Proposal to Designate an Emission Control Area for Nitrogen Oxides, Sulfur Oxides and Particulate Matter

Technical Support Document

Chapter 1
Executive Summary

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1 Executive Summary

Introduction

On March 27, 2009, the United States and Canada submitted a joint proposal (MEPC 59/6/5) to the International Maritime Organization to designate an Emission Control Area (ECA) for specific portions of U.S. and Canadian coastal waters. This action would control emissions of nitrogen oxides (NO_X), sulfur oxides (SO_X), and particulate matter (PM) from ships. Designation of the proposed ECA is necessary to protect public health and the environment in the United States and Canada by reducing exposure to harmful levels of air pollution resulting from these emissions. The burden on international shipping is small compared to the improvements in air quality, reductions in premature mortality and other benefits resulting from designation of the proposed ECA.

This Technical Support Document provides a comprehensive presentation of the many in-depth technical analyses performed by the U.S. Government, in developing the ECA proposal.

Emission Inventory

Chapter 2 describes how U.S. emission inventories were developed to describe air emissions from ships operating in waters within the proposed ECA. These inventories provide the foundation upon which all the subsequent analyses were built, and address Criterion 6 of Section 3, Appendix III to MARPOL Annex VI. Beyond the level of detail provided in MEPC 59/6/5, Chapter 2 explains how the inputs were developed and what assumptions were made in assessing what the emissions are from ships currently (2002 base year), what the emissions would look like in 2020 without the proposed ECA, and what reductions can be expected from the proposed ECA.

Chapter 2 describes the "bottom-up" methodology that was used, based on the latest state of the art models and inputs. This chapter describes which port-related emissions were included and why, and how emissions were obtained for ships while underway in U.S. waters. This chapter explains in great detail each parameter that went into the modeling and analyses, including which ships are included, which fuels are used by those ships, which other (non-ECA) emission controls are in place for each scenario, and what growth rates are expected, incorporating forecasts of the demand for marine transportation services in 2020.

Impacts of Emissions on Air Quality, Human Health and the Environment

Chapter 3 describes in great detail most of the analyses conducted in support of Criteria 2, 3, 4 and 5 of Section 3, Appendix III to MARPOL Annex VI. For organizational reasons, the analyses conducted to assess the impacts of ships' emissions on human health are presented in Chapter 4, summarized below. Chapter 3 contains several sub-sections, outlined here for ease of reference.

Impacts of Pollutants on Human Health

Section 3.1 describes the human health impacts of the pollutants proposed for control in the U.S./Canada ECA. The proposed ECA would not only reduce direct emissions of NO_X, SO_X and PM, but also secondarily formed ambient PM and ground-level ozone. Section 3.1.1 describes the nature of these pollutants, formation processes, and relationship to ship emissions. Section 3.1.2 presents the health effects associated with exposure to NO_X, SO_X, PM and ground-level ozone, summarizing the key scientific literature.

Impacts of Ships' Emissions on Air Quality and Benefits of ECA to Air Quality

Section 3.2 describes the effects of NO_X, SO_X and PM emissions on ambient air quality under the same scenarios for which emission inventories were developed, presented in terms of ground-level ozone and PM. This section also describes the multi-pollutant modeling platform that was used to assess the impacts of reduced marine emissions from the application of the proposed ECA. Appendix A to Chapter 3 describes the relevant meteorological conditions that contribute to at-sea emissions being transported to populated areas and contributing to harmful human health and ecological impacts, and which formed inputs to the modeling platform.

Impacts of Ships' Emissions on Ecosystems and Benefits of ECA to Ecosystems

Section 3.3 describes the impacts of emissions from ships on terrestrial and aquatic ecosystems such as visibility, ozone uptake, eutrophication, acidification, loss of forest biomass, and overall forest health. Using the same scenarios as for the other analyses, improvements in environmental conditions for many types of ecosystems were evaluated. Unlike the analyses for human health, there are a larger number of pollutants of concern to ecosystems. Thus, deposition of many chemical forms of NO_X, SO_X and PM are discussed in this section, as well as the biogeochemical cycles of interrelated pollutants such as mercury.

Impacts of Ships' Emissions on Human Health and Benefits of ECA to Human Health

Chapter 4 presents quantified U.S.-related health impacts for PM and ozone associated with emissions from ships, both in terms of the expected contribution of overall ship emissions to adverse health impacts on land and the reductions in adverse health impacts that can be expected to occur from the adoption of the proposed ECA.

The health impacts modeling presented in Chapter 4 is based on peer-reviewed studies of air quality and health and welfare effects associated with improvements in air quality. This chapter also describes the computer program used to estimate health benefits by integrating a number of modeling elements (e.g., interpolation functions, population projections, health impact functions, valuation functions, analysis and pooling methods) to translate modeled air concentration estimates into health effect incidence estimates.

Cost Analyses

Chapter 5 describes our estimates of the costs associated with the reduction of SO_X, NO_X, and PM emissions from ships, not only to the shipping industry but also to marine fuel suppliers and companies who rely on the shipping industry. This chapter provides additional detail

regarding the analyses conducted in support of Criteria 7 and 8 of Section 3, Appendix III to MARPOL Annex VI. This chapter describes the analyses used to evaluate the cost impact of Tier III NO_X requirements combined with low sulfur fuel use on vessels operating within the proposed ECA, including estimates of low sulfur fuel production costs, vessel hardware costs, and operating costs. This chapter also presents cost per ton estimates for ECA-based NO_X and fuel sulfur standards and compares these with the costs of established land-based control programs.

Economic Impact Analysis

Chapter 6 examines the economic impacts of the projected ECA costs on shipping engaged in international trade. This chapter provides additional detail in support of Criterion 8 of Section 3, Appendix III to MARPOL Annex VI. This chapter describes the econometric methodology that was used in estimating two aspects of the economic impacts: social costs and how they are shared across stakeholders, and market impacts for the new engine and new vessel markets.