Ontario

A Proposed Risk Management Framework for the Air Standard Setting Process in Ontario

A Discussion Paper

Implementation of Ontario's new or revised air quality standards relating to Ontario Regulation 346 (under the *Environmental Protection Act*) as amended

March, 2001

Executive Summary

The Ministry of the Environment's commitment to ensuring cleaner air remains a high priority. The Ministry continues to focus on finding solutions to problems that pose the greatest risk to human health and the environment. We have been active in the development and improved implementation of new air quality standards in Ontario. These initiatives include:

- use of the latest scientific information to develop protective, effects-based air standards;
- a risk management framework with the ultimate goal of implementing the effects-based air standards while allowing for time, technology and economic issues to be considered; and
- an update of the Ontario Regulation 346 air dispersion models to ensure that the latest scientific tools to assess compliance with air standards are being used.

The Ministry of the Environment (MOE) has released on the Environmental Registry (under the Environmental Bill of Rights (EBR)) the following three initiatives:

Air Standards

Following consultation in February, 2000 (and previous consultation in 1998), MOE has posted, on the Environmental Registry, decisions on 18 high priority air standards. In addition, one air standard has been re-posted as a proposal recommending a change from our original proposal based on stakeholder input and reassessing the standard. In summary, one new air standard has been finalized; two air standards are more stringent final effects-based numbers; and four Point of Impingement air standards have been reaffirmed as being protective at their current level. Risk management issues were identified for 11 of these air standards. One standard (plus two from March, 1998) will remain unchanged in the interim until discussions are held on implementation issues. Ten interim, but more stringent, air quality standards have been set pending discussions on the proposed risk management framework. Any new or revised standards will take effect six month from the date of the Environmental Registry posting. MOE plans to incorporate these standards into Ontario Regulation 346.

A Proposed Risk Management Framework for Air Standard Setting in Ontario

MOE has developed a proposal for a risk management framework that is intended to address time, technical and economic issues that arise as a result of new or revised air quality standards. The framework contemplates the use of options, incentives and enhanced enforcement to promote earlier and effective implementation of air standards while improving operational flexibility and equity amongst the regulated community. The proposal outlined in this discussion paper entitled: "A Proposed Risk Management Framework for the Air Standard Setting Process in Ontario" was released on the Environmental Registry in March, 2001 for a 150 day comment period.

New Air Dispersion Models

Ontario proposes to phase-out the existing Ontario Regulation 346 air dispersion models and replace them with the suite of United States Environmental Protection Agency (US EPA) air dispersion models (in particular AERMOD and ISC-PRIME). The adoption of the US EPA models will promote the use of the most modern scientific tools available to assess compliance with air quality standards. A key advantage to introducing the new air dispersion models is the ability to use effects-based standards with appropriate averaging times to assess compliance. The ability to model concentrations using appropriate averaging times provides a more representative assessment of health and environmental impacts from air emissions. The discussion paper entitled: "Updating Ontario's Air Dispersion Models" was released on the Environmental Registry March, 2001 for a 120 day comment period. Implementation issues such as appropriate phase-in period for the models are included for public consultation.

MOE has been active in the development and improved implementation of new or revised air quality standards in Ontario. Effects-based air standards are set to protect critical receptors from environmental and health impacts. MOE's goal is to implement, where possible, final effects-based air standards. This proposed risk management framework will formalize an open and transparent process to deal with situations where the implementation of final effects-based standards is not possible due to proven economic and/or technical considerations. The intent is to provide a balance between effective, equitable and timely implementation of new or revised air quality standards while providing a mechanism to address time, technology and/or economic issues.

MOE continues to look for innovative approaches to complement legislation and regulations. These include working with communities, industries and organizations towards finding flexible, practical, cost-effective ways to strengthen environmental protection. These three initiatives support this vision and we invite all stakeholders to comment on our proposals.

A Proposed Risk Management Framework for the Air Standard Setting Process in Ontario

A Discussion Paper for Consultation with Stakeholders

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1.0 Introduction

The Ministry of the Environment (MOE), through the Standards Development Branch (SDB), sets environmental quality standards[1] to protect human health and the environment. Standards are developed for air, soil, ground water, surface water, drinking water, sediment and biota. This discussion paper focuses on the setting and implementing of ***air*** quality standards in Ontario. There are three stages to the air standard setting process:

	Outcome
Stage 1: Setting Priorities MOE's Standards Setting Plan (revised October, 1999) sets out priorities for the development of all standards including air quality standards. Priorities have been set primarily based on the toxicology of the contaminants and the quantity of release.	70 High Priority Substances (& 75 Reaffirmed)
Stage 2: Risk Assessment Risk Assessment is the scientific evaluation of the likelihood of adverse effects due to exposure of a human or non-human organism to a physical, chemical or biological agent. The Risk Assessment process considers peer reviewed science, and known ambient air concentrations to set an air quality standard based on the limiting effect. MOE sets effects-based air quality standards to protect human health, prevent environmental damage and minimize offensive odours. The outcome of the Risk Assessment process are effects-based air quality standards ((Ambient Air Quality Criteria (AAQC) and Point of Impingements (POI) standards)).	Effects-Based Standards -protect health and environment (AAQC and POIs)
Stage 3: Risk Management Risk Management in air standard setting is a policy decision which integrates information from risk assessment (i.e. the likelihood of adverse effects as well as any measures of uncertainty) with time, economic and technical feasibility considerations. Risk Management considerations in MOE's standard setting process are intended to provide flexibility, fairness, economic efficiency and effectiveness in achieving environmental protection goals and do not prescribe how regulated sources will meet new or revised air quality standards. The proposed Risk Management (RM) framework is for consultation in this discussion paper.	More time &/or standards that are: - interim or final, - site specific, - sector specific, - technology-based

[1] The term "standard" used in this document includes any numerical environmental concentration limit set by MOE.

Ontario's Overall Air Standard Setting Process is outlined in Figure 1. Stakeholder input into the Risk Assessment and Risk Management components is an integral part of the air standard setting process. This discussion paper proposes a framework for the Risk Management (RM) component of the air standards development process. The goal is to ensure a balance between effective, equitable and timely implementation of new or revised air quality standards while providing a mechanism to address time, technology and/or economic issues.

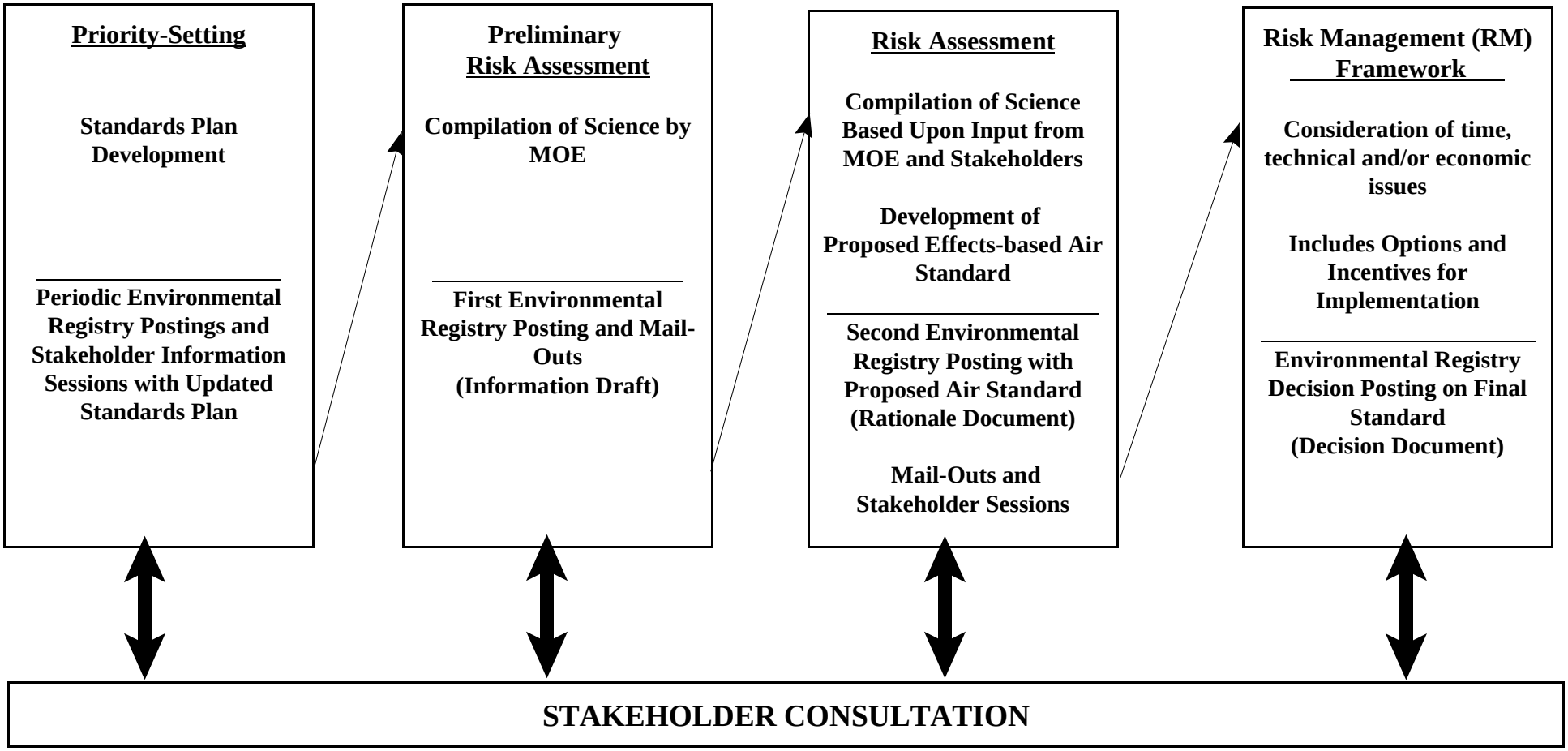
The regulatory tool for implementing the air standards in Ontario is the General - Air Pollution Regulation 346 (O. Reg. 346). O. Reg. 346 specifies that a source of air pollution cannot emit a contaminant at levels which would result in a standard being exceeded at its maximal point of impingement (Section 5(3)). Mathematical air dispersion models are used to predict maximum ground level concentrations or Point of Impingement (POI) concentrations at locations in the vicinity of facilities that emit contaminants into the air. These concentrations are then compared to the MOE's air quality standards[2] to assess environmental and/or health impacts. Historically, the primary mechanism used to assess compliance with air quality standards has been the Certificate of Approval (Air) process (under Section 9 of the Ontario *Environmental Protection Act*).

In the development of new or revised air quality standards, MOE recognizes that not all standards can be achieved immediately because of technology and/or economic considerations. This discussion paper sets out the questions that need to be answered in order to develop an effective RM framework for air standard setting in Ontario. This discussion paper includes:

- a summary of the background information that points to the need for a proposed RM framework in Ontario (Section 2.0); and
- the fundamental objectives and concepts that guided MOE's efforts to develop the proposed RM framework (Section 3.0);
- the proposed RM framework (Section 4.0);
- linkages to other MOE air initiatives (Section 5.0)
- next steps in the finalization of the proposed RM framework (Section 6.0)

[2] Refer to the MOE "Summary of Point of Impingement Standards, Point of Impingement Guidelines and Ambient Air Quality Criteria (AAQCs), Standards Development Branch, Ministry of the Environment", dated November 1999 (or most recent revision).

Figure 1: Overall Air Standard Setting Process



2.0 Background

In 1996, MOE published a three-year plan to review and update, where necessary, our environmental standards: "Setting Environmental Quality Standards in Ontario, The Ministry of the Environment's Standards Plan". The purpose of the standards plan is to set priorities as well as to promote awareness to stakeholders about which standards will be updated or developed.

In 1997, the need for improved input and consultation with stakeholders was identified as a necessary and integrated component of the standard setting process.

In March, 1998, the first group of 14 air quality standards were posted to the Environmental Registry. Subsequent stakeholder information sessions were held in the spring of 1998. MOE continues to review five of these 14 air standards (the metals: cadmium, chromium VI, arsenic and nickel as well as cyclohexane) to address stakeholder concerns (see Table 1 for list of proposed, new and reaffirmed air standards).

In September, 1998 the MOE hosted a stakeholder risk management workshop for air quality standards. A key outcome of the workshop was a recommendation by stakeholders that the MOE link initiatives, such as updating the air dispersion models, to the air standard setting process. MOE acknowledges that stakeholders opinions and comments on a proposed air standard may change if the existing O. Reg. 346 air dispersion models were replaced with the new United States Environmental Protection Agency (US EPA) models. The introduction of new models may impact the ability of industrial sources to comply with new or revised air quality standards and this is a risk management issue.

In October, 1999, MOE revised the standards plan: "Setting Environmental Quality Standards in Ontario: the Ministry of the Environment's Standard Plan". It also proposed to reaffirm 75 air quality standards at their present values based on a jurisdictional review. Decisions on these 75 air standards were posted on the Environmental Registry in February, 2000.

Also in February, 2000, a second group of 18 air quality standards were developed and posted on the Environmental Registry for comment. Table 1 provides a summary of the 18 proposed, new or revised air quality standards. In some cases, air quality standards were finalized or reaffirmed at their existing levels. In other cases, reductions of one to two orders of magnitude were proposed in order to meet the final effects-based air quality standard developed in the risk assessment stage of the standard setting process. In cases where significant implementation issues were identified, interim standards have been set (see individual decision notices on the Environmental Registry) pending the outcome of our risk management consultation. There is a need to finalize a Risk Management (RM) framework to address time, economics and/or technical barriers to meeting proposed effects-based standards before new or revised air quality standards can be implemented. A key purpose of this RM framework is to define when there is a need to develop a technology-based, risk managed air quality standard and/or when, due to economic factors, a longer phase-in period to implement the new or revised effects-based air quality standards is required.

Table 1: List of Proposed, New or Reaffirmed Effects-based Air Quality Standards

(maximum ½-hour average basis and maximum 24-hour average basis)

Compound [d]	Existing Air Quality Standard	Proposed, New or Reaffirmed Effects-Based Air Quality Standards	
	Max. ½-hour Average ($\mu g/m^3$)	Max. ½-hour Average ($\mu g/m^3$)	Max. 24-hour Average ($\mu g/m^3$)
First Group of 9 from Mar/98:			
1,4-Dichlorobenzene [a]	-	285	95
Formaldehyde [a]	65	65	65
Tetrachloroethylene	10000	1080	360 [a]
Trichloroethylene	85000	350 [b]	115 [a]
1,2-Dichloroethane [a]	1200	6	2
Carbon Tetrachloride [a]	1800	7.2	2.4
Styrene [a]	400	400	400
Methylene Chloride	5300	660	220 [a]
Acetaldehyde [a]	-	500	500
Second Group of 18 from Feb/00			
Acrylonitrile	300	1.8	0.6
Ammonia	3600	300	100
Chlorine	300	30	10
Chloroform	1500	3	1
Ethyl Benzene	4000	1400	1000
Ethyl Ether	30000	700	8000
n-Heptane	-	33000	11000
n-Hexane [c]	35000	7,500 [c]	2,500 [c]
Hydrogen Chloride	100	60	20
Isopropyl Benzene	100	100	400
Methanol	84000	12000	4000
Methyl Ethyl Ketone	31000	3000	1000
Methyl Isobutyl Ketone	1200	1200	1200
Mineral Spirits	30000	3000	2600
Propylene Oxide	13500	4.5	1.5
Toluene	2000	2000	-
Vinylidene Chloride	70	30	10
Xylene	2300	2300	-

Notes for Table 1:

a) Environmental Registry decisions for these standards were posted December, 1998 and, although O. Reg. 346 has not yet been amended, these standards are already in use.

b) A decision notice on an interim air standard of 3,500 $\mu g/m^3$ for trichloroethylene was posted on the Environmental Registry March, 2001.

c) Comments from stakeholders prompted a reassessment of the proposed standard for n-hexane. Please refer to the Environmental Registry for more information on the newly proposed standard.

d) The above list is in addition to 75 existing air quality standards that were reaffirmed by MOE in February, 2000.

e) "-" means either there is no existing air quality standard or no final decision has been made

3.0 Objectives and Concepts of the Framework

The primary objective of the proposed Risk Management (RM) framework is to ensure a balance between the need to address any implementation, technical and/or economic issues with the need for transparent, equitable and timely compliance with new or revised air quality standards to protect Ontario communities. This section presents the fundamental objectives and concepts used by MOE to develop the proposed RM framework which provides the necessary balance between these sometimes competing objectives. The objectives of this RM framework are to:

- Ensure implementation of new air quality standards is predictable and has sufficient lead time to minimize uncertainty and allow for planning by facility operators. This objective is consistent the overall standards setting plan.
- Ensure the framework is robust enough to account for a wide variety of situations: from very small to very large facilities; from unique industrial processes to a large number of similar processes; from individual facilities to sectors; and for varying uses/emissions of toxic substances.
- Enhance existing methods (such as the approvals process) for implementing the air quality standards to ensure equity of application, minimize avoidance and encourage compliance.
- Provide the necessary linkages between the development of air quality standards, the approvals process and the proposed new air dispersion models[3].

The RM framework should not unduly delay the effective protection of Ontario communities and the expedient initiation of reductions in impacts, where necessary. Timely implementation of air standards to reduce impacts more effectively improve Ontario's air quality.

3.1 The Science

MOE's ultimate goal is to protect human health and the environment by adopting scientifically defensible effects-based air quality standards. Effects-based air quality standards are the outcome of the Risk Assessment stage of the air standard setting process. Stakeholders will continue to have an opportunity to comment on the science as part of the MOE's consultation process through posting of the Information Draft documents for each contaminant and the Rationale Documents where a standard is actually proposed (see Figure 1). Risk Assessment and Risk Management should, generally, be separate and distinct components of the air standard setting process. Maintaining these two process as distinct will assist with the clear and transparent presentation, to stakeholders and the public, of the scientific, technical and/or economic information that is used to support a new or revised air quality standard and its implementation.

[3] For information on new models, see discussion paper entitled: "Updating Ontario's Air Dispersion Models" posted on the Environmental Registry March, 2001 for a 120 comment period.

The introduction of the new United States Environmental Protection Agency (US EPA) air dispersion models into Ontario will also promote the use of the most up-to-date scientific tools available to assess compliance with air quality standards. The proposed new air dispersion models provide a more accurate picture of environmental effects than the models we currently use (which are outlined in O. Reg. 346). A key advantage to introducing the new air dispersion models is the ability to use effects-based standards with appropriate averaging times to assess compliance. Effects-based standards with appropriate averaging times means concentrations of contaminants are assessed over the period of time which minimizes adverse effects or unreasonable risk of adverse effect. The ability to model concentrations using appropriate averaging times provides a more representative assessment of health and environmental impacts from air emissions (see Section 5.2).

3.2 The Incentives

The use of incentives promotes the timely implementation of new or revised effects-based air quality standards. Incentives reward facilities who make a commitment to reduce key toxins and implement the effects-based air standards within a specified period of time. One of the incentives that the MOE has been exploring is the use of Comprehensive Site-wide Certificates of Approval (air) (see Section 5.3). These Certificates of Approval (air) are intended to improve the implementation of air quality standards while improving operational flexibility and reducing administrative costs and time delays to both Ontario industry and MOE. Facilities that can demonstrate compliance with proposed, new or revised effects-based air quality standards or are willing to implement the new air quality standards over a pre-determined time frame are eligible for a Comprehensive, Site-wide Certificate of Approval (air).

MOE (Environmental Assessment & Approvals Branch (EAAB)) have implemented a pilot project to issue Comprehensive, Site-wide Certificates of Approval (C of A) (air). For more information on how to obtain a Comprehensive Site-wide CofA (air), please contact EAAB. MOE continues to be interested in hearing from stakeholders about what other possible incentives are available to industry to encourage compliance with proposed, new or revised air quality standards sooner.

3.3 The Options

Representatives of industrial facilities/sectors are best suited to determine whether or not there is a need to consider risk management issues. One of the fundamental principles of the proposed RM framework is that the framework should be robust enough to account for a wide variety of situations: from very small to very large facilities; from unique industrial processes to a large number of generic processes; from individual facilities to sectors; and for varying uses/emissions of toxic substances. The RM framework must provide a range of options so facility operators can select the most appropriate approach to address any risk management and implementation issues.

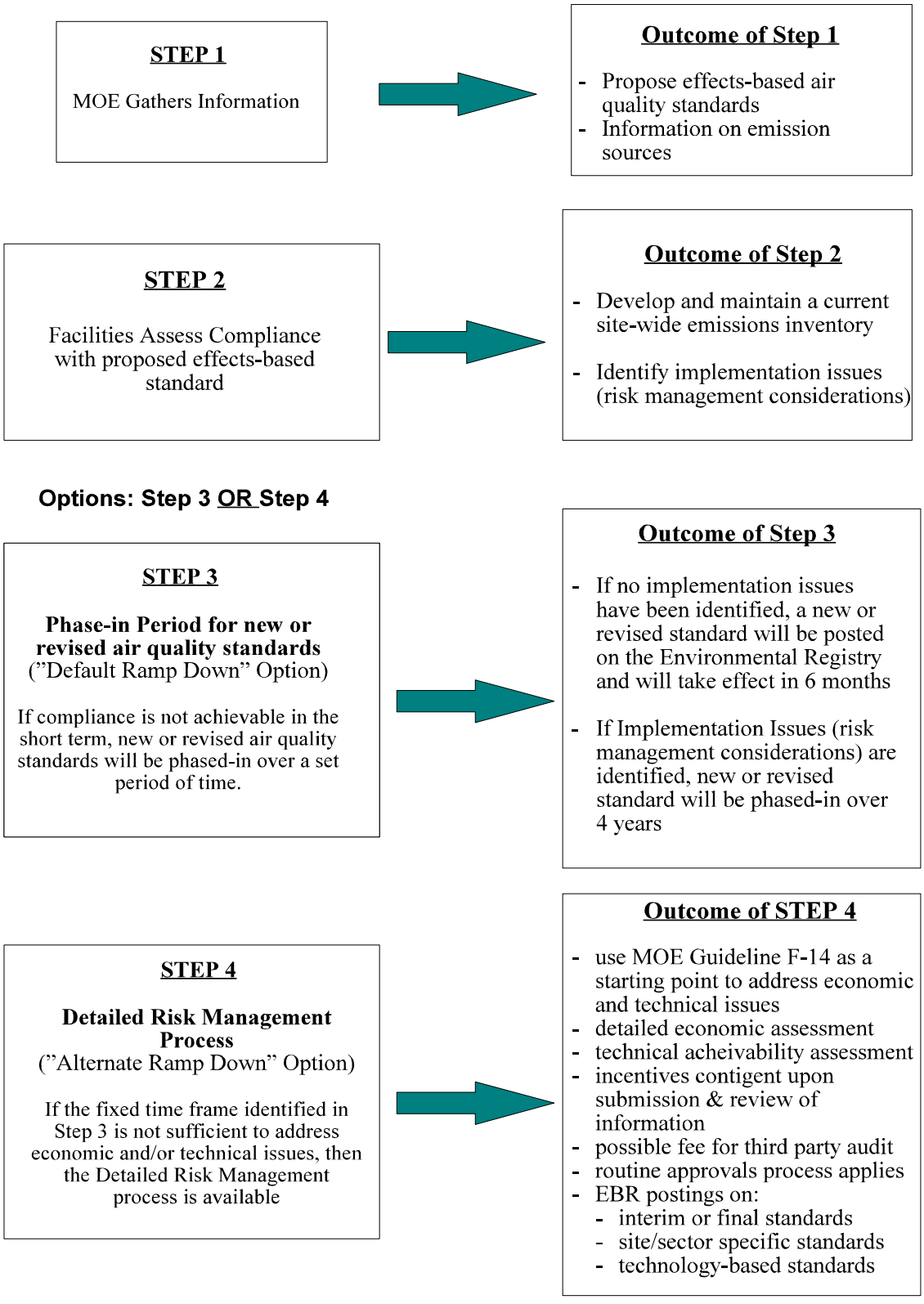
3.4 The Consequences

The *Environmental Protection Act* and O. Reg. 346 requires, among other things, all air emitters to obtain the necessary Certificates of Approval for emissions and to ensure compliance with all air standards while not causing an adverse effect. If non-compliance is identified, then industry has an obligation to report this to MOE (under section 13 and if applicable section 14 of the *Environmental Protection Act*) and the necessary action should be taken. Although incentives can play a key role in the implementation of new or revised air quality standards, the public as well as stakeholders recognize that the success of any program can depend on the degree of compliance monitoring. In 1997-98 MOE's Operations Division launched a pilot project, identified as the Selected Targets for Air Compliance (STAC), to directly audit compliance with Ontario air standards at industrial sources. A select number of large facilities were required to demonstrate compliance with O. Reg. 346 by submitting a site-wide emission summary and dispersion modeling report for review by MOE. The STAC project demonstrated there are benefits to using compliance auditing to improve the implementation of air quality standards. The potential to improve the focus on compliance with the air standards while providing incentives such as improved operational flexibility was also identified. Compliance auditing could complement the approvals process in the implementation of new or revised air quality standards. MOE is looking to provide a linkage between these efforts and the proposed Risk Management framework.

4.0 The Proposed Risk Management (RM) Framework

The RM framework begins once a new or revised air quality standard has been proposed by MOE. This proposed new or revised air quality standard would be the effects-based standard developed under the Risk Assessment stage of the air standard setting process (see Section 1.0). The goal of the RM framework is to implement, where possible, the effects-based air quality standards and develop a process to deal with those exceptional cases where time, technology and/or economic issues need to be considered. The proposed four step RM framework embodies the objectives and concepts outlined in Section 3.0. An overview of the RM framework is illustrated in Figure 2. This section describes the four steps in the RM framework in more detail.

Figure 2: Proposed Risk Management Framework for Air Standards



STEP 1 - MOE Gathers Information

The first step toward implementing new or revised air quality standards is gathering the necessary background material to determine who may be potentially impacted by the introduction of a new or revised air quality standards. There are two phases of information gathering:

a) gathering and reviewing the scientific information used by MOE to develop the proposed effects-based air quality standards; and

b) gathering information to make informed decisions on the need for risk management decisions based on timing, economic and/or technology considerations including identifying sources; distribution of emissions; and reviewing information from other North American jurisdictions.

MOE relies on potentially impacted stakeholders to bring forward any implementations issues as soon as possible. Both MOE and stakeholders need to partner together to gather the relevant information needed to make sound decisions about the implementation of air quality standards. Information gathered in Step 1 is included in the individual Information Drafts and Rationale Documents for each contaminant posted on the Environmental Registry for public comment (see Figure 1). In addition to the Environmental Registry posting, MOE will conduct enhanced outreach to stakeholders through information sessions; meetings with targeted stakeholders and distribution of notices through facsimiles, e-mails, newsletters, etc.

STEP 2 - Facilities Assess Compliance

Consistent with existing requirements in O. Reg. 346, industrial facility owners will complete a site-wide assessment of emissions and predicted impacts relative to the proposed new or revised air standard(s). MOE's document "Procedure for Preparing an Emission Summary and Dispersion Modelling Report, June 1998" can assist stakeholders with this task. If the emission summary and dispersion modelling report shows compliance with the proposed new or revised air quality standards, then a facility is eligible to obtain a Comprehensive Site-Wide CofA (see Section 5.3). If no implementation issues are brought forward by industry, MOE will finalize the new or revised effects-based air quality standard. The new or revised standard would come into effect 6 months from the time the Environmental Registry decision notice is posted.

STEP 3 - Phasing-in Standards that require RM (the "Default Ramp Down" Option)

Under Step 2, some facilities may have no problem meeting a new or revised air quality standard within 6 months of the Environmental Registry decision notice being posted. Other industrial facilities may identify potential issues related to complying with a proposed new or revised air quality standards which will require more time to resolve. For those air standards where implementation issues have been identified, MOE proposes to phase-in these new air standards over a period of 4 years. From the information we have received from stakeholders, a 4 year phase-in period should allow proponents sufficient time to analyze pollution prevention/control measures to meet new or revised air standards; obtain approval of capital expenditures and installation of equipment; and plan for the proposed introduction of the new air dispersion models. Proponents will have 4 years to come into compliance with a new or revised air standard once the final decisions on the effects-based standards are posted on the Environmental Registry registry. Implementation issues are anticipated when:

- the compound with a new or revised air standard is a commonly used chemical;
- it is difficult to identify all the potential emitters of the chemical; and
- the introduction of the new air dispersion models into Ontario may affect the predicted maximum ground level concentration or POI.

This proposed "Default Ramp Down" Option is for those facilities who do not comply with the proposed new or revised air quality standard(s) today but make a commitment to comply within a set period of time (i.e. 4 years). The phase-in period allows stakeholders time to develop their own plan for achieving compliance with the new or revised air quality standards. As an incentive to making this commitment, these facilities would be eligible to obtain a Comprehensive Site-wide Certificate of Approval that provides more operational flexibility (see Section 5.3). It is hoped that this proposed 4 year phase-in period for new or revised air standards will avoid protracted discussions about economic and technology barriers to implementation. The proposed 4 year phase-in period, in conjunction with the Comprehensive, Site-wide Certificate of Approval, provides the incentive for most facility operators to opt for Step 3 - the "Default Ramp Down" Option. Their commitment to achieve the air standard(s) would be enforced through conditions on their Certificate of Approval. Decision Box #1 outlines the points for discussion for implementation of this "Default Ramp Down" option.

Decision Box #1: Phasing-in Standards that require RM ("Default Ramp Down")

Proposal for Discussion:

The proposed "Default Ramp Down" Option means new or revised air quality standards would be phased-in over a predetermined period of time. Where no implementation issues are identified, a new or revised air quality standard will take effect 6 months from the date of the Environmental Registry decision posting. If implementation issues are identified, a 4 year phase-in period to meet a new or revised air quality standard is proposed.

Questions for stakeholders:

4.1.1 If stakeholders have not identified any implementation issues, is it reasonable for MOE to finalize effects-based air quality standards within 6 months of the Environmental Registry decision posting?

4.1.2 Should new facilities be required to meet a new or revised air quality standards immediately?

4.1.3 Where implementation issues have been identified, is a 4 year phase-in period to implement new or revised air quality standards acceptable? If not, what is an appropriate phase-in period or approach to implement new or revised air quality standards? What information should facilities provide MOE to substantiate the need for a 4 year period to comply?

4.1.4 Many health-based air standards are based on chronic impacts that occur over an extended period of time (i.e. health-based carcinogens are based on a lifetime exposure risk): other air standards are based on more short term health or environmental impacts such as odour. Should the phase-in period to comply with new or revised air quality standards vary depending on the nature of the contaminant and/or anticipated health or environmental impacts?

4.1.5 Should MOE consider more clearly defined implementation steps during the phase-in of new or revised air quality standards? (i.e. specified reductions per year) If so, what would be a reasonable approach?

4.1.6 What other incentives could the MOE offer to proponents to promote the use of the "Default Ramp Down" Option in Step 3 ... either in addition to, or as an alternative to, the use of a Comprehensive, Site-wide Certificate of Approval (air)?

STEP 4 - Detailed Risk Management Process (the "Alternate Ramp Down" Option)

MOE anticipates that the 4 year phase-in approach outlined in Step 3 (i.e. "Default Ramp Down" Option) will address most implementation issues for most stakeholders. However, MOE recognizes that, in some cases, industrial stakeholders may decide that a more detailed risk management review is necessary. Step 4, the "Alternate Ramp Down" Option, is designed for those facilities who cannot make a commitment to meet a new or revised air quality standard within the generic 4 years phase-in period due to site specific technical and/or economic issues. The outcome of this more detailed risk management analysis or the development of an alternate implementation approach may be one or a combination of the following:

- more time than the proposed generic 4 years to come into compliance with the new or revised effects-based air quality standards; and/or
- interim or final air quality standards; and/or
- site specific air quality standards; and/or
- sector specific air quality standards; and/or
- province wide technology-based air quality standards.

MOE proposes that in order to be eligible under Step 4, a proponent or sector must demonstrate that economic and/or technology barriers would make it unduly difficult for their facility to comply within 4 years. MOE proposes that economic impacts be assessed using a set of economic indicators that will determine whether or not estimated costs of complying with new air quality standards are unreasonable or not. These economic impacts would be weighed against the health and environmental benefits. Appendix A provides a summary of the factors that could be considered in a detailed economic assessment and how the MOE Guideline, F-14, "Economic Analyses of Control Documents in Private Sector Enterprises and Municipal Projects"[4] would be used as a starting-point for defining the information requirements and protocol for a detailed risk management analysis. Under this more detailed risk management analysis, facility operators will be required to compile and submit to MOE the necessary information to support their position that a new or revised air quality standard is un-achievable and/or un-achievable in 4 years. In the development of this "Alternate Ramp Down" Option, the MOE proposes to include the following items:

- The submission of economic and/or technical information could be required by conditions on a Certificate of Approval, or similar instrument, provided by existing legislation;

[4] MOE Guideline, F-14, "Economic Analyses of Control Documents in Private Sector Enterprises and Municipal Projects is available from the MOE web-site: http://www.ene.gov.on.ca

- A facility who opts for the detailed risk management analysis will not be eligible for a Comprehensive, Site-wide CofA until after the economic and/or technical issues have been reviewed and resolved and a plan has been put in place to deal with any outstanding issues. In the interim, the traditional approvals process would continue to apply. Any process changes and equipment additions would require an amendment to existing or new certificates (as opposed to the flexibility afforded by the Comprehensive, site-wide CofA(s) issued under Step 3 of the proposed RM framework). The purpose of the 4 year phase-in period is to allow facilities sufficient time to be able to assess their air emissions and plan to take action, if necessary. ***A facility would be considered in non-compliance with a new or revised air standard until they have successfully proven undue economic hardship and/or technology gaps by providing the information requested by the MOE.***

- To ensure transparency in the air standard setting process, the economic and/or technical information submitted for MOE review under Step 4, would be posted on the Environmental Registry for public review[5] and comment. MOE feels that because the outcome of Step 4 could be a site/sector specific or a technology-based air quality standard, then there is an obligation to invite the public and all other stakeholders to comment on the proposed outcome.

- MOE could also require a "third-party" review of the information submitted under Step 4 and require the proponent to pay the fees associated with this review.

- If a facility expresses interest in Step 4 but does not provide the information in the agreed upon time frame, then that facility ***would*** be considered to be in non-compliance. Abatement action in accordance with the MOE Compliance Guideline (F-2) would be taken.

Site-specific Certificates of Approval, and other legislative control documents would be used to support the information requirements outlined in Step 4. Decision Box #2 outlines the points for discussion for implementation of this "Alternate Ramp Down" option.

[5] Proprietary information submitted as part of this option would be subject to the *Freedom of Information and Privacy Act*.

Decision Box #2: The Detailed RM Process ("Alternate Ramp Down")

Proposal for discussion

This discussion paper provides an outline of a proposed Risk Management framework. Stakeholder input is important in order to finalize the technical and/or economic considerations for a more detailed risk management analysis. As part of developing the detailed risk management process, MOE proposes to use standard economic indicators to determine undue economic hardship on a facility (for details, see Appendix A).

Questions for stakeholders:

4.2.1 Are the economic indicators outlined in Appendix A reasonable indicators of economic performance for the purposes of determining undue economic hardship in the implementation of new or revised air quality standards?

4.2.2 Is a search of the previous 5 years of financial information reasonable? Is 10 years reasonable?

4.2.3 Does comparison of the economic information against sector wide indicators address the issue of competitiveness within a sector?

4.2.4 In the absence of reliable sector information, is it reasonable to use 50% of the economic indicators to assess undue economic hardship?

4.2.5 What information would a proponent have to provide to determine whether or not there is best available and/or economically achievable technology available to be able to assess risk management issues in meeting a new or revised air quality standard?

4.2.6 Is there any other information that MOE should be requesting from proponents?

4.2.7 As part of this consultation, MOE will discuss with stakeholders the necessary elements to develop the details of the Risk Management framework. Should MOE organize a stakeholder consultation committee to help develop and provide recommendations on the proposed Risk Management framework for air standard setting?

5.0 The Linkages to other programs

Over the years stakeholders have indicated that MOE needs to better link its air initiatives together. One of the primary purposes of this RM framework is to do exactly that. The three program areas that are being linked together through this RM framework are:

- the proposed introduction of the new air dispersion models;
- the air standard setting process; and
- the approvals process.

Each of these initiatives and their linkages to the proposed RM framework are explained below.

5.1 Linkages to the proposed new models

MOE is proposing to phase-out the existing O. Reg. 346 air dispersion models and replace them with the suite of US EPA air dispersion models (please refer to the a discussion paper: "Updating Ontario's Air Dispersion Models" posted on the Environmental Registry March, 2001). The existing air dispersion models, which have been in place for over 30 years, are outlined in an appendix to O. Reg. 346. The adoption of the US EPA models into Ontario will promote the use of the most up-to-date scientific tools available to assess compliance with air quality standards. Introduction of the new air dispersion models coupled with the introduction of new or revised air quality standards could mean a change in the compliance status of some facilities. The MOE acknowledges that, if stakeholders made comments on a proposed new air quality standard based on the existing O. Reg. 346 air dispersion models, any changes in the models may lead to changes in stakeholders opinions and comments.

The introduction the US EPA air dispersion models into Ontario does not affect the risk assessment stage of the air standard setting process. However, the proposed new models could affect the risk management stage of the air standards development process since the RM framework deals with the implementation of new or revised air quality standards and because the new models may predict higher maximum ground level concentrations. Any comments regarding risk management issues created by the introduction of the new air dispersion models should be submitted as part of this consultation process.

Decision Box #3: Coordinating Phase-in Periods with new models

Proposal for discussion:

The MOE proposes to phase-in the introduction the new air dispersion models over a 3 to 5 year period (see Discussion Paper: Updating Ontario's Air Dispersion Models" posted on Environmental Registry March, 2001).

Questions for stakeholders:

5.1.1 Should the phase-in period for the proposed new air dispersion models be the same as the proposed 4 year phase-in period for new or revised air quality standards (i.e. see Step 3 (Default Ramp Down))?

It is important to note that the aligned phase-in periods for new models and new or revised air standards only applies to those standards proposed to date where implementation or risk management have already been identified. The issue of consistent phase-in periods would not apply to future proposed air quality standards.

5.2 Linkages to the Air Standard Setting Process

A key goal of the RM framework is to protect human health and environment by adopting scientifically defensible effects-based air quality standards. We need to ensure a balance between the need to address implementation, economic and/or technical issues with the need for transparent, equitable and timely compliance with new or revised air quality standards to protect Ontario communities. These can sometimes be competing objectives. The introduction of the new air dispersion models could be the tool that provides the balance between these two apparently competing objectives.

MOE uses a combination of regulatory standards and AAQCs in its air management program to protect human health and the environment. AAQCs have been used by MOE to assess general air quality and the potential for causing an adverse effect. POIs are derived from AAQCs by using appropriate conversion factors. Air dispersion models are used to assess the likelihood of compliance with all air standards. A key advantage to introducing the new air dispersion models into Ontario is the ability to assess impacts by using effects-based standards with appropriate averaging times to assess compliance. Use of appropriate effects-based averaging times means concentrations of contaminants are assessed over the period of time which minimizes adverse effects or unreasonable risk of adverse effect. The ability to model concentrations using appropriate averaging times provides a more representative assessment of health and environmental impacts from a facility. For example, the effects-based averaging time for many health-based air quality

standards is over a 24 hour period (or daily). With the existing O. Reg. 346 models, assessment of a facility can only be done using the maximum ½ hour emission rate and comparing that to a conservative screening level concentration typically referred to as the Point of Impingement (or POI). If a facility meets the screening level or maximum ½ hour POI, then it is considered likely to meet the true effects-based standard with the appropriate averaging time. The proposed new air dispersion models allow for an assessment of the air standards using the most appropriate averaging time for that contaminant. The new models can calculate concentrations from 1 hour up to 1 year. This means, for example, that facilities where emissions only occur for part of the day or vary significantly during the day, can use emission rates for actual operating times to assess compliance with a 24 hour effects-based air quality standards rather than the historical ½ hour POI standard. This will provide a more representative assessment of health and environmental impacts from a facility.

MOE intends to amend O. Reg. 346 to incorporate the air quality standards that we have already consulted on. This proposed regulatory amendment would replace the existing Schedule 1 of O. Reg. 346 with a new format. Schedule 1 would be replaced with two tables or new schedules that would include all appropriate air standards with the corresponding effects-based averaging time for a contaminant as well as an implementation date for any new or revised air quality standards. The implementation date would be the agreed upon phase-in period such as the current proposal of 4 years discussed in Section 4.0. Table 2a (Screening Levels) and Table 2b (Effects-based Averaging Times) is an illustration of the proposed two new schedules to the regulation. The new format for the schedule and the introduction of new dispersion models will provide options to facility operators by allowing compliance with **either** a screening level component of the air quality standard (as illustrated in Table 2a) or with the effects-based standard(s) with the appropriate averaging time(s) for that compound (as illustrated in Table 2b).

Both revised schedules in O. Reg. 346 would have an “Implementation Date” column(s) which would introduce, into the schedules, the air quality standards that were derived under the Risk Assessment stage. Where the proposed air quality standards were significantly lowered (i.e., an order of magnitude or more) an interim standard with corresponding Implementation Date may be proposed. Overall, the use of Implementation Date(s) is intended to provide sufficient lead-times and improve predictability and certainty for facility operators.

Decision Box #4: Introducing Effects-based averaging times

Proposal for Discussion:

Once the proposed new air dispersion models have been adopted, MOE proposes to introduce effects-based standards with appropriate averaging times into O. Reg. 346. The proposed new format of Schedule 1 and the introduction of new dispersion models will provide options to facility operators by allowing compliance with *either* a screening level component of the air quality standard (POI) or with an effects-based averaging time air standard.

Questions for stakeholders:

5.2.1 Should effects-based averaging times be incorporated into the regulatory structure?

5.2.2 Incorporating effects-based standards with appropriate averaging times implies that odour-based air quality standard would no longer have a 24 hour ambient air quality standard for odour. All 24 hour odour-based standards would be replaced with a 10 minute air quality standard since odour occurs immediately and not over a 24 hour period. Existing odour-based ½ hour POIs would be converted to 10 minute odour-based averaging times (for conversion factors, see discussion paper: Updating our Air Dispersion Models (Appendix A)). Are there any comments on this approach?

5.2.3 In addition to the POI screening level, should all effects-based standards with appropriate averaging times be incorporated into the regulation? For example, if a contaminant had both an odour-based (now converted to 10 minute averaging time) as well as a health-based (based on a 24 hour (daily) averaging time) standard, should both values be included in the regulation in order to distinguish between health and/or odour impacts?

Table 2a: Sample Format for Schedule 1, O. Reg. 346 - "Screening Level" Air Quality Standards (or Point of Impingement Limits)

Contaminant	Chemical Abstract Number	Maximum half-hour average Air Quality Standard ($\mu g/m^3$)	Basis for Air Quality Standard	Proposed Implementation Dates
Acrylonitrile	107-13-1	300	Health	existing
		180	RM	interim
		1.8	health	4 year phase-in
Ammonia	7664-41-7	3600	RM - odour	existing/interim
		300	health	4 year phase-in
Chloroform	67-66-3	1500	health	existing
		300	RM	interim
		3	health	4 year phase-in
Methylene Chloride (Dichloromethane)	75-09-2	5300	RM	existing
		660	health	4 year phase-in
Methyl Isobutyl Ketone	108-10-1	1200	odour	existing
Mineral Spirits	8052-41-3	30000	odour	existing
		7800	health	interim
		3000	odour	4 year phase-in
Propylene Oxide	75-56-9	13500	health	existing
		450	RM	interim
		4.5	Health	4 year phase-in
Toluene	108-88-3	2000	odour	existing
Trichloroethylene	79-01-6	85000	-	existing
		3500	RM	interim
		350	health	4 year phase-in
Vinylidene Chloride	75-35-4	30	health	March, 2001

Notes for Table 2a:

i) In cases where risk management issues have already been identified, an interim value has been set. In some cases, the interim value is no change from the existing air standard pending the outcome of our risk management consultation.

ii) Compliance is demonstrated through compliance with the Air Quality Standards in Schedule 1 (Table 2a) **or** Schedule 2 (Table 2b).

iii) For a complete list of contaminants that MOE has recently reviewed as part of our Standards Plan and the proposed changes, please see Appendix C of the discussion paper: "Updating our Air Dispersion Models" posted on the Environmental Registry March, 2001.

Table 2b: Sample Format for Schedule 2, O. Reg. 346 - "Effects-Based" Air Quality Standards with appropriate averaging times

Contaminant	Chemical Abstract Number	Air Quality Standard ($\mu g/m^3$)	Averaging Period	Basis for Air Quality Standard	Implementation Dates
Acrylonitrile	107-13-1	100	24-hour average	health	existing
		0.6	24-hour average	health	4 year phase-in
Ammonia	7664-41-7	~~3600~~	~~24-hour average~~	~~odour~~	~~existing~~
		4900	10-minute average	odour	proposed
		100	24-hour average	health	4 year phase-in
Chloroform	67-66-3	500	24-hour average	health	existing
		1	24-hour average	health	4 year phase-in
Methylene Chloride (Dichloromethane)	75-09-2	220	24-hour average	health	existing
Methyl Isobutyl Ketone	108-10-1	~~1200~~	~~24-hour average~~	~~odour~~	~~existing~~
		1630	10-minute average	odour	proposed
Mineral Spirits	8052-41-3	10000	24-hour average	health	existing
		2600	24-hour average	health	4 year phase-in
Propylene Oxide	75-56-9	4500	24-hour average	health	existing
		1.5	24-hour average	health	4 year phase-in
Trichloroethylene	79-01-6	115	24-hour average	health	existing
Toluene	108-88-3	~~2000~~	~~24-hour average~~	~~odour~~	~~existing~~
		2700	10-minute average	odour	proposed
		3750	24-hour average	health	proposed
Vinylidene Chloride	75-35-4	10	24-hour average	health	March, 2001

Notes for Table 2b:

i) In cases where risk management issues have already been identified, an interim value has been set. In some cases, the interim value is no change from the existing air standard pending the outcome of our risk management consultation.

ii) Compliance is demonstrated through compliance with the Air Quality Standards in Schedule 1 (Table 2a) **or** Schedule 2 (Table 2b).

iii) For a complete list of contaminants that MOE has recently reviewed as part of our Standards Plan and the proposed changes, please see Appendix C of the discussion paper: "Updating our Air Dispersion Models" posted on the Environmental Registry March, 2001.

5.3 Linkages to Approvals Process .... Comprehensive Site-wide CofAs

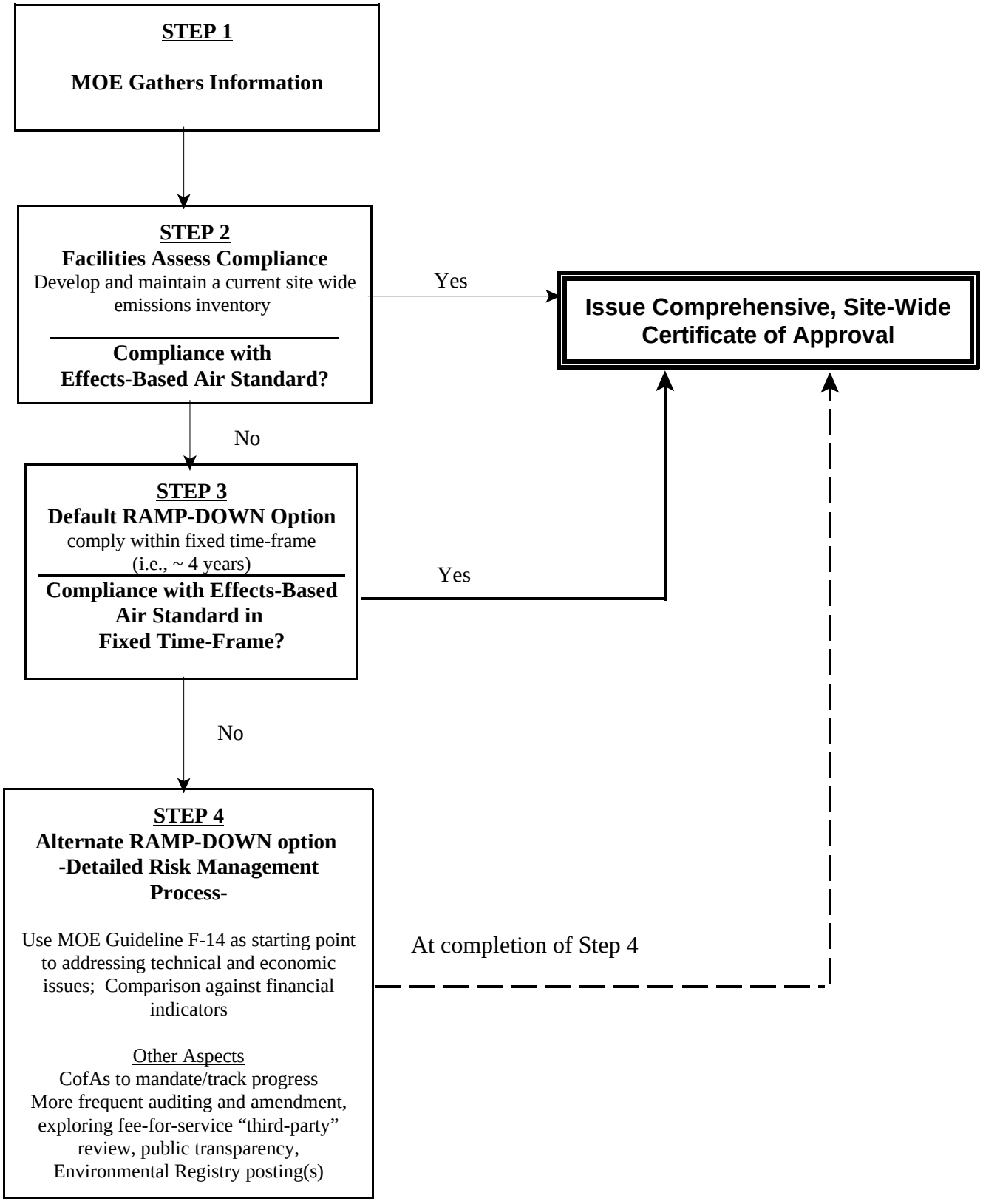
Stakeholders have told MOE that there must be a strong linkage between setting air standards, introducing new air dispersion models and the approvals process. Section 9 (1)(a) of the Environmental Protection Act require proponents to obtain a Certificates of Approval (C of As) for sources of air and noise emissions from a large variety of sources, including the construction, alteration, or extension of any plant structure, equipment, mechanism or thing that emits a contaminant to the environment. Section 9(1)(b) requires approval for an alteration of a process or rate of production. A primary objective of this legislation is to prevent adverse effect through assessment and implementation of MOE's air Point of Impingement standards in the approvals process. A stronger linkage to approvals and the RM framework for air standard setting is proposed through the issuance of Comprehensive, Site-wide CofAs (see Figure 3). A Comprehensive, Site-wide CofA provides operational flexibility to proponents by allowing process changes without the need for further amendments to a CofA so long as a facility can demonstrate ongoing compliance with the air quality standards. Two pilot projects with this concept have demonstrated its success. A prerequisite to obtaining a Comprehensive, Site-wide CofA is participation in MOE's risk management process (Note: the dashed line in Figure 3: The Proposed Risk Management Framework for the Air Standards Setting Process & Comprehensive, Site-wide CofAs, is meant to indicate that the Comprehensive, Site-wide CofA is not available to proponents who opt for Step 4 of the RM framework (outlined in Section 4.0 of this paper) until after the requested information has been submitted, reviewed, and decisions have been made). To be eligible to receive a Comprehensive Site Wide CofA, a facility must:

- provide and maintain an emission inventory (as outlined in Step 2 of Figure 3)
- make a commitment to meet new or revised air standards within a set period of time (Step 3 of Figure 3 "Default Ramp Down"); or
- successfully complete a detailed risk management analysis (which is currently under development through this consultation) and have a plan in place to meet any new or revised air quality standards (Step 4 of Figure 3 "Alternate Ramp Down")

The advantages of a Comprehensive, Site-wide CofA for Ontario industry is that it reduces administrative costs and time delays in making process changes. The advantage for MOE and the public is that it allows for more effective protection of the environment through comprehensive technical reviews and an increased ability for pro-active compliance auditing on a priority basis. This approach will shift the focus from equipment or stack-specific reviews to comprehensive, facility-wide compliance with the air standards which is consistent with the intent of O. Reg. 346.

In summary, the proposed approach includes benefits to the communities around industrial facilities; reduced focus for industry on an administrative process; and an improved ability for MOE to focus resources on direct compliance verification of air standards. This is the incentive MOE is offering industrial stakeholders for being involved in our risk management process.

Figure 3: The Proposed Risk Management Framework for the Air Standards Setting Process & Comprehensive, Site-wide CofAs



Decision Box #5: Comprehensive, Site-wide Certificates of Approval

Proposal for discussion:

MOE proposes to link the approvals process to the proposed Risk Management framework via the issuance of Comprehensive, Site-wide Certificates of Approval.

Questions for stakeholders:

5.3.1 Are there any comments on the Comprehensive, Site-wide CofA approach and its linkage to the Risk Management framework?

5.3.2. What other methods should MOE use to provide a better linkage between air standard setting and the approvals process?

5.3.3 Comprehensive, Site-wide CofAs are meant to be an incentive to industrial facilities by reducing administrative costs and time delays and providing operational flexibility in managing their facilities. They also allow for more effective protection of the environment through comprehensive technical reviews and an increased ability for pro-active compliance auditing by MOE on a priority basis. Are there any other incentives that the MOE could introduce?

6.0 The Next Steps

MOE looks forward to receiving input on this important issue from all stakeholders. Over the next several days, MOE will be consulting with industry, industrial associations, and environmental non-governmental organizations (ENGOs) on this proposed Risk Management framework. The comment period for this discussion paper is 150 days from the date it was posted on the Environmental Registry. Please submit your comments to:

Standards Development Branch
Attention: Cathy Grant, Engineer Specialist - Air Pollution
40 St. Clair Avenue West, 7th Floor
Toronto, Ontario
M4V 1M2
tel. (416) 327-6600
fax (416) 327-2936
email: sdb-ebr@ene.gov.on.ca

Appendix A

Summary of Factors Considered in a Detailed Economic Assessment & Definitions of Financial Indicators

Firms who are recipients of Control Documents (control orders) and Authorizing Documents (certificates of approval) may claim that compliance will cause undue financial hardship. Such claims can invoke Procedure F-14 whereby MOE may commission an evaluation or it can conduct a study with MOE staff who are designated as Provincial Officers. Under this process, firms must verify claims of financial disruption by providing financial records to the MOE. Firms who refuse to supply data and information are presumed to have no problem with compliance costs.

Technical and Abatement Cost Information Required:

To be eligible for Step 4 (outlined in Section 4.0 and Figures 2 and 3 of discussion paper), a facility must define at least 3 potential technology combinations that can achieve reduction of the pollutant of concern. The term "technology" is broadly interpreted as including end-of-pipe abatement devices (e.g., bag houses, scrubbers), pollution prevention activities (e.g., input substitution, process changes) or reduction in production. Facilities would be asked to provide the following information:

- cost estimates for: one-time capital, consulting and development costs and recurrent annual operating and maintenance costs.

- initial emissions of pollutants that can be reduced by technology combination in kilograms or tonnes/year and then present estimates of the loading reductions achieved by technology combination.

- for each technology combination the following information: potential pay backs, kind and quantity of savings of energy, input materials, labour etc.; secondary materials recovered for reuse or sale; increased productivity or product, etc. One of the technology combinations evaluated should be the maximum technically achievable emission reduction for the source given available information.

- potential error ranges in the estimated costs and pollutant removal efficiencies should also be given in terms of "+X% and -Y%"

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Financial Information Required:

1. Audited financial statements for the at least 5 years past (10 years would be desirable), starting with the current year and including, at a minimum; consolidated income statements, balance sheets, statement of disposition of funds, statement of changes in financial position, relevant internal transfer prices and accounting practices used.
2. The above noted data may represent a single establishment or the regulated party may provide consolidated financial data for the entire firms. However, if the regulated party claims hardship for a single establishment, it must provide aggregated data to support its claim.
3. Amounts and recipients of dividends paid and extra-ordinary revenues and expenses realized or incurred over at least 5 years.
4. A list and value of all real property and other assets owned.
5. For an individual, copies of income tax returns that were filed for at least 5 years past, starting with the current year.

Any other relevant data, such as financial performance data for the industry in which the firm operates, may be submitted by the applicant. For example a company may wish to provide its income tax returns as well as financial statements

All proponents applying under Step 4 must be prepared to meet with MOE staff to explain documentation, if necessary.

Note: MOE analysts or their representatives will search other relevant databases the US Securities and Exchange Commission, Edgar and Ontario Securities Commission

Indicators for Assessing Financial Impact of a Firm's Compliance

There are no common conventions and thresholds for financial ratios/indicators. Financial ratios/indicators may change depending on the tax scenarios under which they are determined or the definitions of the variables used in calculating them.

A single ratio or indicator does not fully characterize a firm's financial performance just as a single air pollution parameter does not accurately represent air quality. Moreover, there is no one ideal or correct ratio/indicator for every firm, and it is not always possible to judge the relative importance of a given value of a ratio or a financial indicator or specific changes in these values. Therefore, an inventory of financial indicators is

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necessary to assess a firm's financial health. (Ontario Ministry of Environment and Energy (OMEE), 1993).

In order to decide which firm is eligible for Step 4, annual data for eighteen financial ratios and indicators will be reviewed and compared with equivalent indicators for the relevant industry to judge the financial health of the regulated party. This judgement can be further informed by analyzing the trends of these indicators for the firm over past 5-10 years. These indicators and ratios are selected based on prior MOE experience and represent measures of profitability, liquidity, solvency and efficiency (OMEE, 1993). An annotated list of these 18 financial indicators is outlined below.

Another source of relevant financial data that can be used to judge a firm's financial health is the credit rating services such as Dunn and Bradstreet or Standard and Poor's. The ratings published by these organizations (eg, AAA - C in the Standard and Poor's) can be used to judge and compare firm's financial health and relative positions.

For a firm to enter Step 4, it must demonstrate that all its financial ratios and indicators in the last five years have been consistently below the averages recorded by its industrial sector average financial ratios and indicators for the same period. Where there are no industry averages or benchmarks, the firm must demonstrate that more than half of the suggested eighteen indicators calculated from its last five annual financial statements have been falling consistently or that the averages of more than half of the eighteen indicators in its last five annual financial statements are at least 25% lower than the averages of the previous five years.

Note: Verification that these conditions exist does not guarantee that proponents will be granted extensions, site specific standards or other concessions.

Summary of Factors Considered in a Detailed Economic Assessment

The following factors would be considered in a detailed economic assessment of a company:

- determining the process or processes that generate the contaminants from each key source;
- assessing how the predicted ground level concentrations compare to the range of standards (if applicable) being considered;
- determining the efficiency of in-place measures used to control emissions of the contaminant;

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- assessing the availability of options to further reduce emissions from key sources, the cost of such measures and their impact on the predicted ground level concentration;
- determining what regulatory or voluntary activities are underway or planned to reduce emissions of the contaminant;
- assessing available control measures for reducing emissions from each key source in terms of one-time capital costs and operating costs;
- assessment of the relative compliance costs on key economic and financial indicators of companies or plants;
- assessing how costs associated with compliance will affect investments in other areas including project development, Research and Development, other environmental improvements; product prices; competitiveness, market access or demand for products; and
- assessing costs of compliance against anticipated benefits.

Definitions of Financial Indicators and Liquidity Indicators

Quick (Acid Test) Ratio(x:1)	(Current assets [less inventories] / current liabilities) Quick ratio indicates the level of protection provided to short term creditors. It shows the number of dollars of liquid assets (i.e., assets that are easily convertible to cash such as marketable securities, term deposits) available to cover each dollar of current debt. A quick ratio of 1:1 or greater indicates that the business is in a liquid position.
Note:	Current assets include cash and other assets that will either be transformed into cash or will be sold or consumed within one year or within the normal operating cycle of the business, if longer than one year.
Current Ratio (Working Capital Ratio) (x:1)	(Current assets / current liabilities) Current ratio indicates the degree to which a company has sufficient current assets to cover current liabilities. The higher the ratio the greater the assurance the current liabilities can be met. A current ratio of 2:1 or better is generally considered desirable.
Net Working Capital to Total Assets (%)	((Current assets - current liabilities) / total assets) x 100 The net working capital to total assets ratio indicates the proportion of total company assets which are currently available to cover unexpected costs.

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Solvency Indicators

Total Debt to Total Assets (%)	(Total debt / total assets) x 100 where Total debt = long term debt + short term debt + long term debt due within one year Total debt to total assets measures the degree to which a company is leveraged (i.e., financed by outside debt). A higher total assets/total debt indicates that the company is highly leveraged which may limit their ability to raise additional capital (at a reasonable interest rate) to finance large capital expenditures.
Interest Coverage (Times)	(Net income before interest, extraordinary items and all taxes) / annual interest charges Interest coverage provides information on the extent to which a company's normal operating income is sufficient to cover annual interest charges. A company with a low interest coverage ratio may be unable to pay its annual interest charges and would therefore have a higher risk of being forced into insolvency by creditors.
Cash Flow ($)	Net income before extraordinary items and all non-cash expenses (e.g., depreciation, amortization, deferred taxes) Cash flow provides a measure of a company's ability to pay dividends and finance expansion. A company which shows little net after-tax profit may still be able to meet its short term debts and obligations if cash flow is adequate.
Cash Flow to Total Debt (Beaver's Ratio) (%)	((Net income before extraordinary items, depreciation and deferred taxes) / total debt) x 100 where Total debt = long term debt + short term debt + long term debt due within one year Cash flow to total debt indicates the percentage of total debt which is covered by current cash flow. Generally a cash flow to total debt of 30% or more is desirable. This should be considered in relation to the number of years the debt is being amortized.

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Debt to Equity Ratio (x:1)	Total debt / total shareholders' equity where Total debt = long term debt + short term debt + long term debt due within one year The debt to equity ratio indicates the relationship of debt to equity. It evaluates the proportion of the company's assets that it has financed with debt. The higher the ratio, the higher the strain of meeting principal and interest payments, the higher the financial risk.

Profitability Indicators

Return on Assets (%)	(Net income (before interest and extraordinary items but after taxes)) / total assets x 100 Return on assets is a key indicator of a company's profitability. It matches net after-tax profits (from normal operations) with the assets available to earn a return. Companies that are using their assets efficiently will have a relatively high rate of return. Excluding interest from the definition of normal operating income eliminates any bias resulting from a company's decision to finance assets through long term debt versus raising additional capital internally (i.e., through issuing shares).
Return on Net Assets (RONA) (%)	(Net income (before interest and extraordinary items but after taxes) / (total assets - total liabilities) x 100 Similar to return on assets except the return is expressed as a percentage of net assets.
Earnings Before Interest but After Taxes to Total Assets (EBIAT/TA) (%)	(Net income before interest but after taxes / total assets) x 100 Similar to return on assets except the definition of net income includes extraordinary items.
Earnings Before Interest and Taxes to Total Assets (EBIT/TA) (%)	(Net income before interest and all taxes / total assets) x 100 Similar to return on assets except the definition of net income is before taxes and includes extraordinary items.

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Return on Sales (Profit Margin) (%)	(Net income (after taxes) / sales) x 100 Return on sales measures the profits earned per dollar of sales indicating the profitability of the company. It also indicates the company's ability to survive adverse conditions such as falling prices, rising costs and declining sales.
Return on Capital Employed (%)	(Net income (after taxes) plus after tax interest charges and extraordinary items / total assets employed less current liabilities) x 100 Return on capital employed measures the rate of return being earned on company assets employed in operations. It provides an indication of the level of incentive for owners and investors to remain in that particular enterprise.

Net Income ($) Total revenue less all expenses (cost of sales, operating expenses, taxes).

Efficiency Indicators

Total Assets to Sales (%)	(Total assets / sales) x 100 Total assets to sales indicate the level of investment that is required to generate those sales. A high percentage (in comparison to industry averages) may indicate that the company is not using assets efficiently or needs to market its product more aggressively.

Other Indicators

Amortized and	(Amortized or total regulatory capital costs / total capital expenditures) x 100
Total Recorded Regulatory Capital Costs as a Percent of Recorded Capital Expenditures (%)	This ratio indicates the extent to which capital requirements implied by regulatory requirements would divert available capital resources from uses.
Regulatory Operating Expenses as a Percent of Recorded Operating Expenditures (%)	(Regulatory-induced annual operating expenses / recorded operating and maintenance expenses) x 100 This ratio indicates the extent to which capital requirements implied by regulatory requirements would divert available capital resources from uses.