Chapter 2 defines the risk based process safety approach for applying the RBPS elements to industrial operations. Chapters 3–22 provide the management system framework for each RBPS element. Each element chapter has the same organization:

- Overview
- Key principles and essential features
- Work activities and implementation options
- Performance and efficiency improvement examples
- Possible metrics
- Management review topics

The chapters are grouped into four major sections with the following titles:

1. Commit to process safety: process safety culture; compliance with standards; process safety competency; workforce involvement; stakeholder outreach.
2. Understand hazards and risk: process knowledge management; hazard identification and risk analysis.
3. Manage risk: operating procedures; safe work practices; asset integrity and reliability; contractor management; training and performance assurance; management of change; operational readiness; conduct of operations; emergency management.
4. Learn from experience: incident investigation; measurement and metrics; auditing; management review and continuous improvement.

Chapter 23 describes approaches for initial implementation, correction of deficiencies, and ongoing improvement of an RBPS system at a facility. Chapter 24 sets goals for ongoing improvement of process safety management systems.

A review of the book's Index is a good indication of its contents. First I note that there is an interesting list of accidents that includes explosions (ammonium nitrate, hydrocarbon storage terminal, oil platform, dust, hydroxylamine, and gas plant), BLEVE, Bhopal, commercial aviation, and a runaway chemical reaction.

Other major items found in the index include the following: accident prevention pillar, auditing, check lists, continuous improvement, contractors, corrective action, emergency responders, emergency response, hazard analysis, hazard identification and risk analysis, improvement, incident investigation, inspection test and preventative maintenance, life cycle, operator (this category contains 72 separate entries which is the longest in the index), safe operating limits, safe work practice, and training refresher (this topic has 62 entries).

This book is a very well-written, detailed analysis of industrial chemical plant safety. Following its guidelines, I am sure, will result in many fewer accidents in the future.

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Methods and Reagents for Green Chemistry: Introduction, P. Tundo, A. Perosa, F. Zecchini (Eds.). John Wiley & Sons, Inc., Hoboken, NJ (2007). 331 pp., Price: US$ 100.00, ISBN: 978-0-470-75400-8

This book contains 15 papers presented at the Italian Interuniversity Consortium for the Environment summer school which has been operational since 1988. The goal of this partnership is to discuss innovative approaches to the design of clean chemical reactions. Given the ongoing concern for pollution of the environment and the continuing disappearance of raw materials (especially those supplying energy), this book is a welcome addition to the literature as it will markedly enhance our knowledge of sustainable development process.

One author (Scheldon) of Delft University of Technology in the Netherlands has provided a useful definition of green chemistry: "Technologies that efficiently utilize energy and (preferable renewable) raw materials and reduce, or preferably, eliminate the generation of waste and avoid the use of toxic and/or hazardous reagents and solvents."

The above definition is in one of the papers that cover a wide range of topics. The best way, in my opinion, to show this coverage is to list the titles of the papers in the book:

- Part one: Green reagents
  - The four-component reaction and other multicomponent reactions of the isocyanides.
  - Carbohydrates as renewable raw materials: a major challenge of green chemistry.
  - Photoinitiated synthesis: a useful perspective in green chemistry.
  - Dimethyl carbonate as a green reagent.
- Part two: Alternative reaction conditions
  - Ionic liquids: "designer" solvents for green chemistry.
  - Supported liquid-phase systems in transition metal catalysis.
  - Organic chemistry in water: green and fast.
  - Formation, mechanisms, and minimization of chlorinated micropollutants (dioxins) formed in technical incineration processes.
- Part three: Green catalysis and biocatalysis
  - Green chemistry: catalysis and waste minimization.
  - Seamless chemistry for sustainability.
  - Enantioselective metal catalyzed oxidation processes.
  - Zeolite catalysis for cleaner technologies.
  - Acid and superacid solid materials noncontaminant alternative catalysts in refining.

- The oxidation of isobutane to methacrylic acid: an alternative technology for MMA production.
- Biocatalysis for industrial green chemistry.

To more deeply explore the topic, I will cite briefly from three of the presentations, one from each of the major sections outlined above.

F.W. Lichtenthaler of the Technishe Universitat of Darmstadt contributed a paper entitled "Carbohydrates as Renewable Raw Materials." The author notes that the move from utilization of fossil fuels to the use of renewable feedstocks is inevitable. By far the most important class of organic compounds produced by nature are carbohydrates which represent roughly 75% of the annual output of renewable biomass of 180 billion tonnes. Lignin products amount to 20%. Many carbohydrates are used as feedstocks for the chemical industry to produce furfural, D-sorbitol, lactic acid, vitamins and pharmaceuticals. However, the full potential of the feedstock is yet to be realized.

The second paper I will cite is entitled "Ionic Liquids: 'Designer' Solvents for Green Chemistry" authored by N.V. Plechkova and K.R. Seddon of the Queen's University of Belfast, Northern Ireland. Discussed are neoteric solvents with a suggestion that they should be part of the arsenal of solvents used by all synthetic chemists. Distracting, however, in this paper is an extended discussion of global warming which really does not fit the topic.

The third paper is entitled "Seamless Chemistry for Sustainability" by J. Thoen and J.L. Guillaume of Dow Chemical. Given the growing world population and the increasing need for food coupled with the concomitant increase in CO_2 emissions, the need for sustainable development is critical. This problem results in two major challenges for the chemical industry: (1) feedstock availability—or what alternatives exist for nonrenewable fossil feedstocks and (2) energy costs—or what alternatives exist to increasingly expensive nonrenewable fuels. The authors of this paper discuss the potential uses of carbon dioxide as a feedstock in chemical reactions, the use of stranded methane (to produce, for example, methanol, ethylene, benzene, toluene and styrene) and the exploitation of biomass and vegetable oils.

As a group, these are most excellent papers dealing with a very real and growing problem.

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Carbon Capture and Sequestration: Integrating Technology, Monitoring and Regulation, F.J. Wilson, D. Gerard (Eds.). Blackwell Publishing, Ames, IA (2007). 289 pp., Price: US$ 179.99, ISBN: 978-0-8138-0207-7

As I began my review of this book, I received a newsletter that noted: "Two Canadian provinces and six western US states are setting mandatory limits for CO_2 emissions by reducing those emissions to 15% below 2005 levels by 2020". That goal represents a major challenge as the demands for energy provided by coal combustion, in my opinion, will not, indeed cannot, decrease even though major strides may be taken to reduce energy demand through conservation and use of renewable energy resources such as wind and solar. Consequently, carbon capture and disposal will be required.

The contributors thoroughly review the sequestration process and the ultimate disposal of carbon dioxide in deep geological/ocean formations. The editors note that there are "indications" that carbon capture and geologic sequestration (CCS) is a "technically viable option", but the public (including this reviewer) has serious reservations. The goal of the editors in compiling this book was: ". . . to describe the current state of these technologies and to assess the technical, legal and socioeconomic forces that must coalesce if CCS has to become a viable carbon reduction strategy".

> "Part one examines separation, capture, and monitoring and verification technologies. There are a number of well-known technical challenges associated with potential leakage and groundwater displacement. The chapters in this section provide an overview of the current technologies, discuss critical challenges and assess technologically feasible and politically realistic solutions. It also broadly identifies further research needs into technical aspects of CCS. Part two expounds on a central theme of the volume—CCS technologies must be implemented within a larger and integrated carbon management system. Costs, regulatory drivers, public acceptance, and legal and environmental issues need to be clarified and factored into the strategy for future energy systems.

The present CO_2 problem is discussed in the first paper in which the contributors note that atmospheric CO_2 concentrations have risen from preindustrial levels of 280 ppm to the current concentration, which is 372 ppm. Limiting CO_2 concentrations to acceptable levels is a major challenge to both technology and society.

> Reduction of CO_2 emissions to stabilize climate warming will ". . . fundamentally transform industrial society. There is no single technological fix that can bridge the gap between current and future energy consumption and simultaneously meet these CO_2 reduction targets. Instead, a menu of options that includes improved technologies, energy conservation and cleaner energy sources is necessary".

Some of these options have been tested, the author notes. He cites five geologic sequestration demonstration projects con-