INDOOR AIR QUALITY: A SYSTEMS APPROACH

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SMACNA

SHEET METAL AND AIR CONDITIONING CONTRACTORS’ NATIONAL ASSOCIATION, INC.
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FOREWORD

As the Indoor Air Quality (IAQ) industry has changed over the years, and with coming changes on the horizon, the SMACNA contractor needs to be equipped to handle this every changing market and opportunities. The SMACNA Building Services Task Force was formed to address these issues and develop a manual that provided the hands-on application that would be required by today’s contractor.

This “state-of-the-art” manual should identify IAQ problems as they are currently defined, the methods and procedures used to solve them, the equipment and instrumentation that is used, and the changes that must be made to the building and the building HVAC systems.

This publication is intended to present in a clear and concise, yet comprehensive manner the sources of pollutants, methods of control, and the management techniques necessary to maintain acceptable indoor air quality in today’s market. The SMACNA Building Services Task Force recognizes that this new manual contains the latest information available, and will need to be revised or updated as newer information becomes available.

SMACNA wishes to thank the efforts and funding of the National Energy Management Institute in assisting in the development of this manual for the industry.

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PHASE I

FUNDAMENTALS OF INDOOR AIR QUALITY
CHAPTER 1

INTRODUCTION TO INDOOR AIR QUALITY
Phase I of this manual introduces the fundamentals of indoor air quality (IAQ) concerns and problems. It covers a brief history leading to the current level of concern over this worldwide issue. The five chapters in Phase I include:

a. Basic indoor environmental concerns.

b. Building environmental systems and how they contribute to the problems.

c. Basic testing and sampling.

d. Solutions to some IAQ problems.

e. Other sources of indoor air problems.

Phase I includes material which most building owners and managers should know in order to work with you to contract for the needed indoor air quality preventive measures and problem solving.

1.1 INDOOR AIR QUALITY

1.1.1 Early IAQ

The first attempts to control the quality of indoor air were repeated often as man developed more complex dwellings and a greater need and desire for ventilation. Until mechanical systems were available to ventilate buildings, man relied on natural ventilation to meet those needs. Caves with smoke exits, castles with cleverly designed fireplace drafts, and the American Indian teepee were examples of early methods to control the indoor environment.

Natural ventilation had many of the advantages we look for today in assessing the ability of mechanical ventilation systems to supply sufficient ventilation air. One of the most significant advantages was the constant supply of fresh outside air which was also low in carbon dioxide concentration and other internally introduced contaminants.

1.1.2 IAQ Concerns

The health of the occupants in a facility should be the primary concern of the building management team responsible for IAQ. We will see later how this is also beneficial in support of evidence against claims of negligence resulting from IAQ problems.

Concern for the health of the occupants shows due diligence in pursuit of a healthy environment. The same concern will result in higher levels of work output.

Several studies have shown that work productivity, often spoken about in abstract terms until now, can rise by as much as 10% if the indoor air is clean and perceived to be healthy. On the other hand, if the indoor environment is poor, or is perceived to be below acceptability, work productivity is certain to drop.

In a 1981 report, the National Research Council identified four basic reasons for increasing concerns about indoor air quality:

a. Energy conservation efforts have tended to reduce the amount of ventilation available to dilute indoor contaminants to acceptable concentrations.

b. Techniques for measuring occupant exposure to contaminants at low concentrations have improved.

c. Widespread sources of contaminants exist indoors and outdoors.

d. Awareness by the general public of the impact of indoor air quality on health and well-being has increased.

Understanding of the importance of indoor air quality has increased significantly during the last decade. Demographic studies have shown that current United States populations typically spend up to 90% of their lives indoors.

Studies also indicate that indoor concentrations of contaminants are frequently higher than corresponding outdoor values. Thus, exposures to indoor contaminants may have more impact on public health and well-being than outdoor exposures.

1.1.3 IAQ Definitions

Generally, indoor air quality may be defined as the nature of air that affects the health and perceptions of the occupants. This definition incorporates the concept of health in the constitution of the World Health Organization (WHO): “Health is a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.”

IAQ concerns in the office, educational, and institutional environment differ from industrial indicators of acceptability. The differences are primarily reflected in threshold limit values (TLV’s) which were developed to help maintain the ability of an adult population to perform physical work in an industrial environment. TLV’s are the limits accepted by the