Beryllium
Environmental Analysis and Monitoring

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Preface

Beryllium is a metal with unique properties that make it useful for a number of applications, from consumer products such as cell phones, to nuclear weapons components. These unique properties make it difficult to find alternatives to beryllium and ensure that it will continue to be used for the foreseeable future. However, for some individuals, exposure to beryllium particulates in the workplace can lead to a sensitization reaction. Sensitized individuals with beryllium particulates in the lungs are at risk for chronic beryllium disease (CBD), which can have a long latency period before symptoms appear. Sensitization and/or disease can result from exposure at very low levels. As a result, control of exposures to beryllium in the workplace is essential. Although engineering controls are normally the first line of defense, exposure monitoring, including sampling and analysis, is also important and is typically mandated by regulation.

While most metals and metalloids have occupational exposure limits in the range of milligrams per cubic metre, limits for beryllium are in the microgram or sub-microgram per cubic metre range. Additionally, some forms of beryllium in the workplace are highly refractory, making them difficult to dissolve for analytical purposes. These considerations pose unique challenges for monitoring of beryllium exposure in the workplace. Some of the challenges include: sampling a sufficient air volume to evaluate short-term exposures; sampling settled dust (in some cases accumulated over decades) on a wide variety of surfaces; preparing samples to ensure that all of the workplace beryllium forms are detected; and obtaining sufficient analytical sensitivity. Since datasets often have a large percentage of results below the laboratory's reporting limit, data reporting itself is often a challenge.

Although there is now considerable information on beryllium sampling and analysis in the literature, much of it within the last decade, there has up to now been no single compendium to survey the literature and provide guidance on best practice. Providing such a resource is our goal for this book. We do not

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promote a one-size-fits-all approach; instead, our goal is to provide information that will enable users to ensure that their sampling and analysis techniques are fit-for-purpose. Hopefully, we will promote more consistency along the way.

There are likely more challenges to come. Since there is no known exposure–response relationship for beryllium sensitization or disease, the trend toward lower occupational exposure limits may continue indefinitely. There remains some difference of opinion on the need for particle size-selective sampling, and what fractions should be sampled. We also do not know whether some anthropogenic forms of beryllium are more toxic than others. Future information may point to a need to differentiate, say, beryllium oxide from beryllium metal or alloy. While major research laboratories can do that today, the typical industrial hygiene laboratory cannot. New information on these topics will hopefully spawn improvements in the areas covered in this book. In the meantime, we present the state of the art as it is today and trust it will be of benefit throughout the scientific community.

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