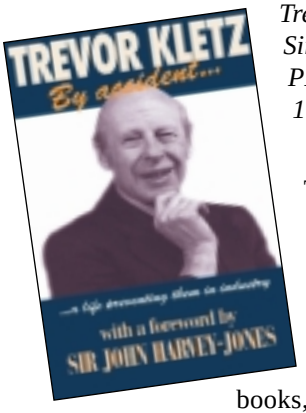
Books

By Accident ... a Life Preventing Them in Industry



Trevor Kletz, with a foreword by Sir John Harvey-Jones
PFV Publications, London, 160 pp., £19.40, 2000*

Trevor A. Kletz has left an indelible mark on chemical process safety. He is internationally recognized as an outstanding communicator on safety in the chemical process industries (CPI). His easy-to-understand books, articles, and presentations have made him known throughout the world. His latest book, "By Accident ...a Life of Preventing Them in Industry," provides an insight into what shaped his well-developed and widely respected philosophies.

All safety professionals should read this book to see if they are living up to their potential, as Trevor is doing.

In "By Accident," Trevor explains that he was part of the revolution in our attitudes to process safety. He successfully attempts to convey the excitement of the time and the growth of process safety from a "within-the-fence" viewpoint. He also delivers the message that working in the industry is useful, satisfying, and enjoyable.

As an admirer of Trevor's skills and accomplishments, I whole-heartedly agree with Sir John Harvey Jones, former head of ICI, as he writes in the foreword: "I am delighted to provide an introduction to Trevor Kletz's autobiography because it gives me an opportunity to pay a public tribute to the remarkable and important contribution he has made to the safe operation of all types of process plant ... Trevor Kletz will, I am sure, always sleep soundly at night, secure in the knowledge that his life and talents have not been wasted, but rather that his persistence, imagination and passion have saved countless numbers of his fellow men from injury, mutilation and even death."

In the Introduction and Chapter 1, Trevor modestly provides a glimpse of his family background, his early years, his university days during World War II, and his choosing a career. In Chapter 2, he describes his initial assignments with ICI (which was at the time one of Britain's largest companies and one of the four largest chemical companies in the world).

In Chapters 2 and 3, he addresses training and how things are achieved within the organizations of operating plants. In Chapter 3, he speaks on British leadership, labor relations and the minicultures of each unit. Trevor mentions that early on, in most ICI plants the operations were supervised by chemists and engineered by mechanical engineers. He shows the acceptance and growth of the chemical engineering discipline within ICI.

During 1955, after 11 years with ICI, Trevor was appointed as the works (plant) part-time safety officer, but was expected to spend no more than a few hours a week on this job. Trevor reveals the safety attitude of the chemical industry at the time in these two sentences: "There was concern that people should not get hurt but there was no realization that the subject required a technical input, or the attention of a senior and experienced manager. In my hand-written notes when I left the job after a year I recall writing that safety was a dull subject apart from the occasional description of a gory accident, a view I was to change later." In mid-1956, Trevor was transferred to the Technical Dept. and he describes that activity in Chapter 4 along with a serious fire.

This book is written in Trevor's inimitable prose and is sprinkled with British expressions, British words, and Trevor's well-developed philosophies. British expressions such as: "taking it to bits" for disassembly or "getting on with it" for proceeding are easy to understand. Single words like "labour," "artificer," "vapour," or "petrol" are easily recognizable. However, ones like "dogsbody," "chargehand," and "demerger" can only be readily understood in the context, not as single words. This makes the book even more interesting.

Chapter 5, which is entitled "Oil Works Revisited," is the longest chapter and describes Trevor's efforts to start a process investigation section. He covers some of his interesting assignments and his promotion to assistant works manager. He then covers labor relations, using costs and overheads, and improving technical knowledge. In 1963, the aim of the Engineering Dept. was "minimum capital cost" (rather than minimum lifetime costs or maximum profit), and plant operating personnel felt that pruning had gone too far. It was also a time when a method of study called "critical examination" was popular.

During 1964, this critical examination of a new phenol plant developed into an approach that became the

beginning of hazard and operability studies (HAZOPs). Trevor states, "I have been called, incorrectly, the father of Hazop. I was there when it was conceived and born but too busy running the existing plants to take interest in the new one. Later, when I took up the full-time safety job, I became an enthusiastic advocate of Hazop."

In his introduction, Trevor states, "My private life has been relatively uneventful so I give only a brief account of it ..." However, there are a few times when he reveals his private life, such as his introduction and marriage to Denise in the last paragraphs of Chapter 5.

Chapter 6 describes his efforts to measure and improve productivity. He relates attempts by ICI to gain productivity by reducing supervision and allowing more flexibility in union tasks. He also mentions some fatal accidents. This chapter acts as a transitional one, as he states that the personnel director convinced the ICI board that there was "a need for technical input to safety, that it could no longer be left to arts graduates, retired soldiers or elderly foremen." Trevor was asked to write a job description. His boss said the description fit him like a "coat."

In Chapters 7, 8, and 9, we begin to see the Trevor Kletz influence that improved ICI's process safety record. This is the point we watch him develop and express the philosophies that we all know and respect. He initially set guidelines for himself in this new job that he followed for the rest of his ICI career.

Trevor's four prime guidelines to deal with process safety issues were to:

1. Concentrate on technical accidents — mainly fires and explosions — rather than mechanical accidents — slips, falls, and so on.

2. To keep a sense of balance, concentrate on the most probable or serious hazards, and not spend time and money in dealing with unlikely or trivial ones.

3. Sell his ideas softly, but persistently ... to manage by persuasion and not authority.

4. As far as practical, if he had an idea, he just got on with it, rather than asking for permission.

During this period, he built up a library of slides illustrating accidents that had happened. He learned to hold meetings, show the slides, and ask the staff to tell what they thought had happened and how they could prevent similar incidents. This became his hallmark style of teaching.

He preached two themes, and I quote, "Most accidents are due to a failure to apply well-known principles or knowledge" and "What you don't have can't leak."

The second quotation was the premise for the inherently safer plant concept that he nurtured and became internationally accepted.

In Chapter 9, which is entitled "Safety Advisor — Part 2," Trevor describes his path to the Trevor we know. He published his first technical paper in 1971. In 1974, there was the major explosion in Flixborough, U.K., that killed 28 persons. It was the worst chemical plant accident to have occurred in the U.K. and one of the worst anywhere for several decades. There were demands for greater governmental control of the industry.

Trevor wrote and presented a paper to the Loss Prevention Symposium of AIChE in 1975, covering the wider questions raised by this tragedy. One portion of his presentation stressed that if the reactor conversion rate could be increased, the inventory could be decreased and the leak size would be reduced. Later, he revised his paper to be titled "What You Don't Have, Can't Leak."

Once he started writing, he gained momentum and continued at a fast pace. In Chapter 9, he also discusses his contributions with other books and the development of process safety modules for the Institution of Chemical Engineers. His modules relating to accidents due to over-pressuring vessels and accidents due to plant modifications are superb.

In the final chapter, Chapter 10, "Second Career," Trevor discusses his activities after he retired from ICI in March 1982. He joined Loughborough University and has maintained that association ever since. Early in his retirement he wrote the world's best selling process safety book, "What Went Wrong?" It has sold over 14,000 copies. He also discusses details of his other writings including ten books and over 100 technical articles.

This is an very interesting, very readable book. In Chapters 1 to 6, we see how the jobs and other industrial, cultural activities shaped Trevor's thinking and how a world-class British chemical plant operated in the 1940s to the 1960s. In Chapters 7 to 10, we observe how he injected sage wisdom into chemical plant safety. The world's chemical plant operations are a better, safer place because of Trevor's persistence, imagination, and passion. All safety professionals should read this book to see if they are living up to their potential, as Trevor is doing.

Roy E. Sanders
R. E. Sanders is compliance team leader for PPG Industries Inc., Lake Charles, LA.

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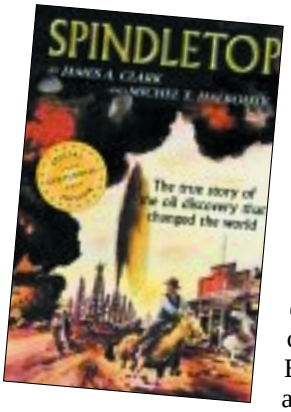
Internet.

Spindletop: The True Story of the Oil Industry That Reshaped the World



James A. Clark and Michel T. Halbouty
Gulf Publishing, Houston, 306 pp., $26.95, 2000, Special Centennial Edition

January 10, 2001 was the 100th anniversary of the day that the first great oil gusher at Spindletop in east Texas came in. This book was first published in 1952, to commemorate the 50th anniversary of that event, republished several times in the ensuing years, and the current "Centennial Edition" was put on press in 2000.

The preface to the 1952 edition reflects the exuberant patriotism of that time, when the U.S. dominated the post-World War II world, in some measure thanks to its position as a major oil producer. Reading the preface today, its tone seems unbelievably arrogant and wrong.

Much of that same feeling pervades the preface to the Centennial Edition, written by the one surviving author, Michel T. Halbouty, who seems proud to state that no changes nor additions have been made to the contents of the book (because none were needed). It is the opinion of this reviewer that a new chapter or an appendix is, in fact, needed, to put into perspective the major events taking place in the Middle East, and elsewhere since Spindletop. Also, it would have been useful to the reader to learn a little of the discoveries and technologies applied to the earlier limited production of oil in Pennsylvania and other parts of the world, leading up to Spindletop.

The first chapters describe the long, frustrating efforts of Pattillio Higgins, who first became curious about the strange mound called Big Hill, which leaked flammable gases and generated sources of waters that smelled of rotten eggs and were used to bathe in or drink to cure various ills. When on a visit to Pennsylvania, he saw similar phenomena, and began to imagine that oil might be found in Texas. This became an obsession with him, and the first drilling failures, because of inadequate equipment, funding, or capabilities, caused him to lose hope. The reader is caught up in Higgins' frustrations and excitement, up to the day the gusher proved him right and a succession of experts wrong.

The first gusher was still regarded by the experts as a fluke, but as people flocked to Beaumont, the competition for leases of property began, and a number of other wells were drilled, each also becoming a gusher. When it was recognized that the output from Spindletop more than equaled the total oil production from the rest of the world, Beaumont became a boomtown, reminiscent of the gold rush to California a half-century earlier. Within the first year, Beaumont saw speculation and swindlers, when people came to believe that the entire Gulf Coast sat on a pool of oil. Finally, enough wells failed in the surrounding areas to convince everyone that only the immediate area of Big Hill contained oil. Small pieces of land in the area began to command exorbitant prices, and to be sold and resold.

By the second year, so much drilling was taking place close together on the hill that the price of oil dropped precipitously, and the pressure of the field decreased. However, the low price and apparent abundance of oil began to encourage coal users such as the railroads to make changes to allow them to use oil as a fuel. Higgins and others began to plan refineries and storage complexes in Texas and Louisiana, some of which eventually came to fruition.

A number of chapters are devoted to the origins of a number of the major oil companies, which were until recently household names. These included Gulf Oil, Texaco, Magnolia, and the Humble Oil Co. Already existing oil companies such as Standard Oil, Sun Oil, Standard of Indiana, and others also took advantage in one way or the other of the oil boom at Spindletop.

The story of how Sun Oil anticipated the need for a refinery in the Northeast, and bided its time during the early speculative days at Spindletop is a particularly interesting one. Also fascinating is the description of how Humble Oil was formed based on unwanted tracts of land that had been given as debt settlements to the owners of a chain of feed stores and a group of bankers.

In the 1920s, there was a second boom in the Spindletop area when successful drilling finally was achieved on the flanks of the original Big Hill, and in the following eight years more oil was produced than had been found at Spindletop during the first boom. The Yount-Lee Co., which was the prime mover of that second boom, was sold in a very complicated deal to Standard of Indiana, when Yount, the founder and president, died suddenly.

An entire chapter is devoted to the major lawsuits that were spawned by the two booms at Spindletop. One of the earliest involved a party apparently selling the same property three times to three different buyers, in the early-to-mid-1800s. When oil was discovered at Spindletop, heirs of each of the so-called owners emerged to fight for their rights. Another suit involved the mineral ownership of the right-of-way of railroads. Many high-producing

wells were eventually developed on these narrow strips of land.

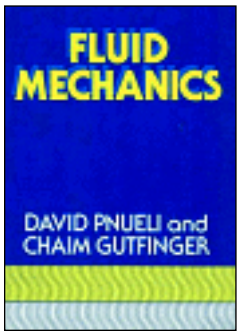
The last chapter describes the erection of a monument at Spindletop and the speculation that there would be a third boom based on deeper drilling. It would be nice to know whether that speculation was borne out or not, but the only appendix deals with the technical details of the formation of salt domes and oil deposits.

The book is full of intimate details and personal anecdotes describing what went on during the boom periods at Spindletop. However, the layout of the book is not at all chronological, and many chapters start by covering events that occurred at or before the time of the first gusher. This makes it extremely hard to follow and put all the characters and events into their proper prospective. Nonetheless, this reviewer believes the book should be of interest to anyone who would like to know more about a very important piece of industrial history.

Joseph V. Porcelli
J. V. Porcelli recently retired as president and CEO of Scientific Design Company, Inc., Little Ferry, NJ, and now is a consultant.

Fluid Mechanics

David Pnueli and Chaim Gutfinger
Cambridge University Press, New York, 493 pp., indexed, $85 hardcover, $41.95 paperback, 1997



Fluid mechanics is generally an engineering student's first introduction to the concepts of applied continuum mechanics. It is important for the student's subsequent academic and professional careers that these introductory concepts be well understood.

"Fluid Mechanics," by David Pnueli and Chaim Gutfinger, both at the Israel Institute of Technology, contains some of the best introductory sections on fluid mechanics and continuum mechanics that I have encountered in recent years.

Pnueli and Gutfinger clearly explain why the material derivative is so important in fluid mechanics. They also present and prove, lucidly, the Reynolds transport theorem, as well as the integral momentum theorem. These authors also clearly present the conditions for which Euler's equation is valid and how potential flow evolves from this equation. They also show how perturbation theory leads to boundary layer concepts.

The authors use the same format for each chapter throughout their book. They begin each chapter with a particular concept of continuum mechanics as related to fluid flow. In separate sections, they then present the applications of the concept. Each section concludes with an extensive set of examples. Each step toward the solution of an example is shown and the reason for each step is given. The ubiquitous "... it is obvious ..." is conspicuously absent in these examples and in this text. An extensive set of practice problems follows the text of each chapter.

The first chapter defines the continuum, continuum mechanics, fluid flow, and various fluid properties. The second chapter presents the concept of fluid stresses. The authors discuss fluid statics in the third chapter.

Generalized fluid flow is covered in Chapters 4 and 5. Chapter 4 shows the integral equations for fluid flow, while Chapter 5 gives the differential equations for fluid flow. The authors discuss the various exact solutions of the Navier-Stokes equation in Chapter 6.

Chapter 7 discusses the energy balance for fluid mechanics. Chapter 8 covers similitude and order of magnitude solutions as applied to fluid mechanics. This chapter provides an introduction to boundary layer solutions for fluid flow, which are covered in Chapters 9, 10, and 11.

The last three chapters of this text discuss topics of fluid mechanics encountered by the practicing engineer; *i.e.*, turbulence, compressible flow, and non-Newtonian fluids.

The authors include four appendices in their text: unit conversion factors, physical properties of water and air, properties of common fluids, and compressible flow data for ideal gases.

The practicing engineer will find much of interest in this book, even though it is written for an introductory course in fluid mechanics for chemical and mechanical engineering students. This text is also a good introduction to fluid mechanics for students of engineering physics.

In conclusion, let me add my strongest reason for acquiring this book: it is well written and highly readable. Neither of which can be said about most fluid and continuum mechanics textbooks.

If you want to review books for *CEP*, contact associate editor Rich Greene at richg@aiche.org.