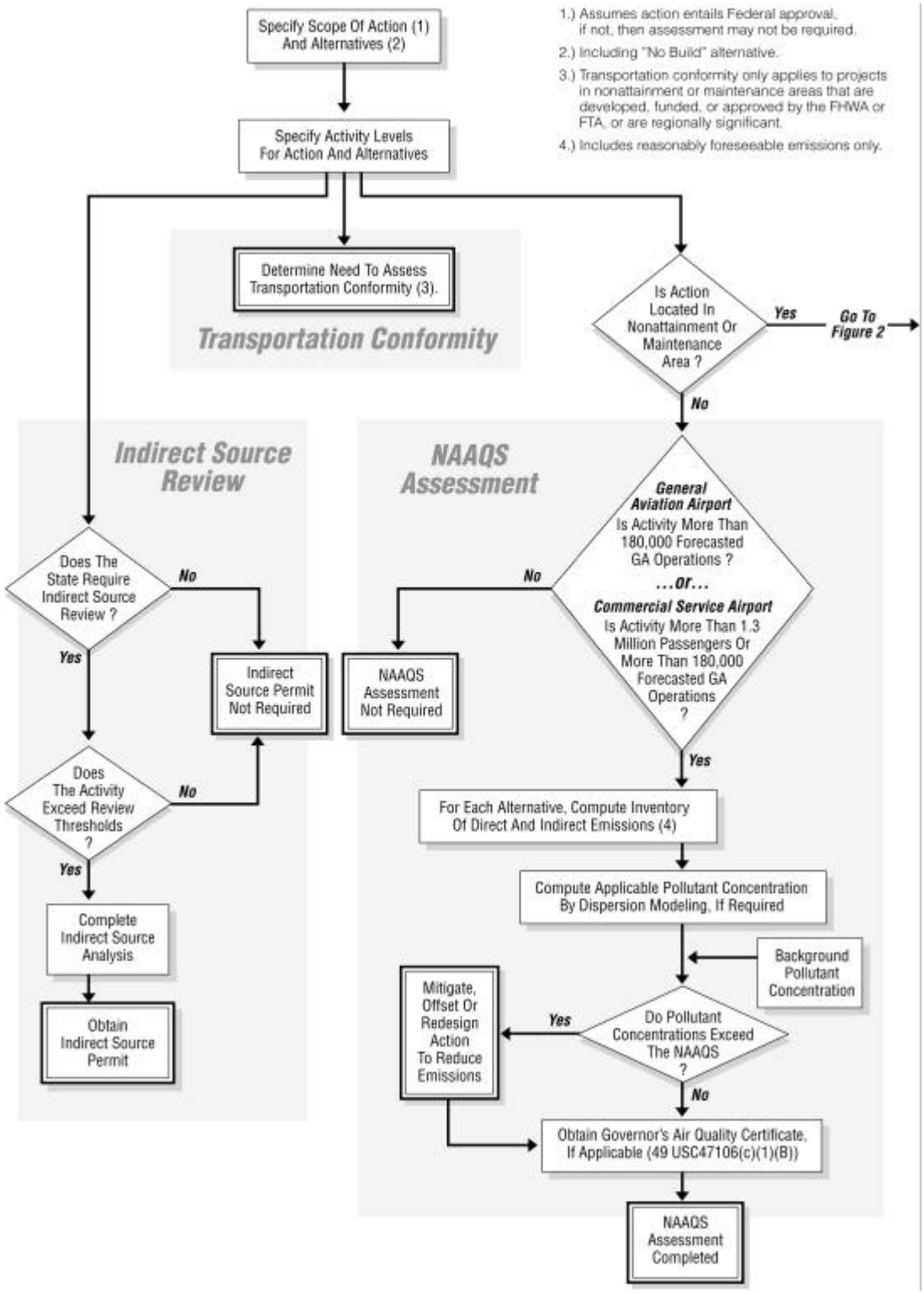

Figure 1. Air Quality Assessment Process for Airports and Air Bases - Part 1

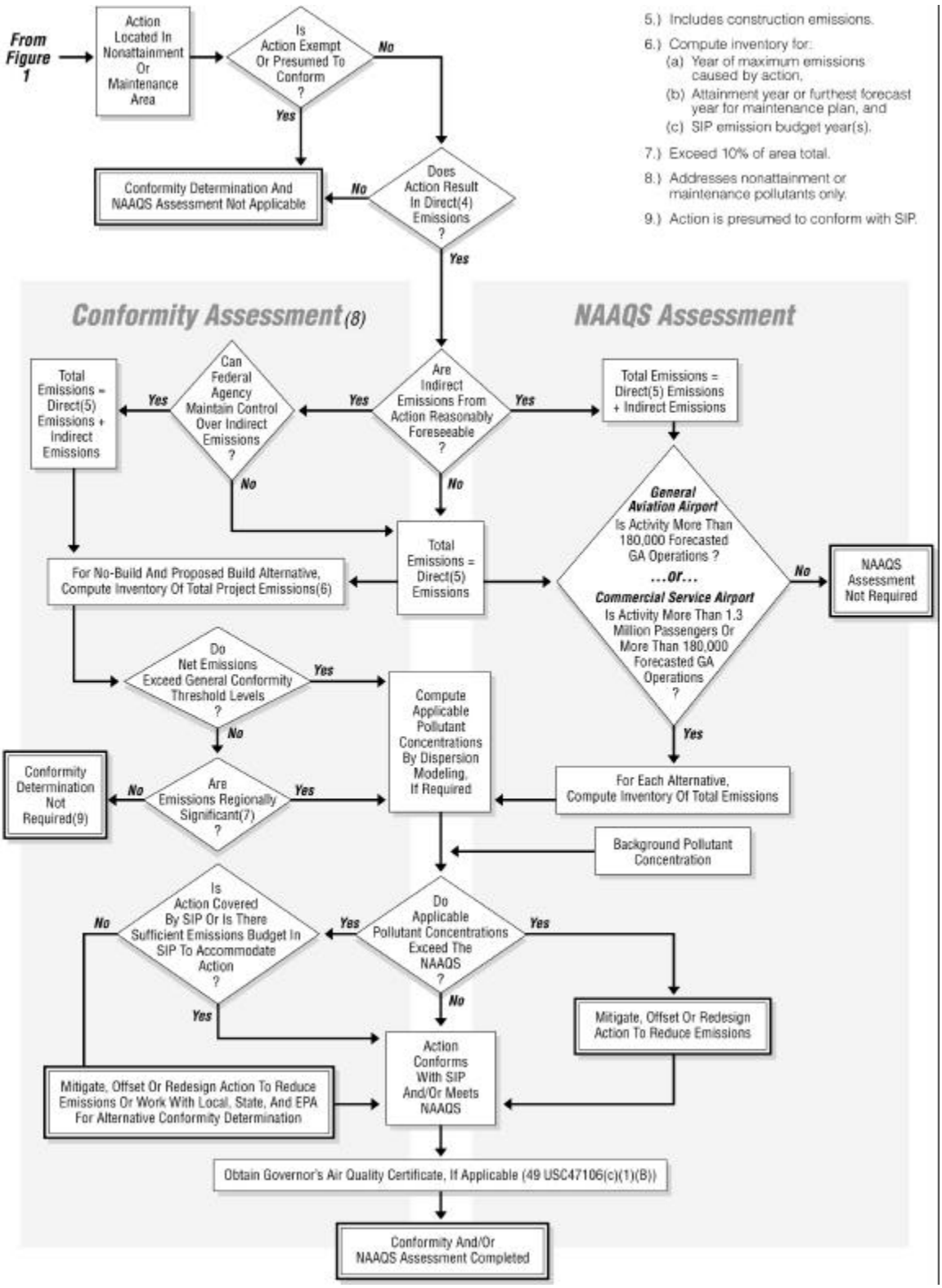

Figure 2. Air Quality Assessment Process for Airports and Air Bases - Part 2

2.1.1 Project Definition

The first step of the air quality assessment process, illustrated in Figure 1, is to define the scope and alternatives of the project or Federal action (if not already accomplished through the EA/EIS scoping process). This provides the structure and definition to guide subsequent data collection and analysis activities. Reasonable project options should be identified, including "build" and "no-build" alternatives.

"Build" alternatives reflect projected airport or air base related operations after a project's completion. The "no-build" alternatives reflect projected airport or air base related operations as they are projected to be in the future without the project's implementation. The "build" and "no-build" alternatives are compared to identify the project's overall environmental impacts.

2.1.2 Emission Inventory

An emission inventory provides a first indication of the magnitude of a proposed project's potential environmental impact. The emission inventory provides the total amount or mass of pollutants generated by all sources affected by the projects during a specified period of time (e.g., tons per year). An inventory may include both direct and indirect emissions. See section three for a detailed discussion. The emission inventory often is used as the basis for further analysis (e.g., SIP, NAAQS, conformity process). Individual pollutants of concern at airports and air bases primarily[2] include CO, NO_x, particulate matter less than 10 micrometers in diameter (PM-10), HC, and in some cases SO_x. Developing an emission inventory involves considerable data collection reflecting the level of activity at the airport or air base and the specific emission sources present.

The scenarios for which an emission inventory must be calculated vary depending on the analysis being performed (e.g. conformity, NAAQS, or SIP process). For a conformity assessment, only the "build" and "no-build" emissions are analyzed (including construction emissions, which are the projected temporary emissions resulting from project construction). The difference between the two emission inventories, in turn, equate to the emissions directly attributable to the project. While it is feasible to calculate project emissions directly, rather than as the difference between two cases, this is recommended only for screening project options. Changes that affect congestion or delay for aircraft or ground access vehicles have many secondary effects that are difficult or impossible to calculate directly. Conversely, for a NAAQS assessment, emissions must be estimated for <u>each reasonable</u> "build" and "no-build" alternative.

"Build" and "no-build" emission inventories should be prepared for the same year. It often will be necessary to calculate emission impacts for future attainment years as well as for the year during which the total direct and indirect emissions are greatest. In addition, an emissions inventory will represent the <u>net</u> emissions, which is the sum of emission increases and decreases.

[2] Analyses routinely do not consider the pollutant lead (Pb) since airports and air bases typically are not a significant source of lead emissions. The chief source of lead at airports and air bases is the combustion of leaded aviation gasoline in piston-engine aircraft. An analysis may need to consider lead if an airport or air base has a significant amount of emissions from the combustion of leaded aviation gasoline in piston-engine aircraft.

The type of emissions to include in each scenario also vary depending on the analysis being performed. For example, under conformity regulations, emissions included in the inventory are limited to those that the Federal agency can "practicably control and will maintain control over due to a continuing program responsibility of the Federal agency" (Reference 7).

Emission inventories can be very complex and difficult to calculate. For a more detailed discussion on creating an emissions inventory, see Section Three.

2.1.3 Indirect Source Review

Some states require a review of emissions from indirect sources. In general, indirect sources are stationary sources that attract or may attract sources of pollution (e.g., vehicles) and thus indirectly cause the emission of air contaminants. Such indirect sources include airports as well as highways and roads, parking facilities, sports and entertainment facilities, and office buildings. The definition of indirect source may vary slightly by state. At this writing, indirect source review requirements are required only for projects in certain parts of California, Connecticut, Minnesota, New York, North Carolina, Oregon, Utah, Vermont, and Wisconsin.

The states that require indirect source review generally establish thresholds that serve as guidelines for applying these rules. For example, a state may require indirect source review for all projects that increase the total airport passengers by more than 100,000 passengers, add 1,000 new parking spaces, or increase aircraft operations by 1,000. Projects that exceed these thresholds could be required to complete an indirect source analysis and obtain an indirect source permit. See Appendix J for more information on state threshold criteria for indirect source review.

2.1.4 Conformity

The FAA and USAF as Federal agencies are required to assure that an applicable proposed action in a non-attainment or maintenance area "conforms" to any relevant State Implementation Plan (SIP). This entails determining whether the emissions caused by the action at the airport or air base are consistent with the state's plan to meet the Federal air quality standards. Federal actions subject to conformity are divided into two categories: transportation conformity and general conformity.

A transportation conformity determination is required for any highway or transit project which is proposed to receive funding assistance and approval through the Federal -Aid Highway program or the Federal mass transit program, OR requires Federal Highway Administration (FHWA) or Federal Transit Administration (FTA) approval for some aspect of the project, such as connection to an interstate highway or deviation from applicable design standards on the interstate system. 40 C.F.R. Part 51, Subpart T. Under such circumstances either the FHWA or the FTA would be responsible for completing the transportation conformity determination not the FAA or USAF. A transportation conformity determination is NOT required for INDIVIDUAL PROJECTS which are NOT FHWA/FTA projects EXCEPT that Section 51.450 applies where the highway or transit project is of REGIONAL SIGNIFICANCE.

Pursuant to Section 51.392, a project is of regional significance when it is on a facility which serves regional transportational needs (such as access to and from the area outside the region, major activity centers in the regions, major planned developments such as new retail malls, sport complexes, etc., or transportation terminals as well as most terminals themselves) AND would normally be included in the modeling of a metropolitan area's transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel. Projects of regional significance, REGARDLESS OF FUNDING SOURCE, must comply with Section 51.450.

A transportation conformity determination is also required where a Metropolitan Planning Organization (MPO) is involved in the development, funding, or approval of a transportation plan, program, or project. An MPO is an organization designated as being responsible, together with the State, for conducting and continuing , cooperative, and comprehensive planning process under 23 U.S.C. 134 and 49 U.S.C. 1607.

Although neither the FAA nor the USAF are directly responsible for assessing Transportation Conformity, there are coordination requirements concerning off-site impacts of motor vehicles and conformity determinations for local and regional planning. Since Transportation Conformity ultimately is not the FAA's nor the USAF's responsibility, it only is discussed briefly in this handbook, (See Section five).

General conformity applies to all other actions in non-attainment or maintenance areas not specifically covered by transportation conformity. To determine whether general conformity requirements apply to an action, the agency in charge must consider the nonattainment and maintenance status of the area, the exemptions from and presumptions to conformity, the project's emissions, and the regional significance of the project's emissions. The current conformity rule only applies to actions located in nonattainment and maintenance areas.

Subsequently, when evaluating conformity applicability, the first question is whether the action is located in an area this is in nonattainment or maintenance for any of the six criteria pollutants found at 40 C.F.R. Section 51.853 (b) (1) & (2) [93.153 (b) (1) & (2)]. The second step is to determine whether the proposed action falls under an exemption or presumption of conformity as identified in the regulations. A conformity determination is not required where a federal action is exempt from the requirements. A conformity determination is not required for a federal action that is presumed to conform ONLY where said action is also not "regionally significant" 40 C.F.R. Section 51.853 (j) [93.153 (j)]. If the federal action is neither presumed to conform nor exempt, then the agency must determine whether for each pollutant the total direct and indirect emissions in a nonattainment area caused by the federal action is equal or exceeds any threshold emission levels (rates) identified in 40 C.F.R. Section 51.853 (b) (1) or (2) [93.153.(b) (1) & (2)]. A conformity determination is not required where the air pollutant emissions of a federal action do not equal or exceed the threshold emission levels but only when said action is also not regionally significant. 40 C.F.R. Section 51.853 (I) [93.153 (i)] (defined below). However, it is assumed that a conformity assessment is not required for an airport or air base action that is presumed to conform since it is unlikely that the emission levels would be regionally significant.

The general conformity threshold emission levels are based on the proposed project's net annual emissions (proposed federal action emission levels minus the no action emission levels), which is the sum of direct (including construction) and indirect emissions. Similar to indirect source requirements, the conformity regulations limit the inclusion of indirect emissions to those that "are caused by the federal action, but may occur later in time and/or may be farther removed in distance from the action itself but are still reasonably foreseeable" and "the federal agency can practicably control and will maintain to control over due to a continuing program responsibility of the Federal agency" 40 C.F.R. Section 51.853 [93.152].

Lastly, even if a Federal action does not exceed the threshold emission levels, it still is subject to a general conformity determination if it is regionally significant[3]. The Federal action is considered "regionally significant" if the total of direct and indirect emissions of any pollutant from a Federal action represents 10% or more of a maintenance or nonattainment area's total emissions of that pollutant. An action that is "regionally significant" must meet the requirements

[3] It is unlikely that an airport or air base action that does not exceed the threshold emission levels would be regionally significant.

of Section 51.850, and 51.855 through 51.860 [93.150, 93.155 through 93.160]. In other words, a conformity determination will be required. See 40 C.F. R. Section 51.853 (i) & (j) [93.153 (i) & (j)]. See Section **Five** for more information on General Conformity.

To determine conformity, applicable pollutant concentrations are computed by dispersion modeling, combined with background pollutant concentrations, and compared with NAAQS for exceedance. If pollutant concentrations do not exceed the NAAQS, the action conforms. If NAAQS are exceeded, two alternatives apply: The action can be demonstrated to conform by coordinating an alternative conformity determination with the local, State, and EPA representatives, or the Federal action can be mitigated, offset, or redesigned to reduce overall emissions. See Section Five for more information on General Conformity.

Determination that a Federal action conforms with the applicable implementation plan does not exempt the action from meeting other requirements of the applicable implementation, NEPA or the CAA. If both an environmental document and a conformity document are required, the conformity documentation or procedures can be combined with the environmental document or procedures (e.g., the conformity determination can be included in an Environmental Impact Statement, or public notices can be combined), or the documents can be prepared separately.

2.1.5 NAAQS Assessment

Air quality is assessed based on a comparison of the NAAQS for each criteria pollutant with the projected pollutant concentrations at the airport or air base. To determine whether the NAAQS must be assessed, the Federal agency first must consider whether the action is an advisory, emergency, or excluded activity. Some Federal actions are advisory in nature (e.g., an airspace determination) and do not require an air quality impact analysis or documentation. An emergency action is an action undertaken in the case of an emergency, disaster, or other similar great urgency. Categorically excluded activities do not individually or cumulatively have a significant effect on the human environment based on agency experience (e.g., issuance of airport planning grants) and do not require preparation of an environmental document. Lists of specific advisory, emergency, and excluded activities are provided in the FAA Order 1050.1 and 5050.4 and/or the USAF *EIAP: Desk Reference*. If the action is an advisory, emergency , or excluded activity, no further action is required.

If the action is not an advisory, emergency, or an excluded activity, screening techniques are used to evaluate whether performing an NAAQS assessment should be considered. *If the action is in a nonattainment or maintenance area and exempt or presumed to conform under conformity requirements, it is assumed that a NAAQS assessment is not required for an airport or air base action (since it is unlikely the action's pollutant concentrations would exceed the NAAQS).* If the action is in a nonattainment or maintenance area, but it is not exempt or presumed to conform, the screening technique (based on passengers and operations) outlined in the threshold analysis discussion following should applied. If the action is in an attainment area, this screening technique also should be applied. See the threshold analysis discussion following for more information.

If a NAAQS assessment is needed, the airport's or air base's "build" and "no-build" emissions are inventoried for each reasonable alternative. The inventory should include both direct and indirect emissions (see section 3 for a more thorough discussion). For this analysis, indirect emissions are not limited to those that the Federal agency can practicably control (as under conformity). The airport's or air base's emissions for the proposed build case then are translated into pollutant concentrations using a dispersion model. This step is very data and computation

intensive and may need to be performed for both "general" airport pollutant concentrations and/or intersection pollutant concentrations.

Assessing NAAQS for "general" airport concentrations requires identifying all emission sources at the airport or air base by individual location, quantifying their peak and temporal emission rates, analyzing the emissions in the context of local weather (which could include hourly conditions of a year or more), and determining the resulting pollutant concentration at receptor sites in the vicinity of the airport.

If congestion increases at off-airport or air base highway intersections due to increased traffic coming to the airport or air base due to an airport/air base action, CO emissions may exceed the NAAQS. As a result, special intersection analysis should be performed to determine the likelihood of a violation occurring as a result of the airport or air base project. For an intersection assessment, the pollutant concentrations would be analyzed at each applicable intersection. For EPA guidance on a methodology for evaluating air quality impacts at one or more roadway intersections where vehicle traffic will cause or contribute to increased emissions of carbon monoxide (CO) see EPA's *Guideline For Modeling Carbon Monoxide From Roadway Intersections*. For an intersection assessment, state or regional air quality regulatory staff or the regional transportation planning staff should be consulted.

Once dispersion modeling has been performed, pollutant concentrations are combined with background pollutant concentrations and compared to the NAAQS. If concentrations do not exceed the NAAQS, an air quality certificate is obtained from the Governor (if applicable) and the assessment is complete. If pollutant concentrations do exceed the NAAQS, emissions must be mitigated or offset, or the action redesigned to reduce emissions.

2.2 Assessment Process Participants

Many different agencies and individuals must be involved when assessing the air quality impact of a project, since Federal, State, and local requirements all must be considered. This coordination, and subsequent analysis, are time consuming and need to be addressed early in the assessment process. Common participants include the airport sponsor or USAF, the FAA, the EPA, the State, the local air quality management district (AQMD), the local metropolitan planning organization (MPO), contractors, and the public. These participants contribute to various stages of the assessment process such as information gathering, scoping meetings, developing modeling consensus, and obtaining consensus on air quality analysis and conformity determination. The airport sponsor's or USAF's responsibilities include defining the project and alternatives and preparing environmental documents. The FAA, as well as the USAF, have the responsibility to analyze the environmental impacts associated with the proposed Federal airport action. Agency documents previously referenced also contain guidance on agency offices/personnel to contact during this process.

2.3 Screening Thresholds

Many projects at airports and air bases are too small to require a detailed air quality analysis and only a few projects are both broad enough in scope and located in nonattainment areas such that the full complement of analyses described in this document would be required. To determine which of the steps identified in section 2.1 will be required, applicable screening threshold levels are reviewed. The performance an Emissions Inventory is dependent on how the analysis is to be used to fulfill Indirect Source Review, Conformity, NAAQS or other requirements.

The following sub-sections define the threshold levels for Indirect Source Review, Transportation Conformity, General Conformity and NAAQS. In addition to summarizing air quality analyses that often are required for different projects, Figure 2 also addresses the specific threshold levels.

2.3.1 Indirect Source Review

Indirect source review requirements are state-specific and at this writing are required only for projects in certain parts of California, Connecticut, Minnesota, New York, North Carolina, Oregon, Utah, Vermont, and Wisconsin. Typically, thresholds are set for secondary measures of emissions rather than calculated emissions. Common thresholds are: number of added parking spaces, total parking spaces, increased highway trips, total highway trips, increased aircraft LTOs, and total aircraft LTOs. Appendix J, State Indirect Source Review Regulations, summarizes the threshold values for the states having indirect source review requirements as of this writing.

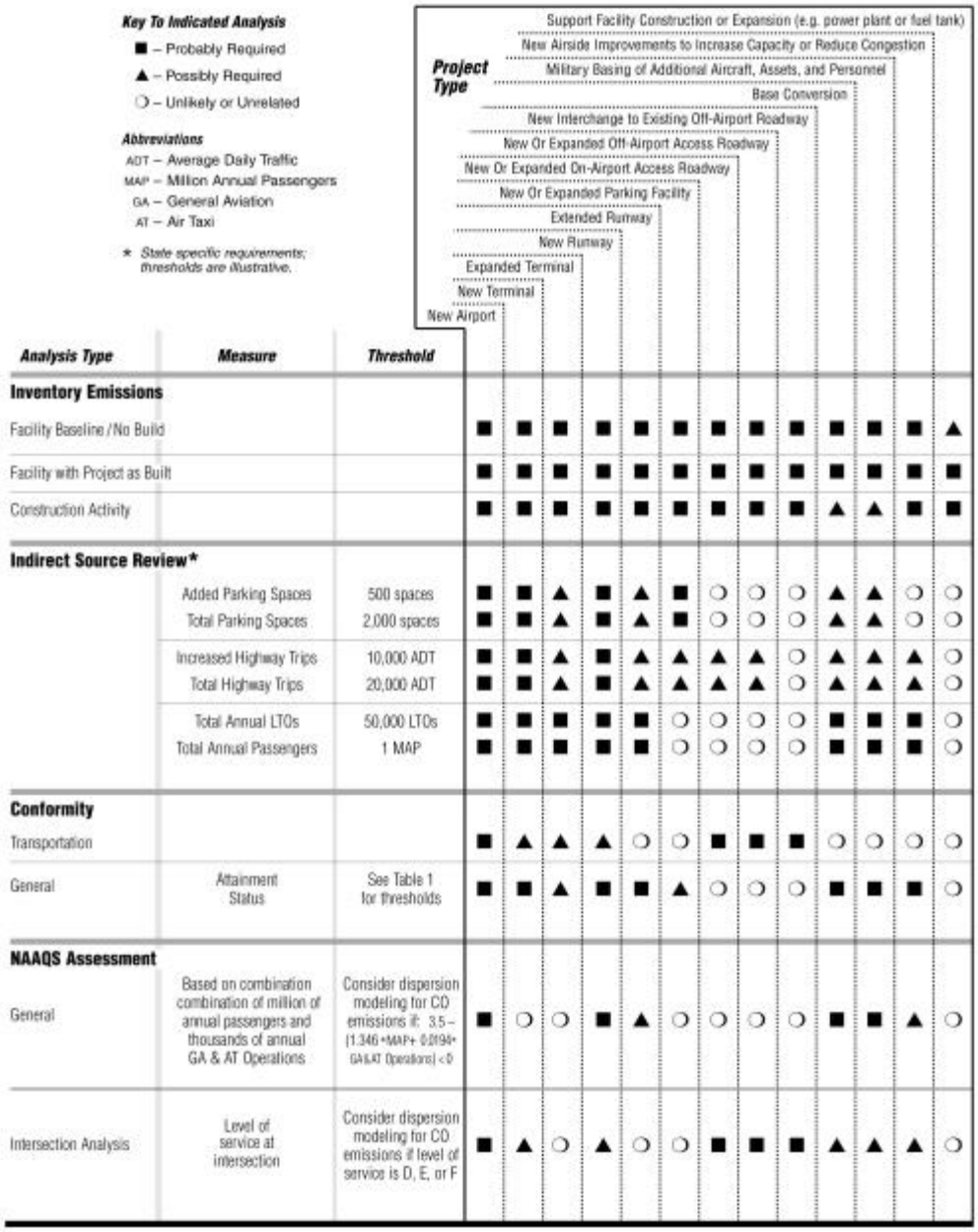

Figure 3. Air Quality Analysis Guidelines and Thresholds

2.3.2 Transportation Conformity

Transportation conformity determinations are required for all nonattainment and maintenance area highway or transit projects that are developed, funded or approved by the Federal Highway Administration or Federal Transit Administration for some aspect of the project. Transportation conformity also applies to projects that are "regionally significant". A "regionally significant" project is a transportation project that is on a facility serving regional transportation needs and would normally be included in the modeling of a metropolitan areas transportation network. In the case of an airport or air base in a nonattainment or maintenance area, almost any roadway or transit project off the airport or air base boundary will require transportation conformity analysis and will likely be included in the region's transportation plan. Even if an access project is not expected to use highway or transit funds, certain provisions of the transportation conformity rule may apply to the project. These projects must be included in the regional emissions analysis for a transportation plan or TIP (40 CFR 93.130 and 40 CFR 51.452).

In addition, no agency that receives Federal highway or transit funds may approve a "regionally significant" highway or transit project, regardless of the funding source, unless either it comes from a conforming plan and TIP, is in the regional emissions analysis supporting the currently conforming TIP, or meets other tests (40 CFR 93.129 and 40 CFR 51.450). This analysis applies only to the pollutant(s) for which the area is nonattainment or maintenance.

2.3.3 General Conformity

As discussed previously, general conformity only applies to proposed projects at airports and air bases located in nonattainment and maintenance areas. In addition to this, the General Conformity Rule contains exemptions from and presumptions of conformity. For applicable projects, general conformity determinations are required if the project's net annual emissions exceed established threshold rates. The threshold rates vary by pollutant and the area's nonattainment and maintenance status. Table 1, General Conformity Threshold Rates, summarizes the threshold values. However, even an action that is presumed to conform or that does not exceed emission thresholds, is still subject to conformity requirements if it is "regionally significant". (It is unlikely that an airport or air base action that is presumed to conform or does not exceed the threshold emission levels would qualify as "regionally significant".) If the direct and indirect emissions from the Federal action exceed 10 percent of the total emissions inventory for a particular criteria pollutant in a nonattainment or maintenance area, the action is considered to be a "regionally significant" activity and conformity requirements to apply. Section Five contains more specific information on Conformity issues.

Non-attainment Status	VOCs (Ozone Nonattain-ment Areas)	NO_x (Ozone Nonattain-ment Areas)	Carbon Monoxide (CO)	Sulfur or Nitrogen Oxides (SO_2 or NO_x)	Particulate Matter (PM)
Extreme	10	10	NA	NA	NA
Severe	25	25	NA	NA	NA
Serious	50	50	100	NA	70
Marginal (inside an ozone transport region)	50	100	NA	NA	NA
Marginal (outside an ozone transport region)	100	100	NA	NA	NA
Moderate (inside an ozone transport region)	50	100	100	100	100
Moderate (outside an ozone transport region)	100	100	100	100	100
Maintenance (inside an ozone transport region)	50	100	100	100	100
Maintenance (outside an ozone transport region)	100	100	100	100	100

Table 1: General Conformity Threshold Rates

(tons per year)

2.3.4 NAAQS Assessment - General

A comparison of the actions' resulting air quality with NAAQS should be considered if pollutant levels are likely to exceed the NAAQS. The number of passengers at larger commercial airports and the level of general aviation and air taxi operations at smaller airports are likely to be good indicators of potential pollutant concerns. For airports, a main pollutant of concern from an air quality standpoint is CO. Cars and aircraft (especially GA) emit moderate amounts of CO while they are idling or taxiing, respectively. Significant road congestion or airport ground delays could potentially cause CO emissions to approach the NAAQS. Actions that would not increase airport capacity, lead to increased congestion of roadways or airfields, or relocate aircraft or vehicular activity closer to sensitive receptors are not likely to exceed the NAAQS for CO. For deciding whether or not a NAAQS assessment should be considered, the total number of airport

passengers and general aviation/air taxi operations should be evaluated. If the level of annual enplanements exceeds 1,300,000 (or 2.6 MAP), the level of general aviation and air taxi activity exceeds 180,000 operations[4] per year or a combination thereof, a NAAQS assessment should be considered. These levels were estimated based on a parametric analysis of concentrations produced by aircraft and other airport sources. The relation between these two factors is incorporated into Equation 1 (Illustrated in Figure 4). The equation can be used as a guide for determining whether a NAAQS assessment should be considered.

$$3.5 - (1.346 \times \text{Million Annual Passengers} + 0.0194 \times \text{General Aviation \& Air Taxi LTOs}) < 0$$

Equation 1: Dispersion Modeling Threshold

If the above equation is <u>not</u> true, a NAAQS assessment does not have to be considered. Otherwise, a NAAQS assessment (including dispersion modeling) should be considered. To determine if a NAAQS assessment should be performed, the nature of the project should be considered in consultation with state or regional air quality regulatory staff. The nature of the project must be considered since special project concerns and characteristics or high background levels of CO may suggest that a NAAQS assessment is indicated at lower activity levels or not at all.

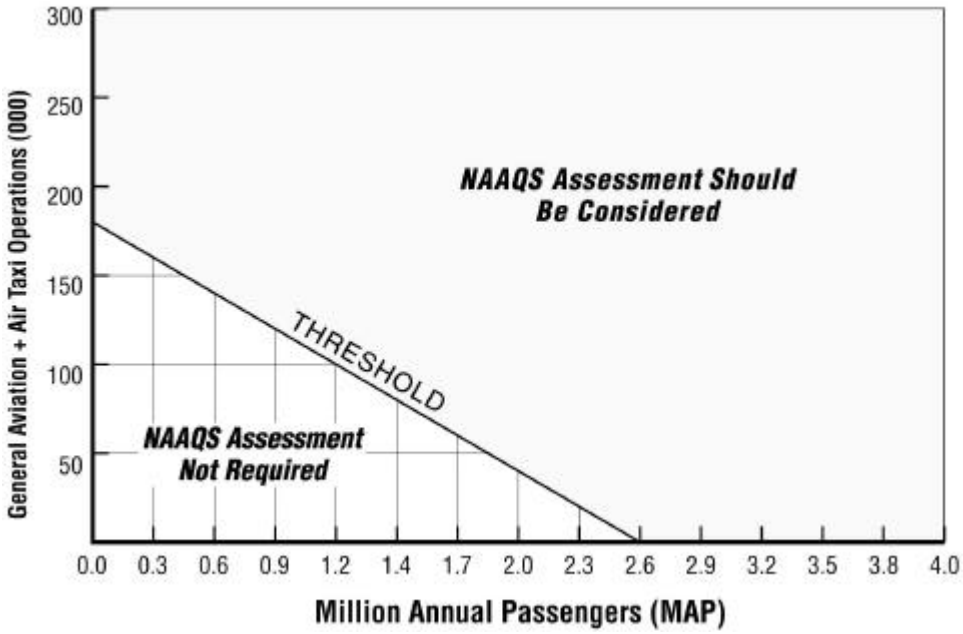

Figure 4. Airport Activity Threshold For NAAQS Assessment

[4] Operations based on an LTO cycle. One landing and one takeoff equal 1 LTO.

2.3.5 NAAQS Assessment - Roadway Intersection Analysis

If a project has the potential to adversely affect the air quality at a roadway intersection (e.g. by significantly increasing traffic volume), CO emissions may exceed the NAAQS. In such cases, a comparison with the NAAQS should be considered. Intersections with the highest traffic volumes and lowest Level-of-Service (LOS) ratings are considered and selected for modeling. LOS ratings measure the operating conditions at the intersection and how these conditions affect traffic volume, signal timing, and related congestion delays. There are six LOS rankings: LOS A through LOS F. LOS A is the highest ranking relating to delays of less than 5.0 seconds per vehicle. LOS F is the lowest, describing operations with delays greater than 60.0 seconds per vehicle. If the top intersections selected for modeling do not show an exceedance of the NAAQS, it is assumed that none of the other intersections will exceed either. Intersections that should be considered for modeling are called Critical intersections. Critical intersections have LOS ratings of D, E, or F or are intersections that have dropped to those levels due to increased traffic volumes or to construction related to a new project in the vicinity.

Intersection modeling may be required based on other special considerations or indications. State or regional air quality regulatory staff or the regional transportation planning staff should be consulted. For EPA guidance on a methodology for evaluating air quality impacts at one or more roadway intersections where vehicle traffic will cause or contribute to increased emissions of carbon monoxide (CO), please refer to EPA's *Guideline For Modeling Carbon Monoxide From Roadway Intersections* (Reference 74).

3. EMISSIONS ASSESSMENT

3.1 Introduction

After defining a proposed project and any alternatives, creating an emission inventory is an important step in assessing air quality. An emissions inventory provides a first indication of the magnitude of a proposed project's potential environmental impact. An emissions inventory provides the total amount or mass of pollutants generated by emission sources during a specified period of time (e.g., tons per year). To determine the emission inventory of an airport or air base, emissions are calculated for all relevant sources and operators and then totaled. Potential sources of emissions at airports and air bases include aircraft, ground support equipment, ground access vehicles, stationary sources, and construction activities[5]. Examples of potential operators include the FAA, the Air Force, the airport authority, airlines, fixed base operators (FBOs), rental car agencies, or individual passengers or employees.

The emissions inventory can be created for various purposes. It can be used to compare various proposed project alternatives (e.g., "build" and "no-build" alternatives), a proposed project's emissions to the total emissions of the local air quality area, or a proposed project's emissions to regulatory thresholds (e.g., general conformity thresholds). The inventory may also be used as part of the State Implementation Plan (SIP) emission inventory.

An inventory may include both direct and indirect emissions. Direct emissions are those emissions that are caused or initiated by a Federal action and occur at the same time and place as the action. Indirect emissions are those that are caused by a Federal action, but may occur later in time and/or may be farther removed in distance from the action itself but are still reasonably foreseeable. Under conformity, indirect emissions are further limited to those that the Federal agency can practicably control and will maintain control over due to a continuing program responsibility of the Federal agency. Motor vehicle emission that result from passengers or employees coming to the airport or air base are the most typical indirect emissions. An example of motor vehicle emissions that are indirect emissions of an action is a planned airport capacity increase that is expected to generate additional passenger traffic to the airport (i.e., caused by the action and foreseeable). In this example, the indirect emissions would be the sum of the motor vehicle emissions resulting from new passenger and employee traffic for an average commute trip distance (as well as any emissions decrease due to a reduction in vehicle traffic). Vehicle emissions while on the airport's property would be included in direct emissions and would be excluded from indirect emissions to avoid double counting.

This section summarizes the various types of emissions sources and models available to aid in the calculation of an emission inventory.

[5] Construction activity is short-term and temporary in nature. Examples include construction of a new or modified runway, roadway, parking facility, or terminal. Emission sources, calculation methodologies, and data inputs vary slightly when evaluating construction impacts.

3.2 Emission Sources

3.2.1 Aircraft

The sources of aircraft emissions addressed in this handbook are: commercial aircraft, general aviation and air taxi aircraft, and military aircraft.

Commercial aircraft are operated on a scheduled basis by civilian international, national, regional and commuter air carriers. Commercial aircraft also are operated on an unscheduled basis by civilian charter operators. In addition to aircraft, emission sources related to air carrier aircraft operations include auxiliary power units (APUs) and ground support equipment (GSE), discussed separately below.

General aviation aircraft are privately owned and operated on a non-scheduled basis at a variety of facilities ranging from commercial airports to small privately owned airstrips. Air taxis are non-air carrier commercial operators that fly scheduled service carrying passengers and freight on a limited basis. The smaller general aviation and air taxi aircraft generally do not require APUs and GSE.

Military aircraft are operated by the Department of Defense (DOD). Military aviation includes the full spectrum or aircraft types, ranging from high performance jet fighters to large transports to small piston engine aircraft. Most military aircraft operations occur at DOD-operated air bases, but certain operations can take place at civilian airports as well. Examples of such activity include National Guard or active duty military aircraft based at a civilian facility and military transports shuttling personnel to a civilian airport. Emissions from military aircraft encompass those occurring at both military and civilian facilities. Civil aircraft also may shuttle personnel between a military and civilian facility. The emissions of civil aircraft operations at DOD-operated air bases also are attributed to the air base. Emission sources related to military aircraft include APUs and GSE, discussed separately below.

A significant consideration for airport and air base emission inventories is that aircraft not only operate on the ground but emit pollutants, during their flight in the atmosphere. Due to atmospheric mixing, some of these emissions affect ground level pollutant concentrations. The portion of the atmosphere that is completely mixed begins at the earth's surface and may extend to a height of a few thousand feet. The volume is often referred to as the mixing zone or inversion layer. The height to which the mixing zone extends is called the mixing height. All pollutant emissions in the mixing zone must be accounted for in a complete airport or air base emissions inventory.

The aircraft operations of interest within the mixing zone are defined as those in the landing and takeoff (LTO) cycle. The standard LTO cycle begins when the aircraft enters the mixing zone as it approaches the airport on its descent from cruising altitude, lands and taxis to the gate. The cycle continues as the aircraft taxis back out to the runway, takes off, and climbs out of the mixing zone and back up to cruising altitude. The five specific operating modes in a standard LTO are: approach, taxi/idle-in, taxi/idle-out, takeoff, and climbout. Most aircraft go through this sequence during a complete standard operating cycle. Some aircraft and operations may go through a slightly different sequence during a non-standard operating cycle. Non-standard sequences combine or eliminate certain modes. For example, helicopters combine takeoff and climbout modes.

For a detailed discussion of the aircraft emissions calculation methodology and data inputs see Appendix D. Models that can be used to calculate the aircraft portion of an emissions inventory are the *Emissions and Dispersion Modeling System* and *FAA's Aircraft Engine Emission Database*, which are both described in Section 3.3.

3.2.2 Auxiliary Power Units

An auxiliary power unit (APU) is a component of a large aircraft and essentially is a small turbine engine. An APU generates electricity and compressed air to operate the aircraft's instruments, lights, ventilation, and other equipment while the main aircraft engines are shut down. It also is used to provide power for starting the main aircraft engines. APU's burn jet fuel and create exhaust emissions like larger aircraft engines. APUs are common on both commercial and military aircraft; they are not common on air taxis and smaller civil aircraft.

During a typical LTO cycle, the APU is turned on as the aircraft taxis from the runway to the gate or parking space. It remains in use while the aircraft is parked, unless an alternative source of electricity and preconditioned air is made available. In such cases, the APU is reactivated at least five to ten minutes before the aircraft leaves the gate or parking space so that it will be able to provide power for starting the aircraft's main engines. Typically, the APU is turned off after the main engines have been started, prior to takeoff.

For a detailed discussion of the APU emissions calculation methodology and data inputs see Appendix E. The only model available for calculating the APU portion of an emissions inventory is the *Emissions and Dispersion Modeling System*, described in Section 3.3.

3.2.3 Ground Support Equipment or Aerospace Ground Equipment

A variety of ground equipment service larger commercial and military aircraft while they unload and load passengers and freight at an airport or air base. As a group, this equipment is known as ground support equipment (GSE) at civilian airports and aerospace ground equipment (AGE) at military air bases.

GSE and AGE primarily consist of the following equipment: aircraft tugs, air start units, loaders, tractors, air-conditioning units, ground power units, cargo moving equipment, service vehicles, buses, cars, pickups and vans. The equipment that service civilian and military aircraft vary slightly based on the types of aircraft and operations occurring at an airport versus an air base. GSE that operate at civilian airport, but typically are not part of the military AGE population, are baggage tractors and belt loaders. An AGE type that operates at a military air base, but typically is not part of a civilian GSE population, is a weapons loader.

There also is a variety of ground equipment that service airports or air bases. This equipment may be assigned to various departments of the facility including administration, emergency response, police department, operations, engineering and construction, automotive, mechanical maintenance, and landscaping/gardening. The types of equipment servicing an airport or air base vary from cars and pick-ups to generators and lawn mowers. There also are GSE associated with the maintenance of the airport that can have a seasonal and regional variability, such as snow plows. This airport equipment also is included in a GSE or AGE inventory.

For a detailed discussion of the GSE or AGE emissions calculation methodology and data inputs see Appendix F. The only model available for calculating the GSE or AGE portion of an emissions inventory is the *Emissions and Dispersion Modeling System*, described in Section 3.3.

3.2.4 Ground Access Vehicles

Ground access vehicles (GAV) encompass all on-road or highway vehicle trips generated by the airport or air base action. GAV include all vehicles traveling to and from, as well as within the airport or air base (excluding those GSE or AGE used for servicing the aircraft and airport or air base). On-road and highway vehicles include privately-owned vehicles, military government-owned vehicles, rental cars, shuttles, buses, taxicabs and trucks.

Due to varying emission characteristics, the EPA (Reference 81) divides on-road vehicles into eight categories based: on duty cycle (i.e., light or heavy duty), fuel (i.e., gasoline or diesel), and type (i.e., vehicle, truck, or motorcycle):

- light-duty gasoline-fueled passenger cars,
- light-duty gasoline fueled trucks with a gross vehicle weight (GVW) rating of 6000 pounds or less,
- light-duty gasoline-fueled trucks with a GVW between 6001 and 8500 pounds,
- heavy-duty gasoline-fueled vehicles with a GVW exceeding 8500 pounds,
- light-duty diesel-fueled passenger cars,
- light duty diesel-fueled trucks with a GVW of 8500 pounds or less,
- heavy-duty diesel-fueled vehicles with a GVW exceeding 8500 pounds, and
- motorcycles (vehicles with no more than three wheels in contact with the ground and curb weight less than 1500 pounds).

There are both on-airport and off-airport emission from GAV. To capture the total emissions from GAV, the full round-trip operation of the vehicle is tracked, from the time the vehicle is started at its point of origin (e.g., an employee's home), arrives at the airport or air base location (e.g., an airport parking lot or the main terminal), departs the airport or air base location, and reaches its point of destination. Usually, due to the lack of detailed GAV trip data, an average trip distance is used to represent full round-trip operation of GAVs.

For a detailed discussion of the GAV emissions calculation methodology and data inputs see Appendix G. Models that can be used to calculate or contribute to the GAV portion of an emissions inventory are the *Emissions and Dispersion Modeling System*, *MOBILE5a*, *EMFAC*, and *PART5*, which are described in Section 3.3.

3.2.5 Stationary Sources

Stationary sources of air emissions at airports and air bases consist of both combustion and non-combustion sources. Typical sources include: boilers, space heaters, emergency generators, incinerators, fire training facilities, aircraft engine testing facilities, fuel storage tanks, painting operations, deicing operations, solvent degreasers and sand/salt piles.

The combustion sources tend to produce a variety of air pollutants that are released to the atmosphere with combustion gases. These pollutants include: HC, CO, NO_x, PM-10 and SO_2. The venting of combustion gases to the atmosphere results in the emission of these pollutants, although emissions may be reduced through the use of air pollution control techniques or devices at the source.

Airports and air bases operate boilers and space heaters to fulfill much of their heating and power generation requirements. These stationary combustion sources burn several different fuel types, most commonly fuel oil, diesel, natural gas, or occasionally jet fuel. Coal combustion is limited to large heating and power plants on some air bases.

Emergency generators at airports and air bases typically are fixed in place and located throughout the site to provide supplementary or emergency power. These generators are likely powered by gasoline or diesel-fueled reciprocating engines.

Incinerators at airports and air bases likely are small industrial or commercial combustors for the disposal of food wastes (e.g., from international flights) or other refuse. Large municipal waste combustors (MWC) are unlikely to be operated at airports or air bases.

Some major airports and air bases operate on-site aircraft rescue and fire fighting (ARFF) training facilities. In these facilities, fuel is burned in a pit or a mockup of an aircraft to simulate emergency situations that may occur at the site. The amount of fuel burned and time of burning depend upon the particular training exercise being performed and type of equipment in use.

Aircraft engine testing also is performed at some airports and air bases as part of regular aircraft maintenance cycles. In general, testing at commercial airports is limited to uninstalled engines in enclosed test cells. These tests are often performed following overhaul or repair of the engine to determine air worthiness, engine safety performance and fuel efficiency. During the test, the engine is mounted in a special enclosed cell that restricts noise but allows air to flow through at speeds simulating aircraft flight. Engine thrust and other essential performance parameters are measured as the engine is taken through a sequence of power settings. At military bases, a large part of aircraft engine testing is also performed in enclosed test cells, but engines also are routinely tested when they are attached to the aircraft. This “trim” testing is commonly performed on the airfield apron or pad, with no additional noise or emission controls.

The non-combustion stationary sources at airports and air bases tend to emit only one type of pollutant instead of the full range produced by combustion sources. Many sources have evaporative emissions of HC as the only air pollution of concern. Sand and salt piles, on the other hand, emit particulate matter to the atmosphere during loading, unloading and wind erosion of the piles.

Airports and air bases may store large quantities of jet fuel, aviation gasoline, diesel fuel and other fuel types in storage tanks on site. Evaporative HC emissions from the tanks occur during fuel loading and unloading as well as during daily expansion and contraction of the tank contents due to ambient temperature changes.

A variety of coating and painting operations also are performed at airports and air bases. Roadway and runway maintenance requires the occasional application of paint, and some aircraft maintenance facilities may include aircraft painting. These operations usually result in the evaporation of HC from the various coatings and solvents used.

In inclement weather, deicing of aircraft and runways is performed at many airports and air bases. In addition, some aircraft such as the DC-9 must be deiced year-round at all airports and air bases because it’s fuel lines are close to the skin of the aircraft, possibly resulting in the formation of ice during the flight. Deicing fluid contains ethylene glycol or other HC that can evaporate upon application to the aircraft or runway.

Solvent degreasing units are regularly used for aircraft and ground vehicle maintenance, paint stripping and other miscellaneous activities utilizing organic solvents. Solvent degreasers use organic solvents to remove fats, oils, grease, wax or soil from various metal, glass or plastic items. There are two types of solvent degreasers commonly used: cold cleaning and open-top vapor degreasers. Cold cleaning operations use alcohol, ketones and petroleum distillates as solvents for parts cleaning through immersion, brushing, spraying or flushing. Open-top vapor systems are boiling degreasers that clean by the condensation of solvent on the surface of parts being cleaned. Each of these operations causes HC emissions due to evaporation of the solvent.

Finally, many airports and air bases store salt and sand piles on-site for use in maintaining roads and runways during inclement weather. Particulate matter emissions can occur during loading and unloading of the piles and through wind erosion of the pile material.

For a detailed discussion of the stationary source emissions calculation methodologies and data inputs see Appendix H. Models that can be used to calculate or contribute to the stationary source portion of an emissions inventory are the *Emissions and Dispersion Modeling System*, *TANKS*, and *WIND*, which are described in the following available models discussion.

3.3 Available Models

Emissions and Dispersion Modeling System (EDMS) - The EPA and FAA preferred guideline model, *EDMS* (Reference 57), can be used to assess air pollution at airports and air bases. The FAA and the USAF jointly developed the *EDMS*, a computer program for taking inventory of emissions from aircraft, ground support equipment, aerospace ground equipment, vehicular traffic, training fires, and miscellaneous stationary sources. For all sources, the program allows users the ability to specify peak hours or annual activities to examine. If an hourly activity is given, the program uses specified operational profiles (duty cycles) to derive an annual activity. Based on the annual activity, the model can compute an emissions inventory for annual emissions of five pollutants: CO, HC, NO_x, SO_2, and PM-10.

The *EDMS* database stores emission factor data for aircraft in the form of aircraft engine emission factors and aircraft-engine combinations. Aircraft operations are considered on an LTO cycle basis with four distinct modes: approach, climbout, takeoff, and taxi. The *EDMS* also stores GSE and AGE emission factors and default assignments of GSE and AGE to different aircraft types. GSE and AGE operating times are specified in minutes per aircraft LTO. Vehicular emission factors obtained from the EPA's *MOBILE5a* and *PART5* programs are stored for the years 1988 to 2010, 14 different vehicle speeds, and temperatures from 0 to 100 degrees Fahrenheit in 5 degree increments. To accommodate changing regulations, the user is allowed the option of entering their own vehicular emission factor data. Additionally, emission factor information for three different aviation fuels is stored for calculating training fire emissions. There are several major categories of stationary sources for which emission factor data are stored in the database. These major categories are power/heating plants, incinerators, fuel storage tanks, surface coating facilities, and solvent degreasers. Under each category several sub-categories are defined. For miscellaneous stationary sources not found in the database, users have the option to input their own emission factors.

The output of the emissions inventory portion of the model lists the calculated pollutant emission totals in summary by source categories and in detail by each source.

EMFAC - *EMFAC* (Reference 14) is California's version of a motor vehicle emissions model. Default values and assumptions are appropriate for California-specific data. *EMFAC* is similar to *MOBILE5a*, although emissions are trip based and not VMT based. See the *MOBILE5a* discussion for more information.

FAA Aircraft Engine Emission Database (FAEED) - *FAEED* (Reference 60) is a computerized emission inventory calculation procedure developed by the FAA with support from EPA. For analysis limited to aircraft, *FAEED* can be used to compute aircraft engine exhaust emissions for any time period, activity level, or common aircraft type.

To calculate exhaust emissions using *FAEED*, the main data inputs needed are aircraft model, engine model, and number of LTOs. Air carrier, airport, or air base information also may be needed in some cases. If site-specific engine and time in mode information is not available, the

model provides default data from EPA's *Procedure for Emission Inventory Preparation*, Volume IV, Chapter 5. The model lists possible engine models for each aircraft type and the associated national market share, which can be used to choose a surrogate engine if site-specific data is not available. The output of the emissions computation portion of the model is a calculated emissions summary listing pollutant emissions, LTOs, and times in mode by each aircraft and engine combination in the given inventory.

MOBILE5a **-** The EPA specifies that the most current version of the MOBILE motor vehicle emissions model should be used to develop highway vehicle emission indices and emission inventories. At the time of this writing (1996) the most current version of the motor vehicle emissions model is *MOBILE5a* (Reference 76). The analysis considers traffic volumes and movements within the terminal area and surrounding airport area. The model is designed to account for the effect of numerous vehicle parameters on the volume of exhaust and evaporative pollutants emitted. EPA's *Procedures for Emission Inventory Preparation*, Volume IV, Chapter 3 contains recommendations and suggestions with regard to determining appropriate MOBILE inputs, although it is not a substitute for the model's user's guide (Reference 88).

Inputs to the model include basic emission rate, fleet characteristics, fuels characteristics, and control programs data. Default values for most input data are built into the EPA's motor vehicle emissions model, but are not likely to be directly applicable to a restricted airport or air base analysis. The output of the model lists inputs and options chosen, emission indices for each of EPA's eight vehicle types, and emission indices for all eight vehicle types combined. Emission indices are calculated for **HC**, **CO**, and **NO_x**. If vehicle emission indices calculated using MOBILE are to be part of an airport or air base inventory being developed using the EDMS, the EDMS model will provide the user with the option to enter the emission indices developed using the MOBILE model.

PART5 **-** The EPA's *PART5* model (Reference 80) should be used in the analysis of the particulate air pollution impact of in-use gasoline-fueled and diesel-fueled motor vehicles. The model calculates particle emission indices (including **PM-10**, **SO_2**, and **lead**) in grams per mile from on-road automobiles, trucks, and motorcycles. The emission indices calculated include exhaust particulate, exhaust particulate components, brakewear, tirewear, and reentrained road dust, which are required for PM-10 inventories and analyses. The required inputs and optional inputs are described in detail in the *PART5* user's guide (Reference 72). *PART5* contains default values that can be used for most data required for the calculation of the emission indices, although they are not likely to be directly applicable to a restricted airport or air base analysis. If vehicle emission indices calculated using *PART5* are to be part of an airport or air base inventory being developed using the *EDMS*, the *EDMS* model will provide the user with the option to enter the emission indices developed using the *PART5* model.

TANKS **-** *TANKS* is an EPA computer model developed using the methodology and tank information presented in Section 7.1, Volume I of *Compilation of Air Pollutant Emission Factors*. When provided with data inputs, the program estimates annual emissions of evaporative hydrocarbons from a single storage tank. Output from the program can be given as a total figure for annual emissions, or a detailed breakdown of emissions by month, fuel component, and cause of emissions (standing storage or working emissions). For many required variables, such as fuel vapor pressure and climatic data, *TANKS* provides default values based on the fuel type or location specified. If more detailed information is available to the user, *TANKS* allows the input of that information so that default values are not used. It is strongly recommended that *TANKS* be used instead of manually following the *Compilation of Air Pollutant Emission Factors* methodology because the program is much easier to use and employs the same EPA-recommended methodology for calculating storage tank emissions.

WIND - EPA has developed the *WIND* computer model for estimating the wind erosion emissions from material piles based on the methodologies described in Section 13.2.5 of Volume I of *Compilation of Air Pollutant Emission Factors*. *WIND* calculates total particulate emissions from a single storage pile per inputs provided by the user.

4. DISPERSION ASSESSMENT

4.1 Introduction

The intent of a dispersion analysis is to assess the air pollutant concentrations at or near the airport or air base resulting from the emissions inventoried in the emission assessment. These pollutant concentrations are calculated to determine whether emissions from the site result in unacceptably high air pollution levels downwind. This section provides a discussion of the dispersion assessment.

Dispersion modeling has become an important part of the air permitting process. Under CAA, the proposed installation or modification of a major stationary emission source now requires dispersion modeling to show the effects of the proposed action on a community's air quality. The pollutant concentrations computed by a dispersion model are compared with the NAAQS or other relevant air quality standards to determine whether or not a source of emissions is likely to result in unacceptably high pollutant levels.

The dispersion model develops a mathematical approximation of future pollution levels resulting from aircraft or airport / air base actions. The input parameters may include source emissions, meteorological conditions, topography, etc. The meteorological parameters are used to find the direction of pollutant transport, the receptors which will be affected and the most probable and worst pollutant concentrations which can be expected at these receptors.

Several key pollutants are commonly considered in dispersion modeling at airports and air bases including CO, PM-10, NO_x, and possibly SO_2 and HC.

CO emissions at airports and air bases arise from aircraft, ground vehicles and stationary combustion sources. Although these sources are widespread, ambient CO concentrations may be high in locations where vehicles slow down and idle, such as roadway intersections. Dispersion analysis of areas surrounding each intersection of concern, both on and off the airport or air base, is commonly performed to determine whether an increase in vehicular traffic can result in congestion that produces locally high concentrations of CO that violate the NAAQS. Such dispersion analysis of intersections is performed using computer models that take into account the number and type of vehicles, their operating mode, their movement, and the length of delay (Reference 74).

Particulate emissions arise from aircraft, ground vehicles, stationary combustion sources and fugitive dust sources such as sand piles. However, these particulate emissions are rarely at levels that would approach the NAAQS unless special circumstances, such as a high background particulate level, were present. In such cases, PM-10 can be included in the dispersion model.

A NAAQS exists for NO_2, which is the primary component of NO_x emitted from combustion sources. The emissions inventory described in Section Three of this document provides emissions of NO_x that may be included in the dispersion model. Significant NO_x sources at airports and air bases are: aircraft, ground vehicles and some stationary combustion sources. Because minor components of NO_x (e.g., NO and N_2O) are fairly rapidly converted to NO_2 in the atmosphere, NO_x emissions are reported on the basis of the molecular weight of NO_2 (Reference 71), and may be assumed to be entirely composed of NO_2 unless more detailed test data is available. In most cases, NO_2 levels above the air quality standards are not expected to result from airport emissions.

Sulfur dioxide emissions at airports and air bases come from the low levels of sulfur in jet fuel, aviation gasoline, diesel and stationary combustion source fuels. However the SO_2 levels produced are very low and are not likely to result in violations of the NAAQS in the area surrounding the airport or air base. SO_2 may be included in the dispersion modeling if necessary.

There is no NAAQS for hydrocarbons, as a result HC is not commonly included in site-specific dispersion modeling. However, HC and NO_x in the atmosphere are precursors to the formation of ozone, which does have an NAAQS standard. Ozone is typically not included in the airport or air base dispersion models because its formation in the atmosphere is difficult to model on a local scale, and because the effects of elevated ozone concentrations are generally felt on a regional rather than a local level.

In summary, dispersion modeling at airports is usually concerned with calculating local CO levels, and may be expanded to include PM-10, NO_x, SO_2 and HC if circumstances warrant their inclusion.

Depending upon the goals of the dispersion modeling effort, one of two types of models may be selected: screening models or refined models. Screening models use simplified emissions and meteorological inputs to provide a snapshot of the likely worst-case air quality scenario. Refined models require detailed input on emissions and climate to provide air quality estimates for a large number of time periods, typically each hour of a given year. Refined models are often required by regulatory agencies because they capture a wide range of meteorological and operating conditions. Many computer models used for dispersion calculations can operate in both screening and refined mode so only a single model is needed to perform both types of calculations.

For a detailed discussion of the dispersion methodology, inputs, and data sources, please see Appendix I.

4.2 Dispersion Inputs

Inputs required for a dispersion modeling run include various characteristics of each emission source, meteorological parameters, local topography and receptor locations.

4.2.1 Emissions Sources

Dispersion models require several pieces of information about each emission source being included in the model. The output of a detailed emissions inventory should provide source type and emissions of each pollutant for each time period being investigated.

4.2.2 Meteorology

Dispersion of pollutants in the atmosphere is largely dependent upon meteorological conditions such as wind speed and direction, atmospheric stability and mixing depth. Wind speed and direction are the most important parameters in the modeling of dispersion of pollutants in air. Atmospheric stability is related to the turbulence of the atmosphere, and is determined by a combination of wind speed, cloud cover and solar radiation. In unstable atmospheric conditions, high turbulence and associated vertical mixing produce a peak ground-level pollutant concentration near the emission source. Whereas in a stable atmospheric conditions, a low level of vertical mixing results in low ground-level steady-state concentrations near the source. In most cases, the most unstable atmospheric conditions occur during daylight hours, with low wind speeds and high solar radiation. The most stable atmospheric conditions occur at night, during times of low wind speeds and clear skies. Finally, the mixing layer height

has the effect of restricting vertical diffusion of pollutants. Generally, the height of the mixing layer ranges between 1,000 ft and 4,000 ft.

4.2.3 Topography

The terrain in the vicinity of airports and air bases is usually quite flat because of the requirement for a level runway, approach and climbout area. Dispersion models can take advantage of this property of airport and air base locations to make the simplifying assumption that the terrain is flat. This assumption allows the model to use the Gaussian approximation without modifications that would increase the computational requirement.

Some sources, such as training fires, stacks, and painting operations, produce emission sin the form of a buoyant plume. These can have an impact on air quality much farther downwind than the flat area surrounding an airport. In such cases, topography may play a role in altering the downwind dispersion of the plume and may be included in the dispersion analysis. Dispersion models designed for use in complex terrain (i.e., terrain that rises above the level of the plume) or intermediate terrain (i.e., terrain that rises above the stack height but not above the plume elevation) are available. For these models, an additional input of a digitized terrain grid file is necessary.

4.2.4 Receptors

Receptors are defined by the user as those areas in which pollutant concentrations in air are to be calculated. If an overall view of pollutant concentration on and off site is desired, then a grid of receptors should be defined. For many applications, however, only those location defined as "sensitive" (e.g. where the public is likely to come into contact with emissions) may be modeled in order to reduce the computational requirement. For a complex emissions scenario such as an airport, reducing the number of receptors may be necessary because each receptor defined may add hours to the computational time.

4.3 Available Models

The following are EPA-preferred models, which are those models that do not require a rigorous demonstration of applicability each time they are used.

Emissions and Dispersion Modeling System (EDMS) - The *EDMS* (Reference 57) is the EPA and FAA preferred guideline model to calculate emissions and model dispersion at airports. *EDMS* is jointly developed by the FAA and the USAF. The model includes an emissions inventory section, which was described in Section Three of this document, and a dispersion modeling section. The heart of the dispersion model is the Gaussian dispersion equation, which takes an emission rate from a source and calculates one hour concentrations of key criteria pollutants in the air at each receptor location.

In addition to the source activity, the dispersion portion of the model requires input on source coordinates and the hourly variation of emissions (using operational profiles). The program allows the user to import weather data files from the National Climatic Data Center and also allows the user to create their own weather files. In running the model for dispersion, the user is allowed the flexibility of choosing a weather file as well as a range of weather hours within that file. During run execution, a progress meter displays the run status.

Line source algorithms are used for aircraft, APU, and vehicle roadway operations. GSE activity and stationary sources are treated as point sources. Vehicle parking lots are treated as area sources. The ability to toggle sources in and out of a given study allows for enhanced analysis capabilities when running dispersion. *EDMS* also incorporates a graphical view of the airport or air base, plotting runways, runway queues, aircraft gates, roadways, parking lots, stationary sources, and receptors in relation to each other.

The output of the dispersion section of *EDMS* is the hourly averaged concentration of pollutants at each receptor for the chosen duration of weather hours. Concentrations averaged over 3, 8, and 24 hour periods also are given for comparison with NAAQS.

CAL3QHC - *CAL3QHC* is the EPA recommended model for analyzing CO impacts at roadway intersections and is available on EPA's *Support Center for Regulatory Air Models Bulletin Board System (SCRAM)* (Reference 83). The model combines the EPA model for estimating the concentrations of nonreactive pollutants from highway traffic, *CALINE3* (Reference 4), with a traffic model to calculate delays and queues that occur at signalized intersections. It can be used in a screening or refined mode. The latest version of the MOBILE model should be used for emissions input to *CAL3QHC*. The EPA user's guide to the model is *User's Guide for CAL3QHC Version 2: A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections* (Reference 86), also available on *SCRAM*. For EPA guidance on a methodology for evaluating air quality impacts at one or more roadway intersections where vehicle traffic will cause or contribute to increased emissions of carbon monoxide (CO) see EPA's *Guideline For Modeling Carbon Monoxide From Roadway Intersections*.

Industrial Source Complex Model (ISC3) **-** ISC3 is an EPA preferred model for assessing pollutant concentrations from a wide variety of sources associated with an industrial source complex. It is a steady-state Gaussian plume model that can account for: settling and dry deposition of particles; downwash; area, line, and volume sources; plume rise as a function of downwind distance; and separation of point sources. ISC3 operates in both long-term and short-term modes. ISC3 is appropriate for the following applications: industrial source complexes, rural or urban areas, flat or rolling terrain, transport distances less than 50 kilometers, 1-hour to annual averaging times, and continuous toxic air emissions. The model is available on EPA's *Support Center for Regulatory Air Models Bulletin Board System (SCRAM)* (Reference 83). The basis ISC3 model is valid for simple terrain (i.e., terrain does not rise above the stack height). Variations on the ISC3 model exist for special situations, such as complex terrain.

A variety of other dispersion models have been developed for use in regulatory applications ranging from highways to stack sources to regional ozone modeling. Most are based on some form of the basic Gaussian approximation, although some of the more recent models use sophisticated numerical modeling techniques to simulate more complex phenomena. Some of these models are labor-intensive; for example, the Urban Airshed Model requires the user to input hourly emissions of all sources within the region of interest. Table 2 presents a list of other EPA-preferred models. The table shows that much of the model development and application activity has focused on stacks as emission sources, with comparatively little emphasis on dispersion modeling of mobile source emissions.

Model Name	Type	Applicability
CALINE3	Gaussian	Highway emissions
Climatological Dispersion Model (CDM)	Gaussian	General stack sources
Gaussian-Plume Multiple Source Air Quality Algorithm (RAM)	Gaussian	General stack sources
Industrial Source Complex Model (ISC3)	Gaussian	General stack sources; Complex terrain
Urban Airshed Model (UAM)	3-D numerical	Urban ozone modeling
Offshore and Coastal Dispersion Model (OCD)	Gaussian	Pollutant transport over water and coastal areas
Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS)	Gaussian	General stack sources; Complex terrain

Table 2: Other EPA Preferred Air Quality Models[6]

[6] Source: Appendix A: Summaries of Preferred Air Quality Models of Code of Federal Regulations Title 40 Part 51, Appendix W "Guideline on Air Quality Models (Revised)" (Reference 8).

5. CONFORMITY

The concept of conformity is a key component in the attainment of national air quality standards, and an important concept to consider when assessing the air quality impact of FAA or USAF actions in nonattainment or maintenance areas. In large part, the administration and enforcement of air pollution regulations are delegated to individual states. (A SIP is a plan that provides for implementation, maintenance, and enforcement of the NAAQS.)

The *CAA Amendments of 1977* stated that no Federal agency could engage in, support in any way, provide financial assistance for, license, permit, or approve any activity that did not "conform" to a SIP after its approval or promulgation. Although the amendments addressed the association of Federal agency activities with a SIP, they did not define "conformity" in detail.

The *CAA Amendments of 1990* (Reference 5) remedied this situation by defining conformity and expanding the scope and content of the relevant provisions. A Federal agency responsible for an applicable action is required to determine if the action "conforms" to the applicable SIP, by ensuring that the action does not:

- Cause or contribute to new violations of any NAAQS,
- Increase the frequency or severity of existing violations of any NAAQS, or
- Delay the timely attainment of any NAAQS or any required interim emission reductions or milestones.

Federal actions subject to conformity are divided into two categories: transportation conformity actions and general conformity actions. Transportation conformity actions are Federal actions in nonattainment and maintenance areas related to transportation plans, programs, and projects that are developed, funded, or approved under title 23 U.S.C. or the Federal Transit Act (49 U.S.C. 1601 *et seq.*), or are regionally significant. Transportation conformity actions must meet the procedures and criteria of the Transportation Conformity Rule [40 Code of Federal Regulations (CFR) Part 51, Subpart T]. General conformity actions are all other Federal actions in nonattainment and maintenance areas that are not covered by the Transportation Conformity Rule. General conformity actions must meet the procedures and criteria of the General Conformity Rule (40 C.F.R. Part 51, Subpart W; 40 C.F.R. Part 93 Subpart B), effective January 31, 1994 (Reference 7). Most Federal actions at airports are general conformity actions. Roadways and transit construction, generally off airport property, that is developed, funded, or approved by the Federal Highway Administration (FHWA) or Federal Transit Administration (FTA) are transportation conformity actions. Discussions of conformity in this document refer to general conformity, unless otherwise noted.

Each state must submit to the EPA criteria and procedures for assessing the conformity of Federal actions to its SIP. Once a revised SIP that includes conformity rules is submitted and approved by EPA, State rules can be applied. However, until EPA approves the State rules, the Federal rule at 40 CFR part 93 should be applied. States may set forth more stringent requirements (e.g., lower threshold levels), but conformity requirements then must apply to non-Federal as well as Federal entities.

The General Conformity Rule consists of three major parts: applicability, analysis, and procedure. These three parts are discussed below, as well as integration with the *NEPA* (Reference 30) process and relevant references and sources of more detailed conformity information.

5.1 Applicability

For applicable actions, a Federal agency must make a determination that a Federal action conforms to the applicable implementation plan in accordance with the General Conformity Rule before the action is taken. To determine whether conformity requirements apply to an action, the agency must consider the following criteria: the nonattainment and maintenance status of the area; exemptions from and presumptions to conformity; the project's emissions in comparison to threshold levels; and the regional significance of the project's emissions.

Nonattainment and Maintenance Areas. The current conformity rule only applies to nonattainment areas and maintenance areas. The *CAA* establishes air quality standards (the NAAQS) for pollutants, called criteria pollutants. A nonattainment area (NAA) is any geographic area of the United States that is in violation of any NAAQS and, therefore, has been designated as nonattainment under the *CAA*. States are required to develop revised State Implementation Plans (SIPs) for such areas, with adequate control measures to achieve attainment within specified deadlines. A maintenance area (MA) is any geographic area of the United States previously designated nonattainment pursuant to the *CAA Amendments of 1990* and subsequently redesignated to attainment, subject to the requirement to develop a maintenance plan under the *CAA*. Such an area must develop a maintenance plan, which is a revision to the applicable implementation plan, meeting the requirements of the *CAA*. Unclassifiable ("Cannot be classified") areas are not subject to the current conformity rules.

Exemptions and Presumptions. The rule contains exemptions from and presumptions to conformity. Federal actions for which it is necessary to perform a thorough air quality analysis in order to comply with other statutory requirements (e.g., actions subject to the New Source Review program, remedial activities under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)) are considered to conform with the applicable SIP. Federal actions that would result in no emissions increase or a *de minimis* emissions increase are exempt from the conformity process. The rule identifies a list of actions that would result in no emissions increase or an increase in emissions that is clearly *de minimis*. Examples include air traffic control activities and adopting approach, departure, and enroute procedures for air operations; routine installation and operation of aviation and maritime navigational aids; participating in "air shows" and "fly-over" by military aircraft; routine monitoring and /or sampling of air, water, soils, effluent, etc.; continuing and recurring activities such as permit renewals where activities currently being conducted; rulemaking and policy development and issuance; routine movement of mobile assets such as aircraft; routing operation of facilities, mobile assets and requirement; routing maintenance and repair activities; administrative actions; and, land transfers. See Determining Conformity of General Federal Actions to State or Federal Implementation Plans, 58 Fed. Reg. 63214, 63229 (November 30, 1993). However, actions that are exempt or presumed to conform still must evaluate whether the emissions are considered "regionally significant," discussed below.

Threshold Emission Levels. Annual threshold rates of emissions were established in the General Conformity Rule to focus conformity requirements on those Federal actions with the potential to have significant air quality impacts. Threshold levels are established in Title 40 §93.153(b) and vary according to the type of pollutant and the severity of the nonattainment/ maintenance area. The project's emissions (proposed project emissions minus no action emissions) are compared to these threshold levels. Table 3 and Table 4 list the threshold levels applicable to nonattainment areas and maintenance areas, respectively. Conformity emission thresholds refer to the total of direct and indirect emissions, which "means the sum of direct and indirect emissions increases and decreases caused by the Federal action; i.e., the 'net' emissions considering all direct and indirect emissions."

Direct emissions are those caused by or initiated by the Federal action, and that occur at the same time and place as the action. Indirect emissions are those (a) "caused by the Federal action, but may occur later in time and/or may be farther removed in distance from the action itself but are still reasonably foreseeable" and (b) that "the Federal agency can practicably control and will maintain control over due to a continuing program responsibility of the Federal agency."[7] Examples of "controlling" or regulating emissions are through the use of emissions control equipment on a boiler (direct control) or through the implementation of regulations or conditions on the nature of activity that may be established in permits or approvals or by the design of the action (indirect control). A Federal agency controlling the level of vehicle emissions by controlling the size of the parking facility and setting requirements for employee trip reductions is an example of one such situation. Mitigation measures in this scenario may include reducing commuting through ride-sharing, flexible work hours, vanpooling, free transit passes, parking surcharges, or telecommuting. The portion of emissions which are exempt or presumed to conform under Title 40 §93.153 (c), (d), (e), or (f) are not included in the "total of direct and indirect emissions." Temporary emissions (e.g., project construction emissions) also must be included in the emissions calculations for a conformity determination. However, these emissions only have to be accounted for during the construction phase and not over the time frame of the project.

A conformity determination is required when the annual net total of direct and indirect emissions from a Federal action occurring in a nonattainment or maintenance area equals or exceeds the annual threshold levels. If a Federal action's emissions are below threshold levels, then the action does not need a conformity determination and is presumed to conform with the applicable SIP, as long as the action is not regionally significant (described below).

[7] *Caused by* means emissions that would not otherwise occur in the absence of the Federal action. *Reasonably foreseeable* emissions are "projected future indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known and the emissions are quantifiable." *Control* means the ability to regulate (directly or indirectly) the emissions from the Federal action.

Criteria Pollutant	Nonattainment Status	Tons/Year
Ozone (VOCs or NO_x)	Serious NAAs	50
	Severe NAAs	25
	Extreme NAAs	10
	Other ozone NAAs outside an ozone transport region (OTR)	100
	Marginal and Moderate NAAs inside an OTR: VOC NO_x	 50 100
CO	All NAAs	100
SO_2	All NAAs	100
NO_2	All NAAs	100
PM-10	Moderate NAAs	100
	Serious NAAs	70
Lead	All NAAs	25

Table 3 : **Threshold Levels For Nonattainment Areas (NAAs) ***

Criteria Pollutant	Nonattainment Status	Tons/Year
Ozone (VOCs)	MAs inside an ozone transport region (OTR)	50
	MAs outside an OTR	100
Ozone (NO_x)	All MAs	100
CO	All MAs	100
SO_2	All MAs	100
No_x	All MAs	100
PM-10	All MAs	100
Lead	All MAs	25

Table 4 : **Threshold Levels For Maintenance Areas (MAs)**

- Source: General Conformity Rule (40 CFR Part 93, Subpart B), effective January 31, 1994 (Reference 7).

- **Regional Significance.** If a Federal action does not exceed the threshold levels or is presumed to conform, it may still be subject to a general conformity determination. If the total of direct and indirect emissions of any pollutant from a Federal action represent 10 percent or more of a maintenance or non-attainment area's total emissions of that pollutant, the action is considered to be a "regionally significant" activity and conformity rules apply. If an action in a nonattainment area is below the thresholds or presumed to conform and not regionally significant, then the conformity requirements do not apply and no official reporting is required. Parts of the overall Federal action that are exempt from conformity requirements (e.g., emission sources covered by New Source Review) should not be included in the analysis. The purpose of the regionally significant requirement is to capture those Federal actions that fall below threshold levels, but have the potential to impact the air quality of a region. I*t is unlikely that an airport or air base action that is presumed to conform would be regionally significant.*

5.2 Analysis

The general conformity rule requires that each Federal agency taking an action subject to this rule must make its own conformity determination and be able to justify its application of the conformity requirements. When a project involves multiple Federal agencies, a Federal agency has the option of using the conformity analysis of another Federal agency, if the action and the impacts analyzed are the same as those for the project for which a conformity determination is required. The Federal agency must consider comments from any interested parties.

The analysis must be based on the latest planning assumptions derived from population, employment, and travel data acquired from the local metropolitan planning organization (MPO) in the area where the Federal action is planned to occur. The latest and most accurate emission estimation techniques must be applied, unless written approval to employ modifications or substitutions is obtained from the EPA regional administrator. These emissions estimation techniques include motor vehicle emission models used to prepare or revise the SIP, and emission factors for non-motor vehicle sources, databases, and models specified and approved by the EPA. It is recommended that the Federal agency consult with State and local air quality officials early in the conformity decision-making process to determine the appropriate criteria to use. Consultation also will assure that the most up-to-date models, emission factors, and population estimates are being used, as well as identify the MPOs from which to obtain any traffic or demographic data needed for the regional significance analysis.

Additionally, the EPA encourages Federal agencies to notify State and local air quality officials of any project that needs a conformity determination so that it can be specifically included in an attainment demonstration or emissions budget. This is one straightforward method of determining conformity. Other common, straightforward criteria for demonstrating conformity are: (1) determining that the total direct and indirect emissions from the action for the future years do not increase emissions with respect to the baseline emissions if the state does not have an EPA approved revision to the relevant SIP attainment or maintenance demonstration since 1990; and (2) obtaining a state's written commitment to review the SIP in the future to accommodate the emissions from a Federal action. Conditional general conformity determinations are not permitted under the regulations. A combination of criteria may be used to demonstrate conformity (e.g., one criteria may be used to show conformity for ozone and another criteria for other pollutants). If mitigation measures, in combination with emissions offsets, are selected as the conformity criteria option, measures and offsets should result in no net increase in emissions (i.e., it is not enough to offset emissions to the threshold levels). Emission offsets have to occur at the same time as the emission increases for which the offsets are necessary. All offsets must be quantifiable, consistent with the applicable SIP attainment and reasonable further progress (RFP) demonstrations, surplus to reductions required by and credited to other applicable

SIP provisions, enforceable at both the State and Federal levels, and permanent within the time frame specified by the program.

5.3 Procedure

A conformity determination for an action is a Federal responsibility. No documentation or public participation is required if an applicability analysis finds emissions are not reasonably foreseeable, cannot be controlled and maintained by the Federal Agency, or exempt, or are below the threshold and not regionally significant, or presumed to conform and not regionally significant, than no conformity determination or public participation is required. It is advisable to note any *de minimis* finding in the EA or EIS. For actions that require a conformity determination, certain documentation and public participation is required. The Federal agency must provide a 30-day notice of the Federal action and draft conformity determination to the appropriate EPA region and State and local air control agencies. The Federal agency must make public its draft conformity determination by placing a notice by prominent advertisement in a daily newspaper of general circulation in the area affected by the action and by providing 30 days for written public comment prior to taking any formal action on the draft determination. The same requirement also applies to the final conformity determination.

5.3.1 Conformity Steps Summary

The following is a summary of the steps taken when addressing conformity.

- Define the scope of the Federal action to include timing and location,
- Determine if the action is in a nonattainment or maintenance area
- Determine if the action is exempt or presumed to conform
- Determine criteria pollutants of concern based on the attainment status of the Air Quality Control Region,
- Calculate emissions based on the scope,
- Review net emission changes for threshold levels and regional significance, and
- Determine conformity for applicable criteria pollutants.

5.3.2 Conformity and *NEPA*

The conformity process is separate from the *NEPA* process. It is up to each agency to determine the best ways to integrate the conformity and *NEPA* processes. However, the conformity analysis can be completed concurrently with the *NEPA* analysis, and linkage between the two is allowed. This may be an efficient and convenient approach. There are certain requirements for *NEPA* that are not required under conformity. For example, *NEPA* requires the development of reasonable alternative actions, whereas conformity does not (conformity only requires analysis of the proposed alternative). In this case, it may be a more realistic approach to perform a conformity analysis for only the one alternative selected instead of for all alternatives. At a minimum, when the specific alternative is selected in the *NEPA* process, the conformity air quality analyses should be performed as appropriate. A joint notification and public participation process also is possible, as long as the requirements for each regulation are met.

5.4 References/Sources

Additional guidance on EPA's interpretation of the General Conformity Rule and answers to common general conformity questions is provided in EPA's *General Conformity Guidance: Questions and Answers* (Reference 73) and EPA's *New General Conformity Q's & A's* (Reference 77). Guidance also is provided in the Policy and Guidance section of Title I and the *CAAA* bulletin board of the EPA Office of Air Quality Planning and Standards (OAQPS) *Technology Transfer Network (TTN)* bulletin board system (Reference 85). Guidance documents also can be obtained from the appropriate EPA Regional Office.

6. MITIGATION/CONTROL MEASURES

There are various measures that airlines and airports can take to improve the environmental performance of their operations. This section briefly describes several possible emission reduction measures that can be applied to aircraft, GSE, and APU operations. These measures are identified so that they may be factored into an air quality analysis when used by an airline(s) or the airport. Currently, there are some airports and airlines that are implementing these measures not only for emission reductions but for non-environmental benefits like cost reductions. However, each measure has certain constraints that limit its full implementation. This section also describes the factors that should be considered when evaluating and implementing a specific measure.

6.1 Aircraft

This section describes modified operating procedures that can be used to reduce aircraft engine emissions. In general these procedures do not require additional equipment or aircraft modifications. Since these procedures may require changes to an airline's standard operating practices and may not be feasible in all weather conditions or at all airports, they should always be implemented at the discretion of the pilot in command.

6.1.1 Single/Reduced Engine Taxiing

Most aircraft are able to taxi and idle with less than all engines running. Operating less engines during taxi and idle reduces the associated emissions substantially. The engine(s) in use operates at a higher power than it would otherwise, but this is at a somewhat more efficient point on its power curve. The remaining engines must run for about two minutes prior to takeoff power to achieve thermal stability, as well as two minutes prior to shutdown after landing to cool down. Despite the operating time required for thermal stability, most of the taxi and idle time would be with a reduced number of engines operating. Many airlines have employed this measure where feasible since the early 1970s. Because reduced engine taxi and idle is feasible for certain aircraft at most airports from a safety standpoint, it is currently employed extensively for fuel conservation and economic reasons. For those aircraft that are amenable to reduced engine taxi and idle, this measure provides the safety and control needed while still reducing HC and CO emissions.

However, the implementation of reduced engine taxi/idle varies and is not always feasible. The number of engines that can be reduced during reduced engine taxi and idle varies by aircraft type due to the location of the engines, aircraft weight, and aircraft size. For some aircraft reduced engine taxi and idle is not feasible at all due to control and safety concerns. Directional control problems could occur in these aircraft because of the adverse, unbalanced thrust that may be created by using less than all engines. Safety concerns include ground personnel and equipment hazards that may be created when the operating engine(s) is brought to the power level necessary to initiate movement of these aircraft. Other factors such as weather, taxi surface, taxi slope, ramp congestion, and individual airline practices also affect safe reduced engine taxi/idle and require on-the-spot judgment of the pilot in command. Under Federal Aviation Regulations (FAR), the pilot in command of the aircraft is responsible for the safety of the passengers, crew members, cargo, and the airplane. Therefore, any procedure introduced to taxi or idle an aircraft with less than the full complement of engines is at the discretion of the pilot. If back blast endangers persons or property, it is a violation of the FAR for which the pilot would be subject to FAA disciplinary action.

6.1.2 Derate Takeoff Power

Aircraft are designed to have adequate power to takeoff under extreme conditions such as very hot days when they are fully loaded with passengers, cargo, and fuel. When the conditions do not require full power, a derated takeoff procedure can be used to limit the engine thrust to the minimum necessary. By operating the engines at a lower power setting, the NO_x emissions can be reduced.

From a safety standpoint, a derated takeoff is feasible for most aircraft. Reduced power takeoffs currently are being used by most air carriers to enhance engine life and to increase fuel conservation and engine reliability time. A number of large airlines currently rely on the Central Air Data Computer's (CADC's) computations to determine takeoff throttle settings. This computed value depends on various aircraft, runway, meteorological, and regulatory variables. This computed throttle setting is often in the range 0.75 to 0.90, but still well below 1.0 (or 100%). The lower throttle setting limit is often established by the FAA regulatory requirements to ensure an aircraft's minimal climb out angle maintains a safety margin that accounts for engine failure. Thus, takeoff throttle settings almost always exceed climb out values independent of the length of the runway. Certain FAA procedures are already in place to deal with derated takeoffs. FAA Advisory Circular (AC) No. 25-13, *Reduced and Derated Takeoff Thrust (Power) Procedures*, describes the requirements when using reduced power for takeoff. AC No. 91-53a, *Noise Abatement Departure Profiles*, is applicable to operators of large turbojet airplanes. Within the provisions of this AC, each airport can define the departure procedures that best serves their community from a noise impact perspective.

Site-specific factors such as wind, weather conditions, aircraft type, and aircraft weight are critical considerations to plan for when performing a derated takeoff. They influence a pilot's decision as to when a derated takeoff may be safely implemented. In addition, noise abatement procedures and length of the runway at some airports require full power for all takeoffs. If derated takeoff is used, it should remain within the discretion of the pilot in command.

6.1.3 Reduce Use of Reverse Thrust

After aircraft land, they often rely on engine thrust reversal to slow the aircraft to taxi speed. Reverse thrust normally is used to reduce the time on the active runway after landing and to reduce maintenance costs incurred with brake repair and replacement. On long runways, it is possible to eliminate reverse thrust and slow the aircraft using only the wheel brakes. Reverse thrust is a high power operation for engines and a source of NO_x emissions. Eliminating the use of reverse thrust reduces NO_x emissions. In some cases, this may occur at the expense of slightly higher HC emissions if taxi time is increased because a runway turnoff is missed or more time is needed for the landing aircraft to exit the runway. If the time needed for the landing aircraft to exit the runway is increased, it also may increase the taxi/idle time (and emissions) of aircraft awaiting takeoff and landing.

Use of reverse thrust is a matter of safety. It is used at the discretion of the pilot in command of the aircraft. Many factors are involved in the decision to use reverse thrust including runway length and width, runway surface conditions, weather conditions, aircraft type, the pilot's desire for a smooth landing, location of intersections for turning off of the runway, taxi way condition and congestion (i.e., other traffic), and proximity of aircraft following on final approach.

6.2 Auxiliary Power Units

Emissions from APUs can be reduced by turning off the APU while an aircraft is docked at the gate. Turning off the APU reduces fuel combustion. When available at the gate, a 400 Hz ground power system and ventilation air source often provide a reasonable alternative to using an APU to support normal aircraft operations. These fixed systems operate at a greater energy efficiency than an APU and substantially reduce pollutant emissions. In addition, the emissions attributable to the generation of electricity for use by the fixed systems usually are generated at an off-airport electric power plant. The emissions generated at the power plant are lower due to higher efficiency and emission controls. Often the cost of the fuel saved is greater than the cost of electricity. For more information on APU emission reductions, see the FAA and EPA's *Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation* (Reference 52) or visit the EPA's Office of Mobile Sources (OMS) On-line Bulletin Board System (Reference 75).

6.3 Ground Support Equipment

GSE commonly are fueled by gasoline or diesel, termed conventional fuels. Replacing conventional fueled GSE with GSE that operate on other fuels is the most effective way to reduce GSE emissions. Alternatives to gasoline and diesel include compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (LPG - commonly propane), and electricity. Many different types of GSE are commercially available that operate on alternative fuels or electricity. From an emissions perspective, equipment originally designed to use these fuels give much better environmental performance than equipment that is converted from using a conventional fuel to use an alternative fuel or electricity. Benefits of changing from a conventional fuel to an alternative fuel or electricity can be evaluated by comparing the emission factors of two engines of the same size that use different fuels. With electric equipment there are no emissions from the equipment itself, although some emissions are released by the power plant that generates the electricity. Power plant emissions generally are small and often are emitted outside of the local area. Electric GSE have the lowest amount of emissions attributed to them (in comparison with conventional fueled, CNG, LNG, and LPG GSE). Therefore, replacing conventional fueled GSE with electric GSE results in the greatest emission reduction. For more information on GSE emission reductions see the FAA and EPA's *Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation*.

7. REFERENCES

This section provides a list of documents, models, and sources referenced in the handbook. The reference list also identifies how to obtain or contact the reference (e.g., a publication number). Following the reference list is an annotated reference list, which includes a brief summary of each reference.

7.1.1 Reference List

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10 Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS), NTIS Computer Product or available on EPA *Support Center for Regulatory Air Models (SCRAM) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

11 Council on Environmental Quality, 722 Jackson Place NW, Washington, DC 20006; (202) 395-5750.

12 Defense Technical Information Center (DTIC). Cameron Station, Building 5, Alexandria, Virginia 22304-6145, (703) 274-6886.

13 Dickson, Cheryl L. and Paul W. Woodward, March 1990. *Aviation Turbine Fuels, 1989*. Published by the Institute for Petroleum and Energy Research, Bartlesville, OK.

14 EMFAC. Air Resources Board (ARB), Mobile Source Control Division, El Monte, CA.

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16 Energy and Environmental Analysis, Inc. January 1992. *Regulatory Strategies for Off-Highway Equipment*, Arlington, Virginia, (703) 528-1900. Prepared for California Air Resources Board, Sacramento, California.

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24 Jet Information Services, Inc., Annual Publication. *World Jet Inventory*, 18711 198th Avenue N.E., Woodinville, Washington 98072-8840, (206) 844-9140.

25 Joynt, D., Symtron, Inc. Letter to P. Forward, EEA, Inc., dated February 12, 1996.

26 Levine, Robert S., National Institute of Standards and Technology. Memorandum to C. Lenhoff and D. King, AAI Corporation dated Dec. 9, 1992. Subject: *Soot and Minor Constituent Emissions from Propane Firefield Runs of 24 Nov. 1992*.

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28 McGraw-Hill Publication, Annual Mid-March Aerospace Forecast Issue. "Aviation Week & Space Technology."

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7.1.2 Annotated Reference List

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   This code requires that a grant application for an airport development project involving the location of the airport, runway, or major runway extension, will not be approved unless the State certifies that there is reasonable assurance that the project will be located, designed, constructed, and operated in compliance with applicable air quality standards.

2. Bucher & Co, Publikationen, 1994. *JP Airline-Fleets International 94/95*, Switzerland (orders taken through BUCHair (U.S.A.) Inc., P.O. Box 750515, Forest Hills, New York 11375-0515, (718) 349-4828.

   A yearly fleet reference book that provides administrative information for all known commercial aircraft operators, plus technical information for every aircraft over 3,000 pounds. Technical information provided includes current registration, type, serial number, previous identity, date of manufacture, engine type and number, maximum takeoff weight, configuration, fleet number, name, and remarks. The publication also includes color photographs and alphabetical airline coding-decoding sections. An example page from the publication is provided in Attachment 1.

3. CAL3QHC, available on EPA's Support Center for Regulatory Air Models (SCRAM) Bulletin Board System, a component of EPA's Technology Transfer Network (TTN).

   The recommended model for analysis of CO impacts at roadway intersections. CAL3QHC combines CALINE3 with a traffic model to calculated delays and queues that occur at signalized intersections.

4. CALINE3, NTIS Computer Product No. PB 80-220833 or available on EPA's Support Center for Regulatory Air Models (SCRAM) Bulletin Board System, a component of EPA's Technology Transfer Network (TTN).

   An EPA preferred air quality model for estimating the concentrations of nonreactive pollutants from highway traffic.

5. *Clean Air Act (CAA), as amended*, 42 U.S.C. section 7401 et seq. (Public Law 91-604, 101-549) (Title 40 Code of Federal Regulations Parts 9, 50-53, 60, 61, 66, 67, 81, 82, and 93).

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   An EPA preferred air quality model for determining long-term (seasonal or annual) arithmetic average pollutant concentration at any ground-level receptor in an urban area.

7. Code of Federal Regulations (Title 40 Part 93, Subpart B). "Determining Conformity of General Federal Actions to State or Federal Implementation Plans."

   The "General Conformity Rule" establishes criteria and procedures for assessing the conformity of all Federal actions not covered by the Transportation Conformity Rule to the applicable SIP.

8. Code of Federal Regulations (Title 40 Part 51, Appendix W, July 1, 1994). "Guideline on Air Quality Models (Revised)," EPA Publication No. EPA-450/2-78-027R.

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   Regulations promulgated by the Council on Environmental Quality (CEQ) to implement the procedural provisions of *NEPA*. In general the CEQ regulations require a Federal agency to evaluate the potential environmental effects of a major action prior to its implementation and notify and involve the public in the agency's decision-making process.

10. Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS), NTIS Computer Product or available on EPA *Support Center for Regulatory Air Models (SCRAM) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    An EPA preferred air quality model for general stack sources in complex terrain and applicable to all stability conditions.

11. Council on Environmental Quality, 722 Jackson Place NW, Washington, DC 20006; (202) 395-5750.

    A national environmental council established by the National Environmental Policy Act of 1969 (NEPA). Duties of the council include assisting and advising the President in the preparation of the Environmental Quality Report required by *NEPA*, analyzing the quality of the environment with regard to the achievement of the policy set forth in the *NEPA*, reviewing and appraising the programs and activities of the Federal Government in light of policy set forth in *NEPA*, and conducting investigations, studies, surveys, research, and analyses relating to environmental quality.

12. Defense Technical Information Center (DTIC). Cameron Station, Building 5, Alexandria, Virginia 22304-6145, (703) 274-6886.

    DTIC is a source for U.S. government-sponsored research and development results.

13. Dickson, Cheryl L. and Paul W. Woodward, March 1990. *Aviation Turbine Fuels, 1989*. Published by the Institute for Petroleum and Energy Research, Bartlesville, OK.

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    The California version of a motor vehicle emissions model. Default values and assumptions are appropriate for California-specific data. Similar to EPA's MOBILE5a.

15. Energy and Environmental Analysis, Inc., December 1988. *Feasibility of Controlling Emission From Off-Road, Heavy-Duty Construction Equipment*, Arlington, Virginia, (703) 528-1900. Prepared for California Air Resources Board, Sacramento, California.

    A study of the feasibility of controlling emissions from off-road, heavy-duty construction equipment such as backhoes, wheel loaders, crawler tractors, skid steer loaders, and roller/compactors.

16. Energy and Environmental Analysis, Inc. January 1992. *Regulatory Strategies for Off-Highway Equipment*, Arlington, Virginia, (703) 528-1900. Prepared for California Air Resources Board, Sacramento, California.

    A study on controlling emissions from light-duty off-road equipment, 25 to 50 horsepower.

17. Executive Order 11514: Protection and Enhancement of Environmental Quality, March 4, 1970.

    Orders all Federal agencies to "initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals."

18. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

    Requires each Federal agency to weigh high disproportionate adverse effects of its programs, policies, and activities on the human health or environment of minority and low-income populations.

19. Garska, Dan, Union Carbide Corporation. Letter to Terrence J. Godar, Virginia Department of Environmental Quality, dated August 22, 1995.

    In this letter, Mr. Garska provided emission factors for ethylene glycol emissions from both aircraft and runway deicing, and the assumptions behind the calculation of those factors.

20. Gaussian-Plume Multiple Source Air Quality Algorithm (RAM), available on EPA's *Support Center for Regulatory Air Models (SCRAM) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    An EPA preferred air quality model for estimating concentrations of relatively stable pollutants from point and area sources in a rural or urban setting.

21. Green, W., J. Mowinski, and G. Swanborough, 1987. *Modern Commercial Aircraft*.

    An illustrated directory of the world's civil airliners currently in service and under development.

22. Industrial Source Complex Model (ISC3), NTIS Computer Product or available on EPA's *Support Center for Regulatory Air Models (SCRAM) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    An EPA preferred air quality model for assessing pollutant concentrations from a wide variety of sources associated with an industrial source complex.

23. Jagielski, Kurt D., and Robert J. O'Brien, July 1994. *Calculation Methods for Criteria Air Pollutant Emission Inventories*, USAF Occupational and Environmental Health Directorate, Air Force Material Command, Brooks AFB, Texas, July 1994.

    An Air Force guidance manual for the development of criteria air pollutant emission inventories of an installation's mobile, area, and stationary point sources.

24. Jet Information Services, Inc., Annual Publication. *World Jet Inventory*, 18711 198th Avenue N.E., Woodinville, Washington 98072-8840, (206) 844-9140.

    A summary of the commercial jet airplane fleet. Information is supplied for airlines, private operators, government agencies, manufacturers, and leasing companies. Data is provided on the fleet (e.g., operator or owner, manufacturer, airplane model-series, world region), airplane orders and deliveries, fleet history, fleet totals, and age distribution.

25. Joynt, D., Symtron, Inc. Letter to P. Forward, EEA, Inc., dated February 12, 1996.

Source of propane VOC and PM emission factors for uncontrolled fuel burning in training fires. Emission factors for propane firefighter training facilities given in this letter were based on Robert S. Levine, "Soot and Minor Constituent Emissions from Propane Firefield Runs of 24 Nov. 1992," memorandum to C. Lenhoff and D. King, AAI Corporation, National Institute of Standards and Technology, Dec. 9, 1992.

26. Levine, Robert S., National Institute of Standards and Technology. Memorandum to C. Lenhoff and D. King, AAI Corporation dated Dec. 9, 1992. Subject: *Soot and Minor Constituent Emissions from Propane Firefield Runs of 24 Nov. 1992*

27. Lister, D. H. and R. J. Murrell, Defence Research Agency, United Kingdom. *ICAO Engine Exhaust Emissions Databank, First Edition, Draft - December 1993*, prepared for the International Civil Aviation Organization (ICAO).

A database of exhaust emissions of engines intended for subsonic and supersonic propulsion applications, for which information is available. An example of a detailed engine data sheet is provided in Attachment 2.

28. McGraw-Hill Publication, Annual Mid-March Aerospace Forecast Issue. "Aviation Week & Space Technology."

The annual issue provides specifications on U.S. and international aircraft and engines such as U.S. commercial passenger transports, U.S. general aviation aircraft, U.S. gas turbine engines, U.S. reciprocating engines, international aircraft, and multinational gas turbines. Attachment 3 provides an example page from the U.S. commercial passenger transport specifications.

29. National Climatic Data Center (NCDC), 151 Patton Avenue, Asheville, NC 28801-5001, (704) 259-0682. Branch of the National Oceanic and Atmospheric Administration (NOAA).

NCDC is a source for climatic information recorded at most airports and other weather stations. Dispersion models and some emissions inventory models (such as WIND) accept as input climatic information stored electronically in NCDC format or in some cases, published NCDC data that must be manually entered into the program. For dispersion models, NCDC provides diskettes containing surface weather measurements (NCDC format #1440) and mixing height (NCDC format #9689) that are used in electronic format by the models. A possible alternative to the NCDC is the National Meteorological Center, (301) 763-8298.

30. *National Environmental Policy Act of 1969 (NEPA)*, as amended, 42 USC 4321-4347 (Public Law 91-190).

NEPA establishes a broad national policy to protect the quality of the human environment. The act provides polices and goals to ensure that environmental considerations are given careful attention and appropriate weight in all decisions of the Federal Government. *NEPA* was enacted to ensure that environmental impacts and associated public concerns are considered in decisions on major Federal action. An act also provides for the establishment of the Council on Environmental Quality.

31. National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, Virginia 22161, (703) 487-4650, URL http://www.fedworld.gov/ntis/ntishome.html.

NTIS is a source for U.S. and foreign government-sponsored research and development results, business information, and engineering solutions.

32. Office of Combustion Technology, GE Aircraft Engines, One Neumann Way MD A309, Cincinnati, Ohio 45215-6301, (513) 774-4438.

33. Office of Certification & Airworthiness, Commercial Engine Business, United Technologies Pratt & Whitney, 400 Main Street, East Hartford, Connecticut 06108, (203) 565-2269.

34. Offshore and Coastal Dispersion Model (OCD), available on the Support Center for Regulatory Air Models (SCRAM) Bulletin Board System, a component of EPA's Technology Transfer Network (TTN).

    OCD determines the impact of offshore emissions from point, area, or line sources on the air quality of coastal regions. The model incorporates overwater plume transport and dispersion as well as changes that occur as the plume crosses the shoreline.

35. Perry, Steven G. et al., October 1990. User's Guide to CTDMPLUS: Volume 2. The Screening Mode (CTSCREEN), EPA/600/8-90/087, available on EPA's Support Center for Regulatory Air Models (SCRAM) Bulletin Board System, a component of EPA's Technology Transfer Network (TTN).

    The user's guide to the screening mode of the CTDMPLUS.

36. Section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. 303).

    The Secretary shall not approve any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance as determined by the Federal, State, or local officials having jurisdiction therof, of any land from a historic site of national, State, or local significance as so determined by such official unless:

    1. there is no feasible and prudent alternative to the use of such land, and
    2. such program includes all possible planning to minimize harm to such park, recreational are, wildlife, and waterfowl refuge, or historic site resulting from such use.

    49 U.S.C. Section 303. Any part of a publicly owned park, recreation are, refuge, or historic site is presumed to be significant unless a statement of insignificance relative to the whole park or site has been issued by the Federal, state, or local official having jurisdiction therof. If there is no physical taking but there is the possibility of constructive use of section 4 (f) land, then the FAA should determine if the activity associated with the proposal would substantially interfere with or is compatible with the normal activity associated with this land. The proposed action would be compatible if it would not affect the normal activity or aesthetic value of a public park, recreational are, refuge or historic site. When so construed, the action would not constitute use and would not, therefore, invoke section 4 (f). See FAA Order 5050.4A, page 36-37.

    "Use" of land for purposes of section 4 (f) is to be construed broadly; it is not limited to the concept to a physical taking, but includes areas that are significantly and adversely affected by a project. See Department of Transportation Order No. 5610.1A, Para. 9 (c) (1), 36 Fed. Reg. 23681 (1971). Activities not located directly on a public park, recreation area, wildlife or waterfowl refuge, or a historic site are also governed by Section 4 (f) if they could d create sufficiently serious impacts that would substantially impair the value of the 4 (f) site in terms of it's prior significance and enjoyment. This can be considered constructive use. See 34 C.F.R. Section 771.135 of the Federal Highway Administration Regulation for guidance.

37. Taylor, Michael, 1990. *Commercial Transport Aircraft*.

Provides specifications and technical data for commercial transport aircraft.

38. Taylor, Michael, 1987. Encyclopedia of Modern Military Aircraft.

An illustrated encyclopedia of military aircraft currently in service. Information provided includes aircraft history, special features, performance data, and versions of each aircraft type.

39. Tennis, Michael W., July 1992. *Impact of Battery-Powered Electric Vehicles on Air Quality in the Northeast States*. Prepared for Northeast States for Coordinated Air Use Management (NESCAUM).

40. Turner, D. Bruce, U.S. Environmental Protection Agency, October 1981. "Workbook of Atmospheric Dispersion Estimates," *APTI Course 423: Dispersion of Air Pollution - Theory and Model Application, Selected Readings Packet*, EPA 450/2-81-011.

41. U.S. Air Force. Air Force Instruction 32-7061: *The Environmental Impact Analysis Process*.

This instruction, formerly Air Force Regulation (AFR) 19-2, implements AFPD 32-70 and describes specific tasks and procedures for the EIAP both within the United States and abroad. This instruction also identifies directives and instructions with further environmental requirements.

42. U.S. Air Force. Air Force Policy Directive 32-70: *Environmental Quality*.

This directive establishes the Air Force's policy in achieving and maintaining environmental quality and compliance with *NEPA* and Executive Order 12114. It addresses development and implementation of an Air Force Environmental Quality Program, establishes environmental authorities and responsibilities, and lists directives and laws implemented by this policy.

43. U.S. Air Force. Environmental Impact Analysis Process: Desk Reference.

A guide prepared to assist Air Force staff in complying with the requirements of the NEPA, provides helpful reference materials that discuss these requirements in more detail; sample documents are provided in attachments. Appropriate use of the reference helps to ensure that the environmental effects of proposed actions are considered in accordance with applicable requirements.

44. U.S. Air Force, 1995. *The Engine Handbook*, San Antonio Air Logistics Center, Kelly AFB, Texas.

This handbook is a reference of current Air Force engines. Engine covered include gas turbine engines (both aeronautical and ground based), reciprocating engines, and auxiliary power units. Engine data provided includes aircraft and engine combinations and number of engines per aircraft.

45. U.S. Department of Defense. DOD Directive 6050.1: *Environmental Effects in the United States of DOD Actions*.

This directive implements the CEQ regulations discussed above and provides the policy and procedures for including environmental considerations in the decision-making process on DOD actions within the United States. The directive includes policy, responsibilities, how to determine if an Environmental Assessment (EA) or Environmental Impact Statement (EIS) is needed, EA content and format, and categorical exclusions.

46. U.S. Department of Defense, July 1993. *DOD Federal Implementation Plan Database Report,* AESO Report Number 07-93, Aircraft Environmental Support Office, San Diego, California.

Aircraft flying, ground, and generation equipment operational information collected on DOD installations to aid the U.S. EPA with their preparation of a Federal Implementation Plan (FIP) for the three southern California air districts that are in severe nonattainment status.

47. U.S. Department of Defense, July 1993. *DOD Federal Implementation Plan Emissions Report: Draft,* AESO Report Number 08-93, Aircraft Environmental Support Office, San Diego, California.

Emissions data for aircraft flying, ground, and generation equipment information collected on DOD installations to aid the U.S. EPA with their preparation of a Federal Implementation Plan (FIP) for the three southern California air districts that are in severe nonattainment status. This report supplements the *DOD Federal Implementation Plan Database Report*.

48. U.S. Department of Defense, 1993. Mobile Source Data for Military Activities in the Federal Implementation Plan (FIP) Areas: Draft.

Mobile source data collected on DOD installations to aid the U.S. EPA with their preparation of a Federal Implementation Plan (FIP) for the three southern California air districts that are in severe nonattainment status.

49. U.S. Department of Transportation, 1988. *A Microcomputer Pollution Model for Civilian Airports and Air Force Bases—Model Application and Background,* FAA Report No. FAA-EE-88-5 or USAF Report No. ESL-TR-88-55 available from NTIS or DTIC, Federal Aviation Administration, funded jointly with the United States Air Force Engineering and Services Center, Tyndall Air Force Base, Florida.

50. U.S. Department of Transportation, August 1988. *A Microcomputer Pollution Model for Civilian Airports and Air Force Bases—Model Description,* FAA Report No. FAA-EE-88-4, USAF Report No. ESL-TR-88-53, NTIS Report No. AD-A199003, Federal Aviation Administration, funded jointly with the United States Air Force Engineering and Services Center, Tyndall Air Force Base, Florida.

This report provides the technical description of the model. It identifies the key design features and describes the type of meteorological information the dispersion portion of the model can accept. The report also presents the results of running EDMS on a number of different microcomputers and compares EDMS results with those of comparable models. The appendices elaborate on the above information and list the source code. This report can be obtained either from the National Technical Information Service (NTIS) or from the Defense Technical Information Center (DTIC).

51. U.S. Department of Transportation, June 1993. *A Microcomputer Pollution Model for Civilian Airports and Air Force Bases—User's Guide* (includes Supplement "A"), FAA Report No. FAA-EE-91-3, USAF Report No. ESL-TR-91-31, Federal Aviation Administration, funded jointly with the United States Air Force Engineering and Services Center, Tyndall Air Force Base, Florida.

This is the final version of the EDMS User's Guide. It contains special instruction for performing air quality assessments at airports and air bases. The report also provides a 94-step example problem to familiarize the user with the model. This report can be obtained either from the National Technical Information Service (NTIS) or from the Defense Technical Information Center (DTIC).

52. U.S. Department of Transportation and U.S. Environmental Protection Agency, 1996. *Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation*, Federal Aviation Administration (See Reference 70).

An advisory circular to encourage continuing progress in reducing emissions in the commercial aviation sector. The document includes technical data needed to evaluate the reduction of emissions.

53. U.S. Department of Transportation, Annual Report. *Airport Activity Statistics of Certificated Route Air Carriers*, NTIS Publication, Federal Aviation Administration and Research and Special Programs Administration.

The report provides data compiled from information reported to the DOT by large certificated route air carriers. The report includes a list of aircraft departures by airport, air carrier, and aircraft type in Table 7. Attachment 4 provides an example page from Table 7.

54. U.S. Department of Transportation. *Airport Master Record*, FAA Form 5010-1, Federal Aviation Administration.

The agency's record of the landing facility indicated. General, runway, lighting/approach aid, obstruction, landing length, services, facility, based aircraft, and operations data are included on the form. Attachment 5 contains an *Airport Master Record* for Ontario International Airport in California, as an example.

55. U.S. Department of Transportation. DOT Order 5610.1C: *Procedures for Considering Environmental Impacts*, Federal Aviation Administration, available from the DOT Warehouse.

This order provides FAA policies and procedures for implementing *NEPA*, DOT Order 5610.1C, and other environment-related statutes, directives, and orders. The order clarifies the *NEPA* process in terms of planning, procedures, content and format, and public participation. It provides an overview of the various *NEPA* assessment documents, including Categorical Exclusions (CEs), Environmental Assessments (EAs), Findings of No Significant Impact (FONSIs), Environmental Impact Statements (EISs), and Records of Decision (RODs), as well as *NEPA* processing requirements.

56. U.S. Department of Transportation. DOT Warehouse, 3341-Q 75th Avenue, Landover, MD 20785; (301) 322-4961.

A source of DOT documents, such as DOT orders.

57. U.S. Department of Transportation. *Emissions and Dispersion Model System (EDMS)*, Federal Aviation Administration (FAA), available from FAA Office of Environment and Energy.

EDMS is a complex source emissions and dispersion model for use at civilian airports and Air Force air bases. The model operates in both a refined and a screening mode. Attachment 6 contains an example emissions outputs.

58. U.S. Department of Transportation, October 1993. *Emissions Model for Ground Support Equipment: User's Guide*, FAA Report No. FAA-EE-93-2, USAF Report No. AL/EQ/1-993/0025, Federal Aviation Administration, sponsored jointly with the United States Air Force Armstrong Laboratory, Tyndall Air Force Base, Florida.

This report describes how to change ground support equipment (GSE) input parameters of the Emissions and Dispersion Model System (EDMS). EDMS is an air quality impact assessment tool for airports and air bases. The GSE extension of EDMS adds the capability to estimate, inventory, and report emissions from diesel and gas-powered GSE. This user's guide provides a brief overview of GSE hardware and operations. It also demonstrates how to use GSE options by guiding the user through a sample problem.

59. U.S. Department of Transportation, Annual Report. *FAA Air Traffic Activity*, NTIS Report, Federal Aviation Administration, Office of Aviation Policy, Plans, and Management Analysis.

    This publication provides terminal and en route air traffic activity data of the National Airspace System. An example page from one report table on airport operations is provided in Attachment 7.

60. U.S. Department of Transportation. *FAA Aircraft Engine Emissions Database (FAEED)*, Office of Environment and Energy, Federal Aviation Administration, available on EPA's *Office of Mobile Sources (OMS) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    FAEED is an automated (computerized) menu-driven procedure for calculating an aircraft emissions inventory.

61. U.S. Department of Transportation. *FAA Aircraft Engine Emissions Database: Users Guide*, Office of Environment and Energy, Federal Aviation Administration, available on EPA's *Office of Mobile Sources (OMS) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    The user's guide for the *FAA Aircraft Engine Emissions Database (FAEED)*. The user's guide provides an overview of the model structure, inputs, and outputs.

62. U.S. Department of Transportation. FAA Order 1050.1: *Policies and Procedures for Considering Environmental Impacts*, Federal Aviation Administration, available from the DOT Warehouse.

    This order provides Federal Aviation Administration policies and procedures for implementing the National Environmental Policy Act, Order Department of Transportation 5610.1C, Procedures for considering Environmental Impacts, and other environmental related statutes, directives, and orders.

63. U.S. Department of Transportation, October 8, 1985. FAA Order 5050.4: *Airport Environmental Handbook*, Federal Aviation Administration, available from the DOT Warehouse.

    Although dated, this 1985 order is recommended for airport personnel, sponsors, and others involved in airport actions when considering environmental impacts, because it contains detailed guidance on preparing the technical assessment of individual environmental impacts (including air quality). Compliance with the order constitutes compliance with DOT Order 1050.1 for airport actions.

64. U.S. Department of Transportation. Form 41, Schedule T-3 - Airport Activity Statistics, Federal Aviation Administration, data tape is available from the DOT/Volpe National Transportation Systems Center, 55 Broadway, Kendall Square, Cambridge, MA 02142.

The data tape provides data reported to the DOT on Form 41, Schedule T-3 by large certificated route air carriers. Data includes aircraft departures by airport, air carrier, and aircraft type. This data also is provided in Table 7 of the DOT *Airport Activity Statistics of Certificated Route Air Carriers* report.

65. U.S. Department of Transportation, Annual Report. *General Aviation Activity and Avionics Survey*, Federal Aviation Administration, Office of Management Systems.

    This report presents the results of the annual General Aviation Activity and Avionics Survey. The report contains activity and avionics information of U.S. registered general aviation aircraft, such as active aircraft, annual flight hours, and average flight hours.

66. U.S. Department of Transportation. Office of Aviation Policy, Plans, and Management Analysis, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

67. U.S. Department of Transportation. Office of Environment and Energy, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

68. U.S. Department of Transportation, Annual Report. *Terminal Area Forecasts*, FAA Publication, Federal Aviation Administration, Office of Aviation Policy, Plans, and Management Analysis.

    This report presents historical and forecast data for over 800 public use airports. For each airport, detailed historical and forecast data are provided by operator type: air carrier, air taxi/commuter, general aviation, and military.

69. U.S. Environmental Protection Agency. *Air Emissions Species Manual*, EPA Report No. EPA-450/2-90-001a.

70. U.S. Environmental Protection Agency. *Clearinghouse for Information on Emission Factors Bulletin Board System (CHIEF BBS)*, Office of Air Quality Planning and Standards, a component of EPA's *Technology Transfer Network (TTN)*. To access the *CHIEF BBS* through the *TTN* bulletin board system with a modem dial (919) 541-5742. Set communications to XModem, 8 Bit System, NO Parity, and 1 Stop Bit. Research Triangle Park, North Carolina.

    The *CHIEF BBS* provides information on air pollutant emission factors, including the latest version of the *Compilation of Air Pollutant Emission Factors*, EPA Report AP-42. Emissions Inventory Models such as *TANKS* and *WIND* are also available for downloading.

71. U.S. Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors*, EPA Report No. AP-42.

    Provides air pollutant emission factors, related emission calculation input data, and emission calculation procedures for emission sources. Stationary point and area sources are addressed in Volume I. Mobile sources are covered in Volume II.

72. U.S. Environmental Protection Agency, February 1995. *Draft User's Guide to PART5: A Program for Calculating Particle Emissions from Motor Vehicles*, EPA Publication No. EPA-AA-AQAB-94-2, National Motor Vehicle and Fuels Emission Laboratory, Office of Mobile Sources.

    The user's guide provides an overview of the PART5 model structure, inputs, outputs. The guide also provides example data.

73. U.S. Environmental Protection Agency, July 13, 1994. *General Conformity Guidance: Questions and Answers*, Office of Air Quality Planning and Standards.

This question and answer guidance document contains issues raised at the general conformity workshop held in Virginia on March 7-8, 1994. The document addresses frequently asked general conformity questions.

74. U.S. Environmental Protection Agency, January 1972. *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States*, NTIS Report Number PB-207103, Research Triangle Park, North Carolina.

    Source of typical mixing height data.

75. U.S. Environmental Protection Agency, July 30, 1993. MOBILE5 Information Sheet #2: *Estimating Idle Emission Factors Using MOBILE5*, available on EPA's *Office of Mobile Sources (OMS) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    MOBILE5 Information Sheets are a series of documents intended to give users detailed information about techniques that can be used to more accurately model highway mobile sources emission and avoid potential errors. The information sheet describes the difficulty in calculating idle emissions and provides a remedy using MOBILE5.

76. U.S. Environmental Protection Agency. MOBILE5a, NTIS Computer Product No. PB95-500179 (IBM PC) or PB95-500187 (Macintosh), or available on EPA's *Office of Mobile Sources (OMS) Bulletin Board System*, a component of EPA's *Technology Transfer Network (TTN)*.

    The motor vehicle emissions model specified by EPA to be used to develop highway vehicle emission factors and emission inventories is MOBILE. At the time of this writing (1996), MOBILE5a is the most current version of the MOBILE motor vehicle emissions model.

77. U.S. Environmental Protection Agency, October 19 1994. *New General Conformity Q's & A's*, Office of Air Quality Planning and Standards.

    This question and answer document addresses additional general conformity questions not included in the EPA *General Conformity Guidance: Questions and Answers* document.

78. U.S. Environmental Protection Agency, November 1991. *Non-road Engine and Vehicle Emissions Study*, Certification Division, Ann Arbor, Michigan.

79. U.S. Environmental Protection Agency. *Office of Mobile Sources Bulletin Board System (OMS BBS)*, a component of EPA's *Technology Transfer Network (TTN)*. To access the *OMS BBS* through the *TTN* bulletin board system with a modem dial (919) 541-5742. Set communications to XModem, 8 Bit System, NO Parity, and 1 Stop Bit. Research Triangle Park, North Carolina.

    The *OMS BBS* provides information pertaining to mobile source emissions, including regulations, test results, models, and guidance.

80. U.S. Environmental Protection Agency. PART5, available on EPA's *Office of Mobile Sources (OMS) Bulletin Board System*, a component of the EPA *Technology Transfer Network (TTN)*.

    A model for use in the analysis of the particulate air pollution impact of in-use gasoline-fueled and diesel-fueled motor vehicles.

81. U.S. Environmental Protection Agency, 1992. *Procedures for Emission Inventory Preparation*, Volume IV, Chapter 3: Emissions from Highway Vehicles.

Describes the procedures for calculating emissions from highway vehicles.

82. U.S. Environmental Protection Agency, 1992. *Procedures for Emission Inventory Preparation*, Volume IV, Chapter 5: Emissions from Aircraft.

Describes the procedures for calculating emissions from civilian and military aircraft within an inventory area.

83. U.S. Environmental Protection Agency. *Support Center for Regulatory Air Models Bulletin Board System (SCRAM BBS)*, Office of Air Quality Planning and Standards, a component of the EPA *Technology Transfer Network (TTN)*. To access the *SCRAM BBS* through the *TTN* bulletin board system with a modem dial (919) 541-5742. Set communications to XModem, 8 Bit System, NO Parity, and 1 Stop Bit. Research Triangle Park, North Carolina.

The *SCRAM BBS* provides regulatory air quality model computer code, meteorological data, documentation, as well as modeling guidance.

84. U.S. Environmental Protection Agency. TANKS, available on EPA's Clearinghouse for Information on Emission Factors Bulletin Board System (CHIEF BBS), a component of EPA's Technology Transfer Network (TTN).

A computerized procedure for calculating the sum of hydrocarbon emissions from above-ground and below-ground fuel storage tanks.

85. U.S. Environmental Protection Agency. *Technology Transfer Network (TTN)*, Office of Air Quality Planning and Standards. To access the *TTN* bulletin board system with a modem dial (919) 541-5742. Set communications to XModem, 8 Bit System, NO Parity, and 1 Stop Bit. Research Triangle Park, North Carolina.

The *TTN* is a network of electronic bulletin boards that provides information and technology exchange in different areas of air pollution control, ranging from emission test methods to regulatory air pollution models. The service is free, except for the cost of using the phone.

86. U.S. Environmental Protection Agency, 1992. User's Guide for CAL3QHC Version 2: A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections, EPA Publication No. EPA-454/R-92-006, Research Triangle Park, NC.

The user's guide for the CAL3QHC model used to predict pollutant concentrations near roadway intersections.

87. U.S. Environmental Protection Agency, 1990. *User's Guide for the Urban Airshed Model, Volumes I-VII*; EPA Publication Nos. EPA-454/B-90-007a-c, d®, and EPA-454/B93-004e-g; NTIS Publication Nos. PB 91-131227, PB 91-131235, PB 91-131243, PB 93-122380, PB 91-131268, PB 92-145382, and PB224849; Research Triangle Park, NC.

The user's guide for the Urban Airshed Model (UAM), which is the EPA preferred air quality model for photochemical or reactive pollutant modeling applications involving entire urban areas.

88. U.S. Environmental Protection Agency, March 1993. *User's Guide to MOBILE5a: Mobile Source Emissions Model*, NTIS Report No. PB95-100509.

The user's guide for the MOBILE5a model, which calculates motor vehicle emission factors.

89. Urban Airshed Model (UAM), NTIS Computer Product or available on EPA's Support Center for Regulatory Air Models (SCRAM) Bulletin Board System, a component of EPA's Technology Transfer Network (TTN).

An EPA preferred air quality model for photochemical or reactive pollutant modeling applications involving entire urban areas.

90. Webb, Sandy, Energy and Environmental Analysis, Inc., (703) 528-1900, June 10, 1991. Memorandum to Rich Wilcox, EPA/Office of Mobile Sources. Subject: *General Aviation Generalized Emission Indexes*.

This memorandum discusses the derivation of generalized exhaust emissions factors for general aviation and air taxi aircraft.

91. WIND, available on EPA's Clearinghouse for Information on Emission Factors Bulletin Board System (CHIEF BBS), a component of EPA's Technology Transfer Network (TTN).

An EPA computer program that estimates the wind erosion emissions from material piles.

92. Weast, Robert C. (ed.), 1982. *CRC Handbook of Chemistry and Physics, 63rd Edition*, CRC Press, Boca Raton.

General reference book for chemical and physical data.

93. Executive Order 11593: Protection and Enhancement of Cultural Environment, May 13, 1971.

Requires Federal agencies to provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation.

8. INDEX

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