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How to Drive a Nuclear Reactor

 Springer

PRAXIS 

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SPRINGER PRAXIS BOOKS IN POPULAR SCIENCE

Springer Praxis Books

ISSN 2626-6113

ISSN 2626-6121 (electronic)

Popular Science

ISBN 978-3-030-33875-6

ISBN 978-3-030-33876-3 (eBook)

<https://doi.org/10.1007/978-3-030-33876-3>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To Lynette

Preface and Acknowledgements

Have you ever wondered how a nuclear power station works? This book will show you, by asking you to imagine that you're a trainee reactor operator on a Pressurised Water Reactor (PWR), the most common type of nuclear reactor in the world. It'll take you on a journey from the science behind nuclear reactors, through their start-up, operation and shutdown. Along the way, it covers a bit of the engineering, reactor history, different kinds of reactors and what can go wrong with them. This book will show you how reactors are kept safe, and what it feels like to drive one.

So what inspired me to write this book? It was a conversation about a book entitled *How to Drive a Steam Locomotive* (by Brian Hollingsworth). I was describing to a friend how the author puts the reader on the footplate of a locomotive and then gradually introduces them to the controls in front of them; what they each do; and what might go wrong. By the end of the book, it felt like you were really there. The conversation ended with me complaining about the lack of any similar book describing nuclear reactors. I have searched for such a book, but have found that most concentrate on energy policy or on nuclear accidents, with only a few short chapters on reactor operation. My experience is that often people want to know more.

So I decided to write *this* book. I hope you enjoy reading it as much as I enjoyed writing it. (I'll let you be the judge of whether or not it matches up to the original.)

As with many industries, nuclear power stations use a lot of jargon. Hopefully, you won't find this too off-putting—there is an Index at the back, which may help. Different kinds of reactors use different jargon (of course!) and you'll see that this book is heavily PWR-biased, though other reactors do make an appearance. Confusingly—especially for people new to the

industry—it's not uncommon for power station equipment to have two or more different names, often used interchangeably, especially if that equipment can have different functions at different times. Examples include using the word 'Containment' instead of 'Reactor Building', 'Reactor Coolant System' for 'Primary Circuit', 'Fuel Rod' for 'Fuel Pin', etc. I've tried very hard to only use single terms in this book. To my ear, and perhaps to others who work at PWRs, that makes some of the text feel a little clumsy. Hopefully, to everyone else it will make things clearer. My advice to anyone reading this book is not to get too hung up on the jargon; it's the safe operation of the reactor that matters, not the labelling.

I want to start my acknowledgements by thanking my wife, Lynette, for encouraging me and helping me find the space and time to devote to writing this book. It's not easy to fit this sort of thing into your spare time without other things being displaced. I also need to thank my first readers, Nicholas Butt and Kevin Martin, who provided both technical and non-technical review comments which have (mostly) been addressed. It can't have been easy to read drafts of chapters when you don't have a clear idea of how it's all supposed to fit together. Their patience and perseverance were much appreciated.

I owe an enormous debt of gratitude to the staff of the UK's Sizewell 'B' nuclear power station. This has been my base for nearly 25 years, primarily working in the field of nuclear safety. Most of my experience of PWRs is Sizewell-based, and I accept that there are risks in this for an author; not every PWR is the same. I hope I've been flexible enough in what I've written for those at other PWRs (and indeed, at other reactor designs) not to feel excluded. Sizewell has a marvellously 'open' culture where I've found that I can ask questions on anything to fill gaps in my knowledge. Beyond this, I'd especially mention the support from the Management Team and from EDF Energy Corporate staff with this project. Their enthusiasm for it from the outset, without interfering in any way with its content, has made it so much more achievable.

Finally, I should mention the 'Nuclear Safety Group' at Sizewell B. Their depth of knowledge, experience, willingness to challenge, patience and rigour go a long way to keeping Sizewell 'B' as safe as it is. Their humour makes it enjoyable! This book, though ostensibly concerned with reactor operation, probably comes closest to a view of the world as it's seen from the Nuclear Safety Group. Make of that what you will...

The majority of the content of this book is my own. Where opinions are expressed—and there are a few—they are also mine, and do not in any way reflect the views or policies of EDF Energy or of any other company. That, of

course, means that any errors that you find must also be mine. For these, I apologise and say ‘well done!’ if you’ve spotted one.

Personally, I find nuclear reactors fascinating. I hope you will too.

Suffolk, UK
September 2019

Colin Tucker

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