Preface to the Fourth Edition

In the Preface to the Third Edition of this book, Donald L. Fox, D. Bruce Turner, and Richard W. Boubel expressed the importance of a multidisciplinary approach to air pollution. I wholeheartedly agree. Nothing has changed in this regard, making it a daunting challenge to update the impressive work of these renowned experts (as well as the late Arthur C. Stern in previous editions). It was easier to add new material than to remove old material. A new edition is an optimization exercise. The book must not change so much that professors using it have to change the course structure so severely that it constitutes a completely new text. On the other hand, a text must be up to date in terms of current technologies and programs, as well as in addressing threats on the horizon.

Over a decade has passed since the publication of previous version. From a regulatory perspective, this is a very long time. By conventional measures, such as the National Ambient Air Quality Standards, the past decade has been very successful. But, science marches on. I recall that in the 1970s, detection in the parts per million (ppm) was impossible for most compounds. During the 1980s detection limits continued to decrease. Now, detections have improved to allow for measurements below parts per billion for many compounds. We have also witnessed sea changes in risk assessment and management. For example, the US Environmental Protection Agency laboratories were realigned to address risks, with separate laboratories to conduct research exposure, effects, risk characterization, and risk reduction.

Indeed, the previous authors were quite prescient in predicting the effects of the then newly amended Clean Air Act. The major changes started to kick in as the focus moved from technology-based approaches (best available and maximum achievable control technologies) to risk-based decision-making (residual risks remaining even after the required control technologies).

The fundamentals of the science underlying air pollution have not changed, but their applications and the appreciation of their impacts have. For example, I have endeavored to enhance the discussion and explanation of the physical and chemical processes at work, particularly those related to air toxics. This has been a tendency through all four editions. New technologies must be explained, better models and computational methods have become available, analytical procedures have evolved and improved, and acute and chronic effects have become better understood. All of these have enhanced the science and engineering knowledge available to practitioners, teachers, and students. And, the savvy of the lay public about air pollution has grown substantially during the previous decade.

I am indebted to my fellow scientists and engineers for their insights and comments on how to incorporate the new trends. I particularly want to note Alan Huber, who shared his work in atmospheric dispersion modeling, especially computational fluid dynamics. Others include Russ Bullock (mercury fate and transport), Paul Lioy and Panos Georgopoulos (modeling), Mark Wiesner (nanotechnology), John Kominsky and Mike Beard (asbestos), and Aarne Vesilind (history).

As in previous editions, my expectation is that the reader has received some formal background in chemistry. I agree with the previous authors that anyone interested in air pollution must have a solid grounding in chemistry and the physical sciences. Without it, there is no way of knowing whether a rule or policy is plausible. I have seen too many instances of "junk science" in environmental decision-making. Often, these are underlain with good intentions. But, so-called "advocacy" does not obviate the need for sound science. That said, with a bit of effort, much of this edition can be a useful tool to any audience who is motivated to understand the what, how and why of air pollution.

Another trend that I have hoped to capture is the comprehensiveness needed to address air quality. A problem need not occur if the processes leading to air pollution are approached from a life cycle or "green" perspective. This goes beyond pollution prevention and calls for an integrated and sustainable view. I have dedicated an entire chapter to this emergent environmental expectation.

The authors of the previous edition introduced discussions about some emerging continental and global threats to the atmosphere. Since then, the urgency of some has abated (e.g. acid rain and some threats to the ozone layer), some have increased in concern (e.g. global warming), and others have continued but the contaminants of concern have varied (long-range transport of persistent chemicals). The scientific credibility of arguments

for and against regulatory and other actions has been uneven. The best defense against bad policy decisions is a strong foundation in the physical sciences.

Let me rephrase that a bit more proactively and optimistically:

> My overall objective of this book is to give you, the reader, the ability to design and apply the tools needed to improve and sustain the quality of the air we breathe for many decades. These tools can only be trusted if they are thoroughly grounded in the *Fundamentals of Air Pollution.*
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