Ergonomic Solutions for the Process Industries

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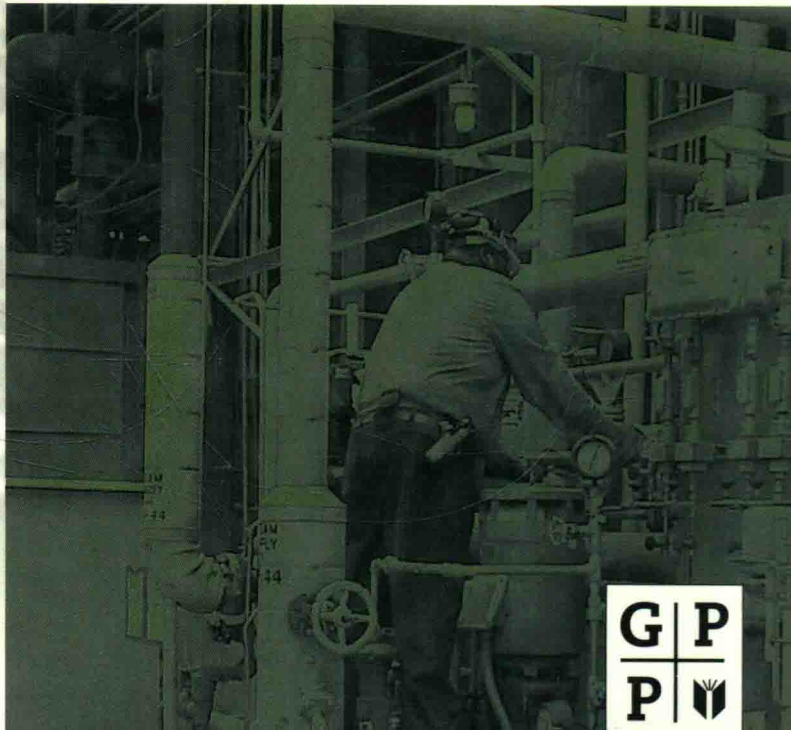

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Ergonomic Solutions for the Process Industries

Preface

Let's begin by understanding what the title means to users of this book. First, the distinction between *ergonomics* and *human factors* has been debated in every major national technical human factors and ergonomics society for decades. Our solution is simple—we make no distinction between human factors and ergonomics and we use the terms interchangeably throughout the book.

Second, the term *process industries* is intended to include not only the integrated oil and petrochemical industry, in which we work, but also industries where process technology is the kernel that controls the production of the product. The product may be electricity from nuclear or fossil fuel power plants, treated waste from municipal facilities, clean water from desalination operations, or manufactured products from virtually any continuous process.

Third, the term *solutions* was chosen intentionally. In the more than 60 years since the start of the Second World War, when ergonomics began, academic research in this area has mushroomed. Many great scholars, including Sanders and McCormick (1993), Grandjean (1988), Welford (1968), and Chapanis (1959), have written books on the general subject of human factors. In addition, books have been written on specific topics in the field, such as Konz (1979), van Cott and Kinkade (1972), and Attwood (1996). Each provides students and practitioners with the basic research that they can use to set hypotheses and develop tools. Our objective in this book is not to provide more academic information to ergonomics specialists but to focus this book on the nonspecialist users of human factors, to use the theory created by academics to develop simple tools and procedures that the nonspecialist can use to apply ergonomics inside

the plant gates. To do so, it is necessary to provide some theory, but only enough to explain and justify the application.

With this in mind, it's important to understand our position on human factors and ergonomics. We believe that an educated, experienced plant practitioner can implement any of the human factors tools and processes contained within these pages. This does not imply that we believe human factors and ergonomics are mere "common sense." We believe that, at the plant level, operators and supervisors who are dedicated to making a difference, have the right tools, and have been trained to use them properly can identify the issues, set priorities, collect and analyze the data, develop interventions, and measure their effects. The specialists have their place, but their place is not performing the routine human factors duties that require local knowledge of the people and plant. In our opinion, the human factors/ergonomics specialist is a resource that should be used to develop programs, train the practitioners, and provide the detailed knowledge required to mobilize the plant staff.

So, we invite you to use the knowledge and the tools that are contained in this book. We hope that we have adequately explained how and why to use the years of human factors/ergonomics knowledge that is at the heart of this book in a deliberate, systematic way.

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Disclaimer

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Contents

1

Introduction

1.1 INTRODUCTION

At 03:00 hours of his fifth consecutive night shift, a process control operator in a chemical plant received a "Group 1" alarm on the visual display monitor of the plant's distributed control system (DCS). He was not alert at this time of the morning. He recalled that, during the shift change meeting, a colleague reported that this alarm had gone off several times during the previous shift. Each time the problem was traced to a faulty transducer on a fin-fan. So, the operator acknowledged the alarm without checking further. If he had checked, he would have found that this time, the "group" alarm was notifying him that power to the DCS had been lost and the entire system was now on battery. In 4 hours, when the batteries discharged, the DCS failed and the control valves on the furnaces

went fully open. The ensuing temperature increase burst the tubes in the furnace and started a major fire. Without power to the DCS, the control valves could not be closed. The damage was $30 million. Fortunately, nobody was hurt.

Human factors/ergonomics is defined as the systematic process of designing for human use through the application of our knowledge of human beings to the equipment they use, the environments in which they operate, the tasks they perform, and the management systems that guide the safe and efficient operations of refineries, chemical plants, upstream operations, and distribution terminals. Neglecting any of the elements, depicted in Figure 1-1, could lead to the failure of the entire system, not just the physical plant control system but the much broader system and structure under which it operates. In the hypothetical example, the design of the alarm system and the shift schedule did not consider the limitations and capabilities of the human operator, and the system failed. System failure could take many forms, including injury or the loss of property,

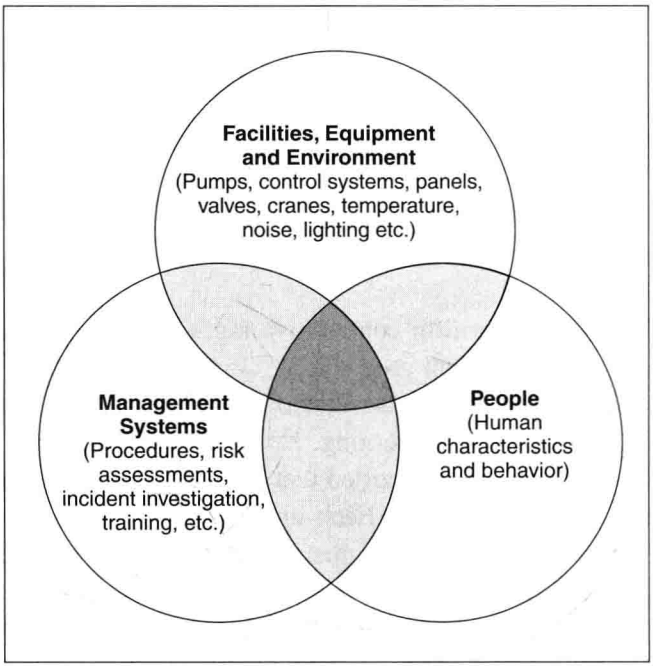

Figure 1-1 The human factors process.