

安全丛书 INSAG-13
SAFETY SERIES INSAG-13

核电厂运行安全管理

国际核安全咨询组报告

MANAGEMENT OF OPERATIONAL SAFETY IN NUCLEAR POWER PLANTS

A REPORT BY THE INTERNATIONAL
NUCLEAR SAFETY ADVISORY GROUP

大亚湾核电运营管理有限公司
安全文化与人因改进项目组 译



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译者的话

自国际原子能机构 1999 年推出 INSAG-13 以来,中文版在国内尚属首次翻译出版。本译稿经过大亚湾核电运营管理有限责任公司(DNMC)安全文化与人因改进项目组的初步翻译、小组审查修改,以及全体成员累计1500人·时的集体会审而形成。虽然项目组成员经过了 INSAG-4、REPORT-11、INSAG-15 三本书会审过程的学习和锻炼,对 INSAG-13 译文质量的追求依然没有丝毫的松懈和动摇,也没有受到项目组成员变动和扩充的影响。无情质疑、激烈辩论的会审风格已经演变成项目组成员之间几乎不假思索的约定和假设,也使译文本身成为无可辩驳的集体智慧的结晶。两年来,我们固然做出了艰苦的努力,但在付出的过程中得到的是更多的收获和回报。追踪安全文化十余年的发展脉络,从 INSAG-4 对于安全文化理念的概括,到 REPORT-11 对于安全文化三阶段的阐述;从 INSAG-15 对于安全文化关键实践问题的提炼,到 INSAG-13 对于整个安全管理体系的透彻分析,我们不禁为国际安全文化专家们与时俱进的深刻见解和洞察力所折服,也为安全文化的理念和实践跨越时空的继承和发展而欣慰。我们深深感到,安全文化的内涵博大精深,即使集中了项目组集体的智慧和力量,力有不逮之处仍然在所难免,因此本书最终还是继续采用中英文对照的方式出版,避免译文可能产生的歧义或误解。借本书出版的机会,我们期望为我国核电安全文化的持续建设贡献自己的一份力量,欢迎广大核电同行继续提出批评指正意见。

本译文的审核工作得到了广东核电领导的关注和指导,尤其是濮继龙先生对译稿全文进行了逐字审阅,提出了诸多宝贵意见,在此谨表感谢。

大亚湾核电运营管理有限责任公司

安全文化与人因改进项目组

2008 年 11 月

FOREWORD

by Mohamed ElBaradei
Director General

The International Atomic Energy Agency's activities relating to nuclear safety are based upon a number of premises. First and foremost, each Member State bears full responsibility for the safety of its nuclear facilities. States can be advised, but they cannot be relieved of this responsibility. Secondly, much can be gained by exchanging experience; lessons learned can prevent accidents. Finally, the image of nuclear safety is international; a serious accident anywhere affects the public's view of nuclear power everywhere.

With the intention of strengthening its contribution to ensuring the safety of nuclear power plants, the IAEA established the International Nuclear Safety Advisory Group (INSAG), whose duties include serving as a forum for the exchange of information on nuclear safety issues of international significance and formulating, where possible, commonly shared safety principles.

Engineering issues have received close attention from the nuclear community over many years. However, it is only in the last decade or so that organizational and cultural issues have been identified as vital to achieving safe operation. INSAG's publication No.4 has been widely recognized as a milestone in advancing thinking about safety culture in the nuclear community and more widely. The present report deals with the framework for safety management that is necessary in organizations in order to promote safety culture. It deals with the general principles underlying the management of operational safety in a systematic way and provides guidance on good practices. It also draws on the results of audits

前 言

总干事 穆罕默德·巴拉迪

国际原子能机构所从事的与核安全有关的活动是以许多前提为基础的。首先最重要的,是每个成员国对其核设施的安全负全部责任。国际原子能机构可以向这些国家提出建议,但这并不能减轻成员国的责任。其次,成员国可以从交流经验中得到很多益处;从教训中也可以学习到防止事故的方法。最后,核安全的形象是国际性的;不论在哪里发生了严重的事故,都会影响到各地的公众对核能的想法。

为了强化对确保核电厂安全的贡献,IAEA 建立了国际核安全咨询组(INSAG)。它的职责包括,提供一个平台,就具有国际普遍意义的核安全事项交换信息,以及尽可能形成共同分享的安全原则。

多年以来,核工业界就一直密切关注着工程方面的问题。然而,仅在最近十来年方才认识到要想达到安全运行,组织和文化上的问题也是至关重要的。在核工业界里和更广的范围内已经将 INSAG 的第 4 号出版物看作是对安全文化进一步思考的里程碑。本报告探讨了推进安全文化所必需的组织上的安全管理的架构。它明确了系统地实施运行安全管理的总原则,并提供了一些良好实践的导则。它也

and reviews to highlight how shortfalls in safety management have led to incidents at nuclear power plants. In addition, several specific issues are raised which are particularly topical in view of organizational changes that are taking place in the nuclear industry in various countries. Advice is given on how safety can be managed during organizational change, how safety performance can be effectively monitored and how declining performance can be detected at an early stage so that no significant safety concerns arise.

The report is intended primarily for managers and others involved in the organization and conduct of safety related activities at nuclear power plants, but it will also be of interest to regulators and others.

I am pleased to have received this report and am happy to release it to a wider audience.

凭借审查和检查的结果强调在安全管理上的缺陷是如何在核电厂里引发事故的。此外,不同国家的核工业组织正在发生变化,本报告也探讨了与这些变化有关的特殊议题。本报告就组织变动期间应该如何进行安全管理,如何有效地监测安全业绩,以及如何早期探测安全业绩下滑等一系列问题提出建议,以避免出现重大的安全问题。

这份报告主要是为组织的管理者和在核电厂从事与核安全活动有关的人员而编写,但对监管人员和其他人员也具有参考价值。

我很高兴能收到这份报告,并很乐意与广大读者分享它。

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1. INTRODUCTION

1. There is increasing recognition of the importance of a strong safety culture to ensure that high standards of safety are achieved by both organizations and individuals. This was recognized by INSAG in its report on Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 [1].

2. The term 'safety culture' was expanded upon in a subsequent INSAG report, 75-INSAG-4 [2], which set out the universal features of a strong safety culture. The report emphasized that safety culture is both attitudinal as well as structural and relates to both organizations and individuals. The term 'organization' is used for the company or utility responsible for the operation of one or more nuclear power plants. The structural aspect of safety culture comprises the organization's arrangements for safety, which is commonly described as the safety management system for the organization. 'Management' is used to mean the administration of the organization.

3. Organizations having a strong safety culture will have an effective safety management system with the support and ownership of all staff. However, the safety management system has a broader role in that it provides a framework by means of which the organization ensures good safety performance throughout the planning, control and supervision of safety related activities. The safety management system, in turn, provides a means by which the organization promotes and supports a strong safety culture. In particular, the system will shape the environment in which people work and thus influence their behaviour and attitudes to safety. The safety management system is thus generally considered to be an integral part of the organization's quality management system, provided to ensure the quality of all aspects of nuclear power plant operations, including safety. However, the existence of a quality management system does not in itself ensure that there is an effective safety management system, since there is a requirement to ensure that the required arrangements for safety have been identified and implemented.

1. 引言

1. 人们越来越认识到强势的安全文化在确保组织和个人实现安全高标准方面的重要性。INSAG 在 75-INSAG-3^[1]《核电厂基本安全原则》中指出了这个问题。

2. 其后的 INSAG 报告 75-INSAG-4^[2]对“安全文化”这个术语作了进一步阐述,提出了强势安全文化的普遍特征。该报告强调,安全文化既有态度属性,又有结构属性;既与组织相关,也与个人相关。“组织”这个术语是指负责运营一座或几座核电厂的公司或实体。安全文化的结构属性包含组织为安全所做的各种安排,通常是指组织的安全管理体系。“管理”通常是指组织的行政管理。

3. 具有强势安全文化的组织必然有一个有效的、为全体员工所支持和拥有的安全管理体系。然而,安全管理体系具有更广泛的作用,因为它提供了一个框架,使组织能够确保安全相关活动的计划、控制和监督都取得良好的安全业绩。反过来,安全管理体系又为组织提供了一种促进和支持强势安全文化的手段。特别是,安全管理体系能塑造人们工作的环境,进而影响他们对待安全的行为和态度。因此,安全管理体系通常被看成是组织质量管理体系不可分割的一部分,后者用于确保核电厂运营所有方面的质量,包括安全。然而,质量管理体系的存在本身并不能确保就有一个有效的安全管理体系,因为还要求确保安全所需的各项安排都已识别和实施。

4. The purpose of this report is to build upon the ideas outlined in 75-INSAG-4 and to develop a set of universal features for an effective safety management system in order to develop a common understanding. This is based on best practices in quality assurance and management systems set out in other IAEA publications such as Safety Series 50-C/SG-Q [3]. The report recognizes the crucial importance of the commitment of individuals in the organization in ensuring the effective implementation of a safety management system.

5. The focus of the report is directed towards operating nuclear power plants and utilities but will also have application in other nuclear organizations. The report does not attempt to describe in detail the required arrangements for the management of safety, as these will need to reflect the particular legislative requirements in the respective country and the culture^① of the organization.

6. The report also provides guidance on various topics of current interest concerning the management of safety, including:

- introducing a safety management system;
- management of safety during organizational change (including personnel changes) ;
- monitoring effectiveness using performance measures ;
- identifying declining safety performance.

In addition, Appendix I provides a set of questions by which an organization can make an internal judgement on the effectiveness of its safety management arrangements. It is important to supplement such internal benchmarking with periodic external peer reviews. Thus the Annex provides examples of events brought about by weaknesses in the safety management system, to illustrate the principles described in the report.

① The culture of the organization comprises the mix of shared values, attitudes and patterns of behaviour that give the organization its particular character. Put simply, it is ' the way we do things round here '.

4. 本报告的目的是,基于 75-INSAG-4 所概括的安全文化理念,建立和发展一套有效安全管理体系的通用特征,以达成共同的理解。这一工作以 IAEA 其他出版物,如安全系列丛书 50-C/SG-Q^[3] 中关于质量保证和管理体系方面的最佳实践为基础。本报告指出,为确保安全管理体系的有效实施,组织中个人的承诺是极端重要的。

5. 本报告重点针对运营核电厂及公司,但也同样适用于其他核组织。本报告并不打算对安全管理所要求的安排做详细说明,因为那需要反映不同国家的具体立法要求和组织文化^①。

6. 本报告也对当前所关注的安全管理相关的各种课题提供了指导,包括:

- 引入安全管理体系;
- 组织变动(包括人员变动)期间的安全管理;
- 使用业绩指标监测安全管理的有效性;
- 识别安全业绩的下滑。

此外,附录 1 提出了一系列问题,组织可以依此对其安全管理的有效性进行内部评价。用定期的外部同行评审作为内部标杆对比的补充也很重要。为说明本报告提出的原则,报告附件还提供了安全管理体系缺陷引起的一些事件实例。

^① 组织文化由共同的价值观、态度和行为方式综合组成,它们赋予组织特有的特征。简言之,就是“我们这儿做事的方式”。

2. DEFINITION OF THE SAFETY MANAGEMENT SYSTEM

7. *The safety management system comprises those arrangements made by the organization for the management of safety in order to promote a strong safety culture and achieve good safety performance.*

8. The safety management system has two general aims:

— to improve the safety performance of the organization through the planning, control and supervision of safety related activities in normal, transient and emergency situations; and

— to foster and support a strong safety culture through the development and reinforcement of good safety attitudes and behaviour in individuals and teams so as to allow them to carry out their tasks safely.

9. The term ‘safety management system’ should not be taken to suggest that safety is managed separately from other business activities. Neither should it be seen as an optional extra. Safety is an integral component of the way the whole organization is managed and must have the involvement and active participation of all staff. Consequently, the organization’s safety management system is generally considered to be an integral part of its quality management system. In particular, the documented arrangements for the management of safety are likely to form part of the documentation for the organization’s quality system. It is important that the documentation for the quality system cover all safety related activities within the organization. The associated quality assurance assessments (e. g. QA audits) carried out will provide one of a number of mechanisms to judge the effectiveness of the safety management system.

10. The safety management system embraces all those arrangements that are needed to ensure that safety is properly managed. It will comprise some arrangements that are primarily provided in the interests of safety, for example a permit for work system, systems for the review and authorization of plant modifications and the setting up of nuclear safety committees. The safety management system will also involve arrangements that contribute to other business objectives as well as to safety, for example the provision of competent staff. The arrangements to co-ordinate with external organizations such as plant vendors, suppliers and contractors are also an important part of any safety management system.