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古里1号机组全厂断电隐瞒事件与安全文化

卓越核安全文化八大原则

健康的核安全文化特征

中核集团核安全文化同行评估实践

参加IAEA30年运行安全评审服务改进技术会议的总结报告

核电厂同行评估及经验交流委员会秘书处

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古里1号机组全厂断电
隐瞒事件与安全文化

作者：Mansu Kim先生

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KHNP
KOREA HYDRO & NUCLEAR POWER CO., LTD

0 引言

韩国水力与核电公司拥有23台运行机组（8台WEC型压水堆+11台OPR1000压水堆+4台CANDU 重水压水堆），提供约30%的国内电力供应总量，另有5台在建机组（1台OPR1000+4台APR1400）。

分类		机组	容量 (MWe)
运行	Kori	6	5,137
	Yonggwang	6	5,900
	Wolsong	5	3,779
	Ulchin	6	5,900
小计		23	20,716
在建	Shin-Kori #3,4	2	2,400
	Shin-Wolsong #2	1	1,000
筹建	Shin-Ulchin #1,2	2	2,800

【韩国核电厂分布】

古里1号核电机组为韩国核历史中建造的首座核反应堆。机组自1977年开始投运。经过30年的运行，其许可设计寿命已过，2007年进行了许可证延期。该机组在587 MWe下运行性能卓越。WEC设计的古里1号核电机组的反应堆中有121件燃料组件，相当于43吨金属铀。此外，去年8月份，为了延寿和提高关键设备的可靠性，更换了应急柴油发电机（EDG）、反应堆顶盖和主控板。

1 1.1 古里1号核电厂历史

1972年5月：颁发施工许可（CP）和运行执照（OL）

1977年6月：初始临界

1977年6月：首次发电并网

1978年4月：商业运行

1997年6月：更换低压涡轮转子

1998年9月：更换蒸汽发生器和过程控制/保护系统

2001年10月：更换主变压器

2007年12月：执照更新，可继续运行至2017年

1983年IAEA运行安全评审小组（OSART）的首次活动是在古里核电厂开展的。2007年7月，在许可证延期前，IAEA曾向古里1号机组派过长期安全工作组（SALTO），实施了安全评审

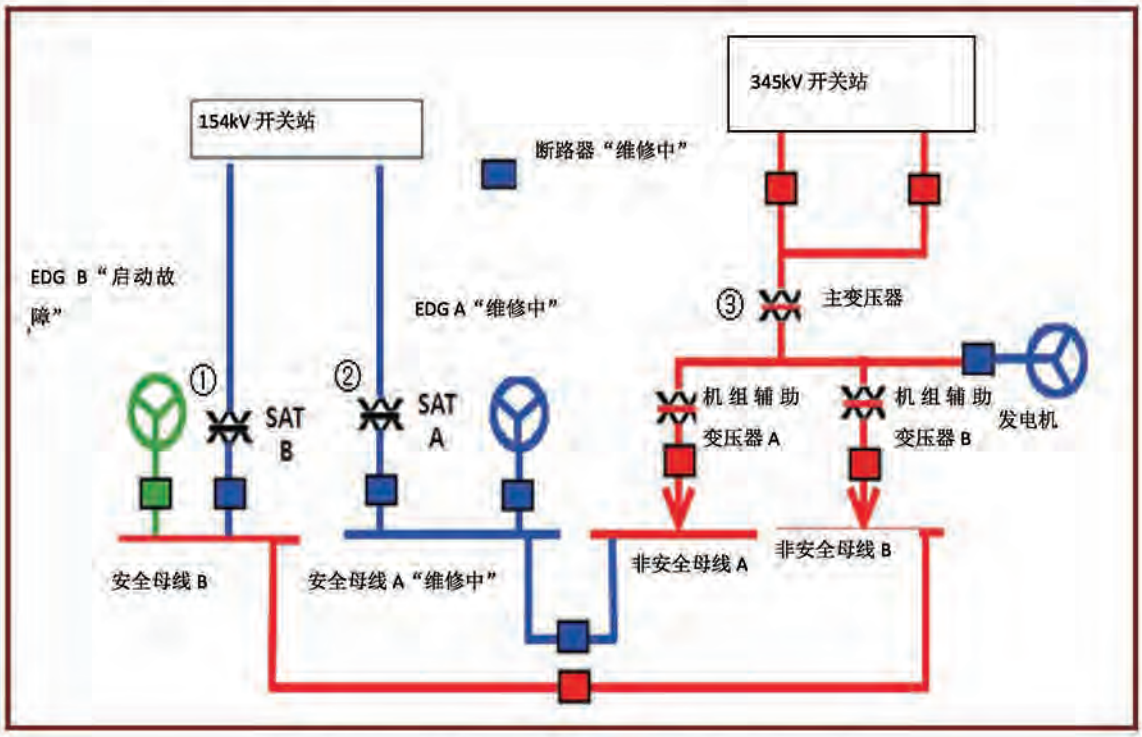
【古里电厂鸟瞰图】

1.2 Key parameters 关键参数

反应堆类型	压水堆，两个环路
净发电功率（MWe）	610 MWe
反应堆输出功率（MWe）	1723 MWth
电厂地震设计基准	0.2 g
厂外电源数量	2
厂内电源高压母线数量	2
柴油发电机数量、电压、装机容量	2/4.16kV/2920kW
厂内其他备用电源	1
AAC D/G /4.16kV/5,500kW	
应急堆芯冷却	
a.高压注入	
列数	2
泵的数量和类型	2，电动离心泵
b.低压注入（RHR）	
列数	2
泵的数理和类型	2，电动离心泵

Event summary 事件概述

2012年2月9日，在古里1号机组的第29次换料大修期间，发生厂外电源失电事件，而应急柴油发电机B未能启动，同时应急柴油发电机A因计划维修而停机，因此造成全厂断电。

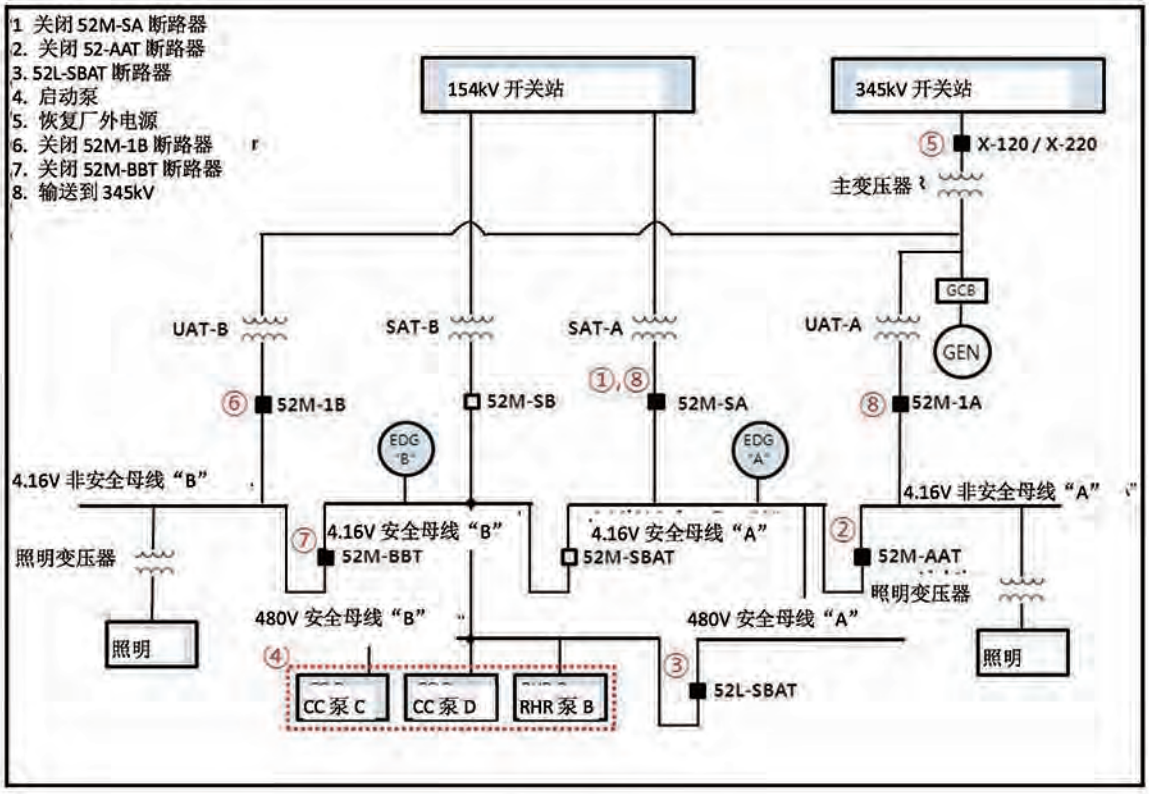


[Electric switchgear configuration before SBO event]

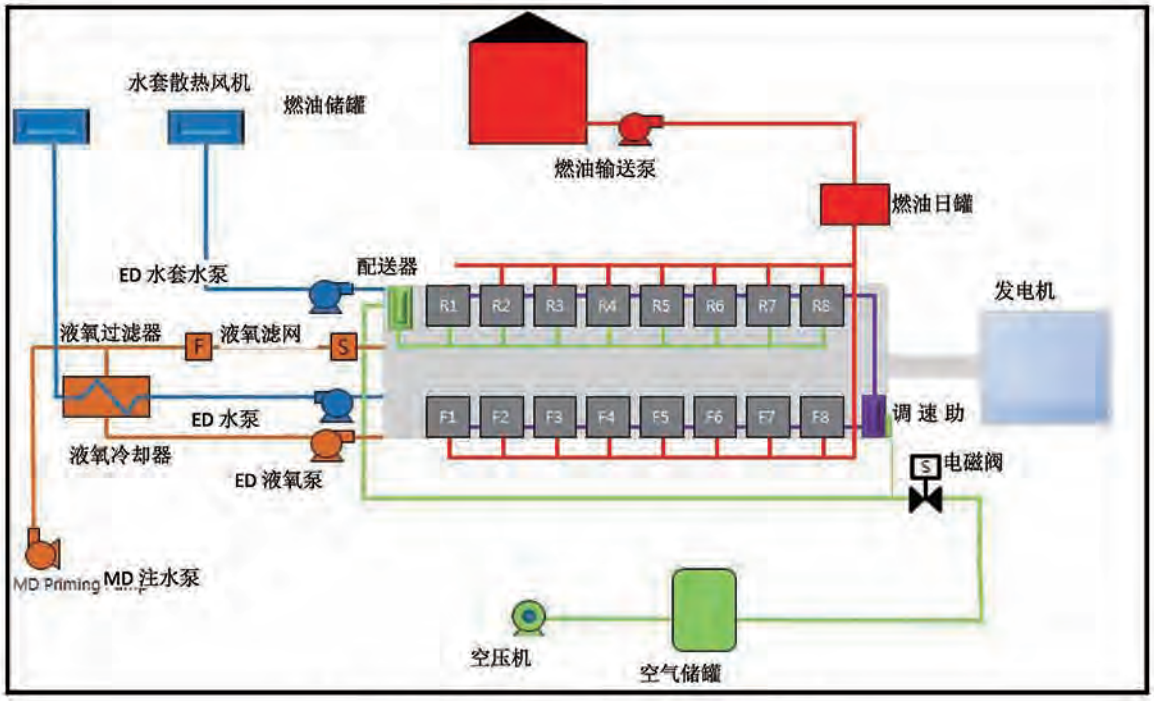
【SBO事件前电气开关设备配置】

事件发生时，可使用三（3）处电源，即通过主变压器的一处厂外电源（③345kV）、应急柴油发电机“B”和AAC D/G。两处备用厂外电源（①、②，154kV）因维修计划隔离。在发电机保护继电试验过程中，厂外电源（③）断电，造成厂外电源失电（LOOP）。由于分包商对发电机保护继电试验设备的不当操作（人为失误），造成了一（1）处运行厂外电源断电。应急柴油发电机A处于维修状态，而应急柴油发电机B未能按照自动命令信号启动，因此造成了所有的交流电源失电。全厂断电造成了核电厂失去了反应堆冷却系统停堆冷却和乏燃料水池冷却。

为了应对全厂断电情况，主控室操纵员通过连接SAT“A”而并非连接至AAC DG（AAC DG处于备用状态，并为古里4号机组共用设备）恢复了电力，然后由于RHR“A”处于维修状态，按照程序将480V母线A与480V母线B进行交叉，恢复了RHR泵“B”的电力供应。在11分43秒后，恢复了原先处于维修状态的一（1）处厂外电源（①），并为指定的1E级母线供电。此时停堆冷却失去了19分钟。发生全厂断电时，所有燃料仍在反应堆内，反应堆处于顶盖移除及堆腔被淹没状态。由于该事件的发生，热段中的反应堆冷却剂最高温度从37℃上升到58.3℃（上升了约21.3℃），乏燃料池的温度从21℃小幅上升到21.5℃。



【恢复序列】



【应急柴油发电机启动供气管路原理图】

根据监督部门调查组的RCS系统碘-131活度分析和热工水力审核计算，未发现燃料受损。

3 当时的立即行动和决定

电厂经理及其控制室工作人员决定不上报该全厂断电事件。由于电厂经理内心有成为公众批评焦点的沉重负担，并担心损害电厂管理层公信力，他选择了隐瞒该事件。该事件发生在因为一年前福岛第一核电厂事故，世界核工业遭到沉重打击，反核情绪高涨之时。而且在SBO事发当天，KHNP的首席执行官曾宣布与政府合作运营核电厂的行动计划，并在公共媒体面前承诺不会发生意外事件，接受了记者采访。

该全厂断电事件未对电厂安全造成不利影响，未给员工带来辐照，也未向环境释放放射性物质。但是古里1号机组未能按要求，依照电厂应急计划上报该全厂断电事件。

该隐瞒事件被公众获悉后，对社会造成巨大的影响。NSSC立即要求电厂停堆。去年KHNP请求IAEA派专家工作组。在未出现公众负面影响的情况下，电厂关停了5个月。直到制定了安全文化改善计划后，监管部门才批准电厂重新启动。

邀请独立的核专业机构进行检查，并向公众（包括当地社区和环境团体）公布检查结果是展现核电厂安全性的一种方法。为了重获公众信任、恢复电厂受损的信誉，有必要通过其制度和理念的革新，来改善其安全文化。IAEA工作组（评估）作为一种方法措施，对重启反应堆很有帮助。

在该起隐瞒事件中，包括电厂经理在内的五名员工因隐瞒而被起诉。其中一名员工被判一年监禁并处罚款。我本人也因在柴油发电机不可运行的情况下进行堆芯换料受到怀疑，接受检察官的审问。遗憾的是，在事件发生时，主控室操纵员未告知我柴油发电机不能运行。无论如何，我还是对此感到羞愧，虽然最终我被认定无罪。

以下列出了全厂断电事件所涉第29个堆芯周期的主要里程碑。反应堆关停了将近一年的时间。

- 2012年2月4日因换料大修停堆
- 2012年2月9日20:34发生SBO
- 2012年3月4日反应堆第29个周期临界
- 2012年3月9日，事件发生一（1）个月后，全厂断电事件遭到披露
- 2012年3月13日，反应堆启动后9天，被迫停堆
- 6月4～11日，IAEA工作组
- 2012年8月10日，被迫停堆后5个月，电厂重新启动
- 2013年4月12日，电厂停堆，更换主隔离间
- 2013年9月11日，电厂按期启动
- 2013年9月29日，按期启动后18天，反应堆临界
- 2014年2月12日，换料大修（计划）

4 原因

4.1 全厂断电（SBO）

直接原因（事件发生原因）：主发电机保护继电器误动。

间接原因/障碍：

- 缺乏可开展发电机保护系统试验的有资质的承包商——由于可用承包商要赶到下一工作现场，因而重新对试验计划进行了安排。
- 重新安排的发电机保护系统试验计划绕过了既定程序（重排试验计划需经大修控制中心批准），这导致了未对非正常的试验编排进行额外的风险分析。
- SAT A未能恢复运行，但仍开始SAT B的维修，从而进一步导致了电厂失电。
- 设计方面：柴油发电机启动空气的单电磁阀。纠正措施：作为该全厂断电事件根本原因分析的组成部分，电厂应延伸应急柴油发电机B电磁阀的失效条件，对发挥重要安全作用的电厂其他设备和系统进行分析，识别并管理关键零部件、组件及薄弱环节（类似于应急柴油发电机B电磁阀），从而避免再次发生此类事件。
- 维修：无完整的预防性维修，“丢失的”橡胶盖被换成塑料盖，无法提供适当保护。
- 沟通方面的人为失误：主管要求“不要进行下一步骤”，而工人在发电机保护试验中激活了下一通道。
- 人为失误：工人因长期从事此类试验而过度自信。
- 程序：未说明前提条件、潜在危险和失误后果；未要求对已完成步骤进行签字。
- “工前会应作为避免人因失误、沟通障碍和误解的措施”，但是其工前会却在试验前一天举行。

4.2 未上报全厂断电，包括未宣布应急行动级别“警报”

直接原因（事件发生原因）：古里1号电厂经理和其他员工决定不上报SBO事件

- 间接原因/障碍：
- 信誉风险：电厂经理当时由于内心有成为公众批评焦点的沉重负担，并担心电厂公信力受到损害（该反应堆面临延寿的压力－译者注），从而决定隐瞒该事件。
- 福岛事故、2011年4月古里1号发生反应堆的保护停堆，以及之前古里3号和4号备件供应相关的两起贪污事件，降低了公众对该核电厂的信任。
- 来自KHNP保持没有发生过事件纪录的巨大压力。
- 由于普遍对主管的过度尊崇，使其他相关员工即使在违反多条安全政策和管理程序的情况下，仍不会对电厂经理提出异议。
- 自2012年5月起的古里1号安全文化调查表明：
  - 相对较少（仅23.2%）的电厂员工对是否“安全文化应视为开展所有活动的最优先考虑事项”作出肯定回答。
  - 相对较少（仅19.5%）的电厂员工对是否“创设重视安全性的业务环境”作出肯定回答。

4.3 违背技术规范

下列方面违背了电厂技术规范：

a)2月9日下午的运行班组未能采取果断措施，使应急柴油发电机恢复到可运行的状态；

b)2月10日下午的运行班组在应急柴油发电机不能运行的情况下，开始进行燃料移动（实际上，该班组在两次意外事件中当执）。

直接原因（事件发生原因）：由于无视之前的全厂断电事件，未宣布柴油发电机B不能运行。

间接原因/障碍：

- 古里1号经理决定不上报该SBO事件。
- 其他相关员工即使在数份安全政策和管理程序要求采取行动的的情况下，仍不敢反对电厂经理的决定或提出异议。
- 接班的夜班工人未能识别状态改变（图表记录器上主冷却剂温度上升、报警打印机上出现“RHR低流量”和“RHR脱扣”报警）；虽然一般情况下要求进行相关检查，但当时无详细检查列表。
- 古里1号内部监督未能识别该SBO事件。
- NSSC/KINS检验员未能识别该SBO事件。

4.4 韩国文化的某些方面

韩国民族文化中尊敬长辈和上级的特点起了重要作用。此类文化的优点是遵从作业主管的要求和期望，而领导也被寄予信赖和更重大责任，来展示优秀的行为准则和标准，并引领团队走向卓越绩效。但这种文化对于“质疑的态度”也有一种隐含的影响，这就有必要作出调整以确保安全文化能在KHNP公司内部发挥作用。在作业主管违反政策和程序的情况下，员工可能没有一种可以接受的文化氛围，从而对其提出质疑。

“努力工作，尽量利用有限时间尽可能开展多项任务”的文化问题业已显露。这种文化特征的优点在于经理们能利用韩国的这种职业道德，高效、快速地完成任务，但这种特征的难处在于可能使得细致、系统地完成任务被打了折扣。现场广泛应用的“检查列表”和质量/程序“停工待检点”有助于缓解该问题。

4.5 该全厂断电事件的间接原因/障碍

导致上述行为的更广泛文化影响：

- 虽然多种安全政策和管理程序要求对全厂断电这种情况进行上报，并启动当时已经就位的应急响应，但对主管的高度尊崇使得其他相关员工未对电厂经理提出异议。
- 福岛事故、2011年4月古里1号发生反应堆相关停堆，以及之前古里3号、4号机组备件供应的两起贪污事件，降低了公众对该核电厂的信任。

古里内部文化影响

- 信誉风险：电厂经理当时由于心存成国公众批评焦点的沉重负担和担心损害电厂公信力而决定隐瞒该事件。

• 来自KHNP公司，无运行事故、以绩效为导向的无故障周期（OCTF）任务的巨大压力。

在随后对古里1号机组开展的安全文化调查结果表明，古里1号的员工和经理均认为业务优先应置于安全优先之前。

古里1号机组管理层决定不上报事件背后的文化类型以及采取何种措施来提升安全文化受到深入探讨。IAEA工作组指出，韩国文化中盛行高度尊崇权威和资历导致此次隐瞒事件。迄今已采取了22项措施来提升安全性，其中包括内外部的监督体制、24小时远程电厂监管系统、多重厂外电源等。引进了员工匿名举报计划。除了这些软件改进外，还更换了大量主要设备，来提高可靠性。遗憾的是，一旦丧失了公众信任，很难重获信任。尽管KHNP公司作出大量努力来改善安全性，但公众更倾向于不再信任古里1号。公众的唯一要求就是反应堆停堆。在停堆后的5个月，去年反应堆得到了重新启动，IAEA工作组在此方面起了关键作用。在这些活动开展期间，作为古里1号机组管理层成员之一，我愿意与参与调查者共享资源，包括在被NSSC指控后接受检察官的讯问。

提高安全性所采取的措施

5.1 报告系统的改进

原因： 古里1号机组管理层隐瞒SBO事件之所以发生也可能是由于电厂只有一个处于工作状态下的在线报告系统，电厂管理者通过该系统能够掌控所有的信息流。

如何改进：引入多道监督与报告系统，从运行结构上消除隐瞒情况的发生。

编号	项目	说明
1	远程监督和自动报警系统、软件系统	启动和停堆期间用于电厂运行参数监测的远程在线监视系统：在首尔办事处，可监测所有的电厂。 核事件警报系统（NEWS） 该系统进行了最新设计，它可将主要报警在线发送给KHNP作业现场、KHNP首尔办事处、KINS、NSSC驻地办事处、NSSC总部。主要警报包括反应堆停堆、安注、失压、高辐射报警、自然灾害等。 系统配备不间断电源。
2	独立的安全监督组织	新的独立安全监督组织。 采用4班制作业，每个现场各配6人。 在主控室周围，增加主设备和安全相关的监视和维护措施。 - 可直接向首尔办事处报告安全相关事件，而不受电厂经理的影响，并可检查电厂所作的决策。
3	闭路电视监视	- 近期，现场已安装了64台闭路电视，从而安全监督人员可对电厂员工进行远程监督。
4	向公众开放的核电运行状态网站	- 核电运行参数可进行实时开放。 - 公开重大问题/决议。

5.2 安全文化的深入传播

- 原因：为了根除业务优先于安全性的观念，在各领域传播安全文化。
- 改进措施：通过咨询外部安全专家发现待改进项，并采取合适的且切实可行的后续措施。
- 基本理念：安全性是一种公认的价值，领导层对安全负责，安全要有质疑的态度，安全在于学习引导，安全应贯穿于所有活动和沟通，安全应采用严谨的工作方法。

编号	项目	说明
5	发现待改进项，并实施后续措施	- 咨询外部安全文化专家 ✓ 邀请了Excellons专家，诊断了公司层面的7个领域，其中包括总裁、CEO、公司使命和愿景以及安全文化政策。 ✓ 邀请了来自工业界与大学的13名国家安全文化评估员，得到了5项评估结果。 - 电厂层面已经开展12项改进措施。 - 开展电厂经理和各员工之间的安全对话 - 改进之前不合理的安全文化匿名邮箱举报系统 - 开展改善安全性沟通的团队会议 - 每天早会期间开展安全文化信息的宣传 - KHNP和承包商之间的安全文化会议 - 每天上午、交接班、工前会上大声喊出安全口号 - 对为安全文化有所贡献的员工作出嘉奖 - 开展安全文化专题讲座 - T将安全文化纳入培训计划
6	IAEA 对安全文化领域的评估	- IAEA提出了6项安全文化改进建议，目前正在对其解决方案进行落实。
7	修订安全指标	- 在个人评价和管理绩效评估时，强调安全文化改善的作用因素 - 安全态度成为了批准个人晋升的重要因素

5.3 提高电源系统可靠性

- 原因：电源系统为上世纪70年代设计和制造。需要增加厂外电源线路。在维修过程中，该系统容易触发LOV。
- 如何措施：制定维修计划从而避免设备的失效，并更新主要组件。

编号	项目	说明
8	通过增加 345KV 输电线路，提高厂外电源的稳定性	- 厂外输电线路由原来的2条增加到6条。
9	电源线路试验期间，加强监督活动	- 对可能导致LOV的工作单元分类，得出119个项目。
10	配备额外移动式柴油发电机	- 每个现场各部署一台4.16 kV、3,00kW的应急柴油发电机。
11	应急柴油发电机中设置双重启动空气系统	- 引进冗余的供气系统。
12	对所有运行电厂的应急柴油发电机开展专门试验和检验	- 已完成。
13	更换新的古里 1 号应急柴油发电机	将柴油发电机从 2,920kWe 扩容到 3,500kWe。 - 更换两台应急柴油发电机。

5.4 换料大修活动的改进

- 原因：原换料大修活动的目标更多集中在减少维修时间，而不是在安全优先的管理上。
- 改进措施：对容易受LOV影响的活动进行分离并安排连续的工作计划。

编号	项目	说明
14	简化备用变压器维修计划	- 为了从根本上防止全厂断电的发生，逐一安排备用变压器维修，而不是同时进行。 - 容易引起LOV的潜在工作项目需互相分离，而且不同时进行。
15	延长换料大修日程	- 给换料大修分配更长的时间，以确保安全性。 - 换料大修延长一到两天。
16	在合同中调整专业化的技术条款	- 技艺方面 - 安全文化方面

5.5 公司层面

- 对已授权的反应堆操纵员/高级操纵员候选者进行教育。
- 利用模拟机对操纵员进行培训，以应对全厂断电等紧急事件。
- 审核880份运行程序，并对其进行修订。
- 增加运行和维修方面的人力。
- 检查所有运行电厂的应急柴油发电机。
- 更换运行了20年以上电厂的主要组件。

5.6 监管机构层面

- 在监督检查项目中加入安全文化。
- 增加派驻现场的检查员。

IAEA technical meeting on the evolution of the Operational Safety Review Team(OSART) service over the last 30 years

SBO concealment event and safety culture at Kori 1

Presenter : Mr. Mansu Kim

29 Oct. ~ 1 Nov. 2013

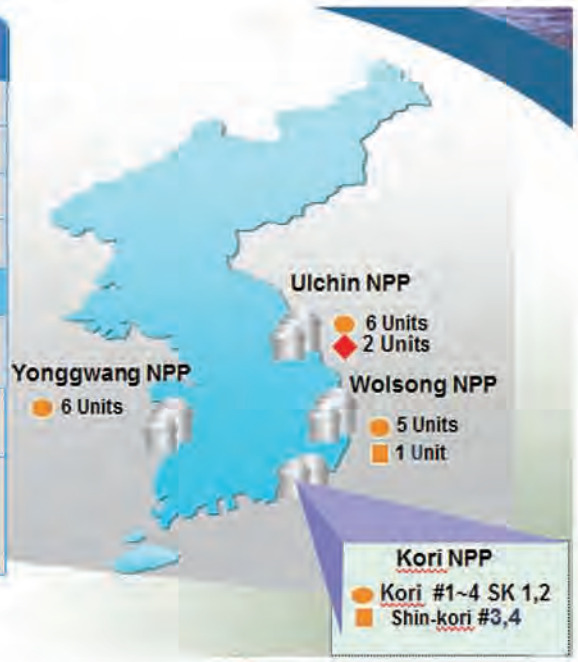
Busan city, KOREA

KHNP
KOREA HYDRO & NUCLEAR POWER CO., LTD

1 Introduction

Korea Hydro and Nuclear Power Co. has 23 units operating (8 WEC type PWR + 11 OPR1000 PWR + 4 CANDU PHWR), providing approximately 30% of the total domestic electric power supply, 5 units (1 OPR1000 + 4 APR1400) under construction.

Classification		Unit	Capacity (MWe)
In Operation	Kori	6	5,137
	Yonggwang	6	5,900
	Wolsong	5	3,779
	Ulchin	6	5,900
Sub-Total		23	20,716
Under Construction	Shin-Kori #3,4	2	2,400
	Shin-Wolsong #2	1	1,000
In Prep. for Construction	Shin-Ulchin #1,2	2	2,800



[NPP sites in Republic Of Korea]

Kori nuclear unit 1 is the first reactor built in Korea nuclear history. It commenced the operation since 1977. After 30 year operation, the licensed design life time was expired, the license renewal was introduced since 2007. It has shown excellent operational performance with 587 MWe capacity. WEC designed Kori 1 accommodates 121 fuel assemblies in the reactor, amount to 43 MTU. In addition, in last August, the EDG, the reactor head and the main control board were replaced to extend the life time and enhance the reliability of critical equipment.

Kori 1 NPP history

- May 1972 : Construction Permit (CP) and Operating License (OL) issued
- Jun 1977 : Initial Criticality
- Jun 1977 : First grid synchronization
- Apr 1978 : Commercial operation
- Jun 1997 : Rotor of LP turbine replaced
- Sep 1998 : SGs and process control/protection system replaced
- Oct 2001 : Main transformer replaced
- Dec 2007 : License renewal for continued operation till 2017

The first ever IAEA Operational Safety Review Team (OSART) mission was conducted at Kori NPP in 1983. The IAEA Safe Long Term Operation Mission (SALTO) was conducted at Kori 1 NPP in July 2007 prior to the license renewal.

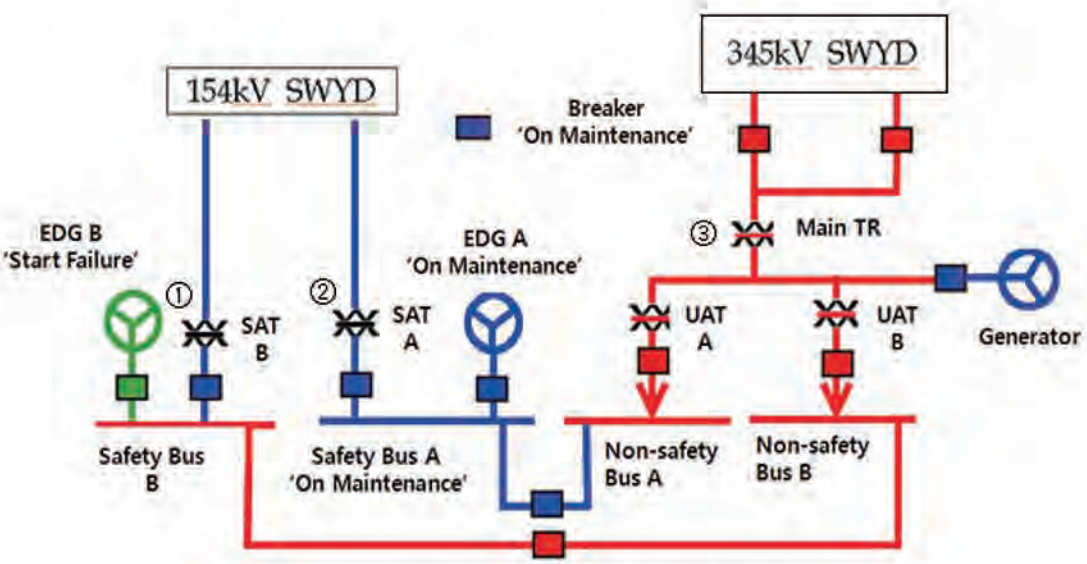
[Bird's eye view of the Kori site]

1.2 Key parameters

Reactor type	PWR, two loops
Net electrical output (MWe)	610 MWe
Thermal power output (MWth)	1,723 MWth
Site design earthquake	0.2 g
Number of off-site power supplies	2
Number of high-voltage buses for on-site power supplies	2
Number of diesel generators, voltage, capacity	2/ 4.16kV/2,920kW
Other on-site backup power supplies	1
AAC D/G /4.16kV/5,500kW	
Emergency Core Cooling	
a. High pressure injection	
Number of trains	2
Number and type of pumps	2 Electrical, Centrifugal
b. Low pressure injection (RHR)	
Number of trains	2
Number and type of pumps	2 Electrical, Centrifugal

2 Event summary

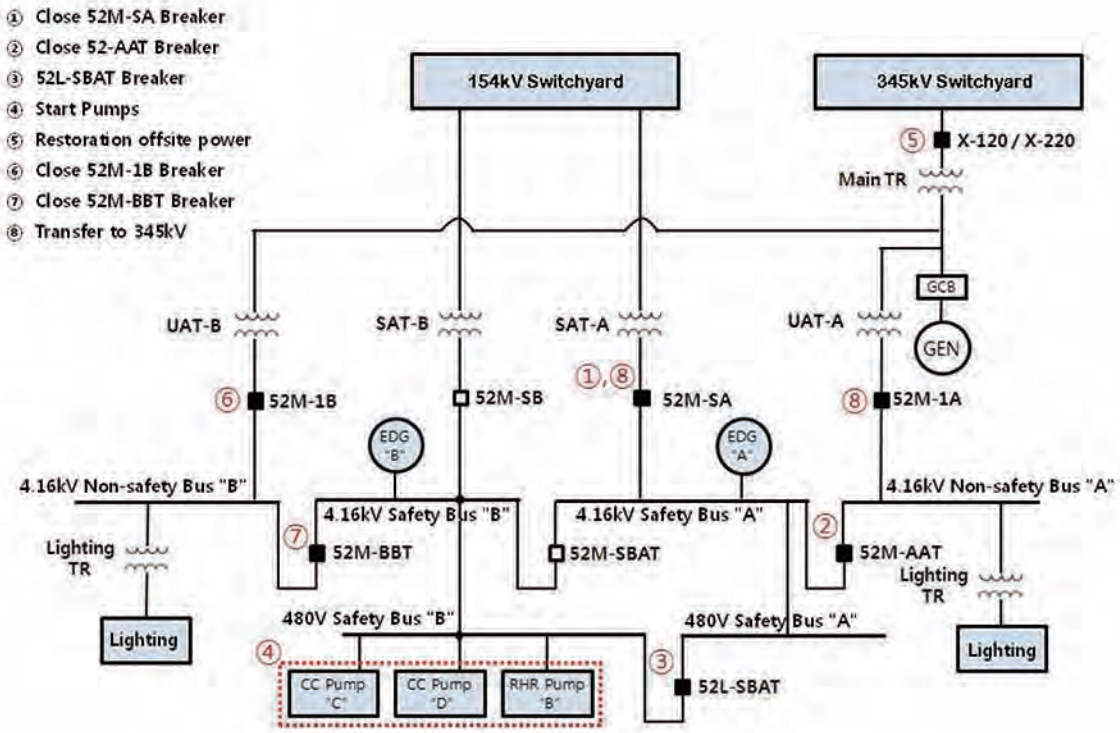
On February 9 2012, during the 29th refueling outage of Kori 1, loss of off-site power occurred and emergency diesel generator B failed to start while EDG A was out of service for scheduled maintenance, resulting in a station blackout.



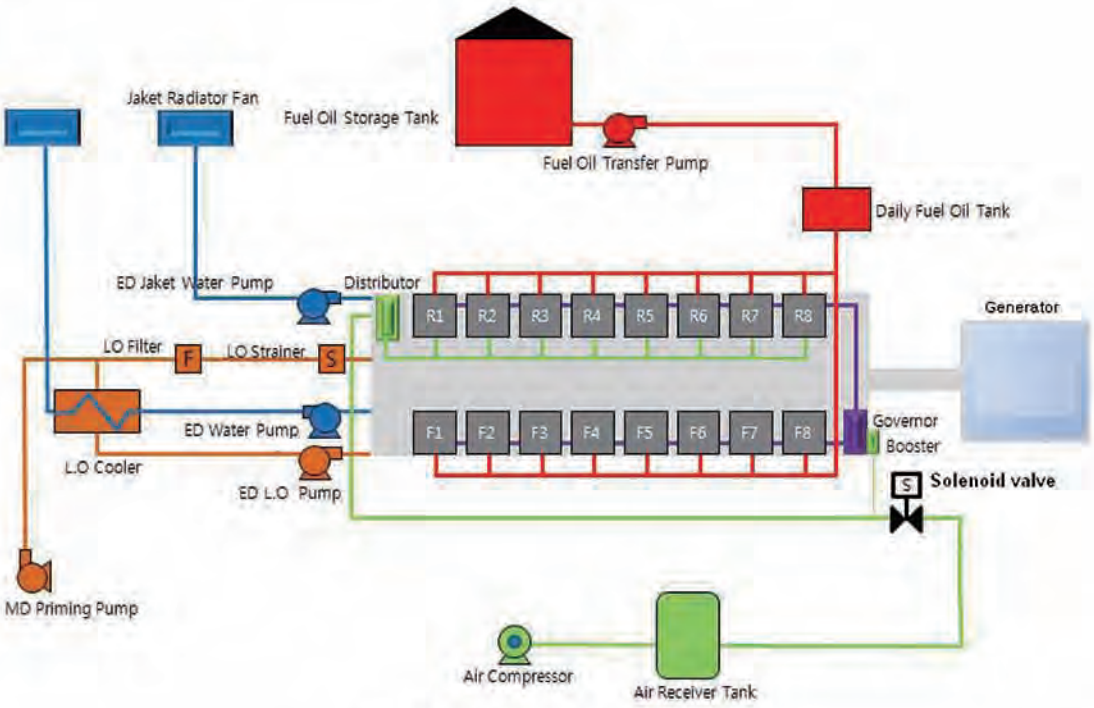
[Electric switchgear configuration before SBO event]

Three (3) power sources were available at the time of the event, one offsite power (③ 345kV) via main transformer, EDG "B", and AAC D/G. Two standby offsite power sources (①, ②, 154kV) were isolated for planned maintenance. Operating offsite power (③) was terminated in course of the generator protective relay test resulting in loss of offsite power (LOOP). Operating one (1) offsite power source (③) was terminated because of subcontractor's incorrect manipulation of generator protective relay test equipment (human error). EDG-A was under maintenance, EDG-B failed to start on an automatic demand signal and resulting in a loss of all AC power. The SBO led the loss of RCS shutdown cooling and spent fuel pool cooling.

In response to the SBO, the MCR operators restored the electrical power by connecting to SAT 'A' rather than to AAC DG (in stand-by state and in arrangement with Kori Unit-4), and subsequently restored the power supply to the RHR pump 'B' in accordance with the procedure by establishing cross-tie of 480V bus 'A' with 480 bus 'B' because RHR 'A' was under maintenance. One (1) offsite power source (①) which had been under maintenance condition was restored and powered to the assigned Class 1E bus after 11 minutes 43 seconds. The shutdown cooling was lost for 19 minutes. At the moment when the SBO occurred, all the fuels were still in the reactor with the reactor head removed from the reactor and the reactor cavity was flooded. As a result of the event, the reactor coolant maximum temperature in the hot leg increased from 37℃ to 58. 3 ℃ (approximately 21.3℃ increase) and the temperature of spent fuel pool was increased slightly from 21℃ to 21.5℃.



[Restoration sequence]



[EDG starting air supply line schematic]

No fuel damage was identified based on RCS I-131 activity analysis and thermal hydraulic audit calculation by regulatory investigation team.

3 Prompt actions and decisions for the moment

The plant manager and his staff in control room decided not to report SBO. The plant manager opted to hide this event due to heavy feeling of a burden to preempt public critics and a fear of worsening the plant management' s credibility. This event occurred at the time when the antinuclear sentiment was rampant since Fukushima Daiichi nuclear disaster swept world nuclear industry a year ago. And the same day as the SBO occurred, the CEO of the KHNP announced the action plan to operate the nuclear power plants with the government and made a promise without events in front of the mass media and had the interview with the reporters.

There was no adverse effect on plant safety as a result of SBO, no radiation exposure to the workers and no release of radioactive materials to the environment. However, inconsistent with the requirements, Kori 1 did not report the SBO event in accordance with the plant emergency plan.

After this concealment was leaked out to the public, the impact to the society was colossal. The plant was immediately ordered to do shutdown by NSSC. KHNP requested IAEA to conduct the expert mission last year. The plant was shut down for 5 months with nothing from the negative influence of the public. And the regulatory body did not approve the plant startup until the enhancement plan of the safety culture were drawn

One of the ways to show the safety was thought to get the inspection from the independent nuclear expert institute and show the inspection result to the public including the local community and the environment group. In order to regain public trust and recover the tarnished reputation, it was necessary to improve the safety culture through both its structure and mindset renovation. IAEA EM was thought to be the only way. IAEA EM was very helpful to restart the reactor.

From the concealment event, five employees including the plant manager were indicted on charges of the concealment. One of them was sentenced to one year in prison and fines. Personally, the presenter, myself, was also interrogated from the prosecutor as a suspicious man proceeding the core alteration with not being EDG operable. Unfortunately, at the time of event, I was not reported of being EDG not in operable from the MCR operator. Anyway, it is shame of me. I was ruled innocent.

Following is the brief milestone of the 29th core cycle which the SBO event was involved. Almost one year was shutdown.

- Feb 4 2012 Shutdown for refueling outage
- Feb 9 20:34 2012 SBO occurred
- Mar 4 2012 Reactor criticality for cycle 29
- Mar 9 2012 SBO leaked, one(1) month after the event occurred
- Mar 13 2012 Forced shut down, 9 days after the reactor startup
- June 4 ~June 11 IAEA EM
- Aug 10 2012 Plant restart, 5 month after the forced shutdown
- Apr 12 2013 Plant shut down for the major compartments replacement
- Sep 11 2013 Scheduled plant startup
- Sep 29 2013 Reactor criticality, 18 days after the scheduled startup
- Feb 12 2014 Refueling outage(Schedule)

4 Contributing causes

4.1 Station Black Out (SBO)

Direct cause (why it happened): Mis-operation of the protective relays of the main generator
Contributing causes/broken barriers:

- Scarcity of contractors qualified for test of generator protection system – this was the reason for rescheduling the test, because of time pressure for the available contractors to move to next work site
- Rescheduling the generator protection system test bypassing established process (to be approved by Outage Control Centre), this resulted in lack of additional risk analysis for the unusual lineup for the test
- Maintenance of SAT B was started although SAT A was not returned to operation, this resulted elevated shutdown
- Design: single solenoid valve for startup air for DG. Corrective action: As a part of a root cause analysis of the SBO event the plant should extend conditions of the EDG-B solenoid valve failure and perform analyses of other plant's equipment and systems important to safety to identify and manage critical parts and components and its vulnerabilities (similar to EDG-B solenoid valve), to avoid repeat events.
- Maintenance: no complete preventive maintenance, 'lost' rubber cap was replaced by a plastic cover not providing proper protection
- Human error of communication: supervisor instructed "do not proceed to next step", worker activated next channel during generator protection test
- Human factor: overconfidence of worker due to long experience with this test
- Procedure: preconditions, potential risk and consequence of error not described; no requirement to sign off completed steps
- Pre-job brief was performed one day before the test, although "it should be used as means of avoiding personal errors, difficulties in communication and misunderstandings"

4.2 Not reporting SBO including not declaring Emergency Action Level "Alert"

Direct cause (why it happened)
: Kori 1 plant manager and other staff decided not to report SBO

- Contributing causes/broken barriers:
- Reputation risk: That time plant manager stated he decided to hide this event due to heavy feelings of a burden to preempt public critics and a fear of worsening the plant's credibility
- Decrease of public trust in Kori 1 NPP associated with Fukushima accident, reactor trip at Kori 1 in April 2011 and two cases of corruption related to supply of spare parts for Kori 3 and 4
- Undue pressure from KHNP to operate without events
- The prevailing high respect for authority of supervisor prevented other staff involved to disagree with plant manager, although several elements of safety policy and administrative procedures were violated
- Kori 1 safety culture survey from May 2012 indicates that:

o Relatively few (only 23.2%) of plant staff provided positive response to whether "safety culture is regarded as the most overriding priority in performing any activity"
o Relatively few (only 19.5%) of plant staff provided positive response to whether "business environment that put an importance on the safety is created"

4.3 Violation of Technical Specifications

The plant Technical Specifications were violated by

a) not immediately starting to take action to restore EDG to operable condition by the afternoon shift on 9 February;

b) starting of fuel movement with no operable EDGs by the afternoon shift 10 February (in fact the same shift was on duty on the two occasions).

Direct cause (why it happened): EDG B was not declared inoperable as a part of ignoring the previous SBO

Contributing causes/broken barriers:

Decision of Kori 1 plant manager not to report SBO

Other involved staff did not oppose/disagree with plant manager' s decision, although several elements of safety policy and administrative procedures required that action

Incoming night shift failed to identify status change (increase of primary coolant temperature on chart recorder, alarm of "RHR flow low" and "RHR trip" on the alarm printer); although relevant checks are required in general, but detailed checklist does not exist

Kori 1 internal oversight failed to identify SBO event

NSSC/KINS inspectors failed to identify SBO event

4.4 Some aspects of Korean Culture

The Korean national culture attributes of respect for elders and superiors came to have significance. The strength of this cultural attribute is that compliance with line manager' s requirement and expectations is good but puts a reliance and greater responsibility onto the leader to show an exceptionally good code of conduct, standards and leading the team to excellence. This attribute also has an implied effect on 'questioning attitude' which needs to be accommodated to ensure that this safety culture characteristic is working inside KHNP. Where a line manager chooses to work outside policy and procedures there may not be an acceptable cultural route for a worker to raise a question.

A cultural aspect of 'working hard and fitting as much activity into the time as possible' emerged. The strength of this characteristic is that managers can use the Korean work ethic to complete tasks efficiently and quickly, however the difficulty with the characteristic is that detail and systematic completion may be compromised. 'Check lists' and quality/procedural 'hold points' that are used extensively at the site could help counter the problem.

4.5 Contributing causes/broken barriers to the SBO event

Wider Cultural influences leading to behavior:

- High respect for authority of supervisor prevented other staff involved to disagree with plant manager, although several elements of safety policy and administrative procedures would require that the plant blackout was a situation that required onward reporting and initiation at the time of a readiness emergency arrangement response.
- Decrease of public trust in Kori 1 NPP associated with Fukushima accident, reactor trip at Kori 1 in April 2011 and two cases of corruption related to supply of spare parts for Kori 3 and 4 Internal Kori cultural influences
- Reputation risk: At that time the plant manager stated he decided to hide this event due to heavy feelings of burden to preempt public critics and a fear of worsening the plant's public credibility

• Undue pressure from KHNP to operate without events, the performance oriented mission as OCTF(One Cycle Trouble Free)

In a subsequent Safety Culture survey at Kori 1, the results supported the view that the Kori 1 workforce and managers felt that business priorities are put ahead of the safety priorities.

What kind of culture was immersed in Kori 1 management so that management thought to not report, and which actions have been taken to improve the safety culture was discussed. That high respect of authority and seniority which is rampant in Korea culture and led to the concealment was pointed out by IAEA EM. 22 actions have been employed so far to enhance the safety including internal and external oversight organization, remote plant monitoring system around clock, multiple off-site power source etc. The anonymous reporting scheme for employee concerns has also been introduced. Other than these software improvements, number of major equipments have been replaced to enhance the reliability. Unfortunately, once the trust was lost, it is not easy to recover it from the public. The public doesn' t like to trust Kori 1 although KHNP paid a lot of efforts to enhance the safety. Only their demand is to shut down the reactor. IAEA expert mission played the critical role to restart the reactor last year after 5 month shutdown. As one of the management at Kori 1 when these activities was implementing, I want to share this resources with participants including the interrogation from the prosecutor after being accused of by NSSC.

5 What has been employed to enhance the safety

5.1 The reporting system improvement

- Why : SBO concealment at the Kori 1 management was possible due to only one line reporting system in working which the plant manager can seizure all information flow
- How to improve : Introduce the multiple oversight and reporting system, in a way the concealment cannot be rooted in operating structure

No	item	Description
1	Remote oversight and automatic alerting system, software system	- Remote online monitoring system for plant operation parameters oversight during the startup and shutdown : In Seoul office, all plants can be oversighted - NEWS, Nuclear Event Warning System It is newly designed to send the major alarms to the nuclear related reporting line in KHNP job site, KHNP Seoul office, KINS, NSSC residency office, NSSC head office. Major alarms are consisted of the reactor trip, Safety injection, Loss of Voltage, Radiation high alarm, natural disaster etc - This system is equipped with the UPS
2	Independent safety supervisory organization	- New independent safety oversight organization - 4 shift work, assigned 6 at each site - Round the main control room, major equipment and safety related surveillance and maintenance. - Reporting the safety concerns to Seoul office directly, independent from the plant manager, check the decision made at the plant.
3	Monitoring with the CCTV	- Safety oversight staff are newly allowed to oversight the plant in remote with 64 CCTVs which were already installed at job site
4	Nuclear operation status website opened to the public	- Nuclear operation parameters are opened on real time basis - Significant issues/resolutions are posted

5.2 Safety culture proliferation in-depth

- Why : To root out the view that the business priorities are still put ahead of the safety priorities, and proliferate the safety culture in all areas
- How to improve : Draw the findings to be improved, consulting from the outside safety experts and implement the appropriate following actions, but should be tangible
- Basic philosophy : Safety is a recognized value, Leadership for safety, Questioning attitude, Safety is learning driven, Safety in integrated into all activities and communication, rigorous approach

No	item	Description
5	Draw the findings to be improved and implement the following actions	- Consulting from the outside safety culture experts ✓ Excellons, 7 areas including diagnosing leadership of executive, CEO, corporation mission and vision and safety culture policy at the corporation level ✓ National safety culture reviewers, 13 from industry, university. 5 findings were made - 12 actions have been implemented at the plant level - Safety dialogue between plant manager and each employee - Anonymous reporting mail box system for irrational safety culture to be improved - Team based meeting to enhance the safety communication - Safety culture message proliferation during the meeting every morning - Safety culture meeting between KHNP and the contractor - Speak loudly the safety slogan every morning, shift turnover, pre-job briefing - Rewards to the employee, contributed to the safety culture - Special lecture on safety culture - Training program participation for safety culture
6	IAEA review for safety culture area	- 6 improvement proposals for safety culture were advised and its resolutions are being implemented
7	Revise the safety indicator	- The effort factor of safety culture enhancement is emphasized to evaluate the individual evaluation and management performance - Safety attitude is a significant factor in approving a promotion

5.3 Enhancement of power supply system reliability

- Why : Power supply system was designed, manufactured in 1970s. More offsite power lines are thought to be needed. The system is vulnerable to triggering the LOV while doing the maintenance.
- How to improve : Preparing the maintenance schedule to avoid any fault and Replacing the major components with new ones

No	item	Description
8	Enhance offsite power stability by adding more 345 KV transmission line	- Offsite transmission line enlarged to 6 from the previous 2 lines
9	Reinforce the supervising activity during power line test	- Categorized the work unit which can be caused to LOV, 119 items were drawn
10	Deploy additional portable diesel generator	- One 4.16 KV, 3,200KW EDG deployed for each site
11	Duplicate the starting air system in the EDG	- The redundancy air supply system was introduced
12	Perform special test and inspection on all operating plant's EDG's	- Completed
13	Replace Kori 1 EDG with new one	- 2,920kWe → 3,500 kWe - 2 EDGs were replaced

5.4 Refueling outage activities improvement

- Why : Refueling outage activities has been more targeted to shorten the maintenance hours than safety first management
- How to improve : Separation and serial work scheduling of the activities which are vulnerable to LOV

No	item	Description
14	Simplified the stand-by transformer maintenance schedule	- To prevent the SBO occurring fundamentally, the maintenance of stand-by transformer is scheduled one by one, not by overlapped - The potential work item vulnerable to triggering the LOV is separated from each other, no overlapped
15	Extending the refueling outage schedule	- Allotting more time to secure the safety - 1 or 2 days more
16	Intervene the maintenance expertise of the contract	- Workmanship - Safety culture

5.5 At the corporation level

- To educate the qualified RO/SRO candidates
- To train the operators using the simulator in preparation for the emergency as SBO
- To review the 880 operational procedures and revise them
- To add the more manpower for the area of operation and maintenance
- To inspect the EDGs at all operating plants
- To replace the major components for over 20 year operation plants

5.6 At the regulatory body level

- To add the safety culture as the regulatory inspection item
- To enlarge the inspectors in residence

2 卓越核安全文化八大原则

卓越核安全文化八大原则

《卓越核安全文化的八大原则》是WANO2006年发布的文件，该文件对WANO以前发布文件进行了补充。文件中的相关概念与WANO的其它相关文件（如《有效运行决策的原则》（WANO GL 2002-01）、《卓越人员绩效原则》（WANO GL 2002-02）、《有效的自我评估和纠正行动计划的原则》（WANO GL 2002-07）。）保持了一致

本文件描述了健康的核安全文化（以下简称“安全文化”）的重要特征，目的是为全世界核电行业创建一个公开讨论和持续提升安全文化的框架，本导则所描述的原则和相关特征都以核电厂事件为基础。

本导则仅陈述基本原则，而不是制定一个具体的大纲或实施办法。如果很好地采用这些原则和特征，将会促进核电厂价值观、假设、经验、行为、观念和规范等方面的完善。

本导则鼓励核电厂经理将日常规定和做法同这些原则进行深入的比较，利用它们之间的差异作为改进的依据。

本文件描述了以下八项原则：

1. 核安全人人有责
2. 领导做安全的表率
3. 建立组织内部的高度信任
4. 决策体现安全第一
5. 认识核技术的特殊性和独特性
6. 培育质疑的态度
7. 倡导学习型组织
8. 评估和监督活动常态化

原则及其特征

1、核安全人人有责

明确界定核安全的责任与权利，并让全体人员清楚自己的责任和权利。落实与核安全责任相关的指挥体系、岗位权限、人员配备和资金保障。公司政策中强调核安全高于一切。

特征：

- 规定从董事会成员到每个员工的核安全责任及权限，每个岗位都以书面的形式对其任务、职责和权限做出规定，并为在岗人员所理解。
- 非生产直接相关的部门也应明白它们在核安全管理中的作用。
- 员工及其专业能力、价值观和经验应被视为核电厂最宝贵的资源。人员配备水平应与维持核电厂安全可靠运行的需求相一致。
- 董事会成员和公司领导采取措施定期强化核安全，包括现场巡视，以便直接评估核安全管理的有效性。
- 从总经理开始的指挥管理体系是核电厂唯一的指挥渠道。来自指挥体系之外的建议不能淡化或转移指挥体系的权力和责任。
- 所有员工认识到遵守核安全标准的重要性。各级组织对未能达到标准的领域负相应的责任。
- 核电厂与各上级部门之间的关系不得模糊或削弱核安全责任的界限。
- 奖惩制度不但要与核安全政策的关注重点一致，同时还应能不断强化期望的行为和业绩。

2、领导做安全的表率

高层领导和高级管理者是核安全的主要倡导者，应重视言传身教，要经常不断地、始终如一地宣贯核安全第一的理念。

特征：

- 经理和主管的作用体现在通过现场关注问题，指导、监督和强化标准，及时纠正偏离电站期望值的行为等方面。
- 管理层在理解和分析问题时考虑员工的观点。
- 经理和主管应适当监督与安全相关的重要试验和活动。
- 经理和主管参与高质量的培训，始终如一地强化期望的员工行为。
- 管理层认识到，如果沟通不当，生产目标可能会对核安全重要性发出误导信息。他们要敏锐地察觉和避免这样的误解。
- 把重要运行决策的依据、预期的后果、潜在的问题、应急预案以及行动中止的准则及时传达给员工。
- 鼓励企业内有较大影响力的资深员工在安全方面作出表率并影响同行去达到同样的高标准。
- 选择和评价经理和主管时，要考察他们推进卓越核安全文化的能力。

3、建立组织内部的高度信任

在组织内建立高度的信任，通过及时准确的沟通来培育这种信任，有畅通的信息流程来提出和处理问题，对员工提出问题所采取的措施要告知员工。

特征：

- 尊重员工的人格和尊严。
- 员工可以提出核安全方面的问题，不必害怕惩罚，相信所提的问题会得到回应。
- 期望和鼓励员工提出新思路来帮助解决问题。
- 欢迎和尊重不同的意见，必要时，用公平和客观的方法来解决冲突。
- 主管善于以坦诚开放的方式应对员工的问题，这是一个管理团队的重要组成部分，这对于用安全文化来促进团队关系是至关重要的。
- 预见和管理即将发生的变革，确保维持组织内部的信任。
- 针对高级管理层的激励机制侧重于反映核电厂长期业绩和安全。
- 向监督、审查和监管机构提供的信息完整、准确和及时。
- 作为建立信任和强化良好安全文化的一种方式，管理人员定期与员工沟通重要决策及其决策的依据，并定期了解员工的理解程度。

4、决策体现安全第一

员工在做出支持核电厂安全、可靠运行的决策时，经过系统和严格的考虑。操纵员得到充分的授权并了解安全期望值，当面临突发或不确定工况时，将核电厂置于安全状态。高级管理层支持和强化保守决策。

特征：

- 核电厂拥有一支有丰富学识和经验的员工队伍，以支持各类运行和技术决策。必要时聘请外部专家。
- 经理、主管及员工清楚地理解和尊重各方在决策中的作用。
- 核电厂员工采取严格的步骤来解决问题，在不完全理解时采取保守决策。
- 针对重要安全事项的决策，指定专人负责，以对决策的执行情况进行连续的跟踪和反馈。
- 讨论安全问题时，鼓励公开对话和讨论。
- 保守决策时应具备辨识“可接受的选择”和“慎重的选择”的能力。
- 当情况发生变化时，应重新评价原决策和相关的基本假设，以提高今后的决策水平。

5、认识核技术的特殊性。

所有的决策和行动都要考虑核技术的特殊性。反应性控制、持续堆芯冷却、核裂变产物屏障的完整性是核电厂有别于其它的重要特性。

特征：

- 实施可能引起堆芯反应性变化的活动时应格外谨慎。
- 对专设安全设施功能的维持给予特别关注。
- 严守设计和运行的安全裕度，只有慎重考虑后方可改变。特别关注维持裂变产物屏障的完整性和纵深防御的功能。
- 精心维护设备，使其性能在设计要求范围内。
- 核电厂的日常活动和变更要考虑概率风险分析的结论。
- 核电厂活动受全面的高质量的过程和程序控制。
- 员工熟练掌握适合于工作岗位的反应堆及核电厂的基础知识，为可靠决策和良好行为打下坚实的基础。

6、培育质疑的态度

通过质疑假设、分析异常工况、思考行动的潜在不利后果，员工表现出质疑的态度。事故的产生往往来自于，由于组织根据错误的假设、价值和信念，所采取的一系列决策和行动。员工要对可能给核电厂安全产生不利后果的状态或活动提高警惕。

特征：

- 员工希望每天的工作有圆满结果，但他们同时也应认识到犯错误和出现最 坏情况的可能性，因此应有应急预案来应对这些可能性。
- 识别异常工况、深入调查、及时缓解并定期进行分析总结。
- 在面对不确定性事件时，员工应停止继续操作。
- 员工能够识别可能降低运行或设计裕度的工况或行为，并及时解决问题。
- 员工认识到复杂技术可能以不可预见的方式而失效，并作出保守决策。
- 通过思维的多元化来避免群体思维，鼓励和重视不同的意见。

7、倡导学习型组织

高度重视运行经验，培育学习和应用经验的能力。通过培训、自我评估、纠正行动和对标，来激励学习和提高业绩。

特征：

- 组织要避免自满，培养不断学习的氛围，着重培育“事件可能在这里发生”的意识。
- 通过培训加强宣贯管理标准和期望。除了传授知识和技能外，教员还要善于灌输核安全相关的价值观和理念。
- 员工能从行业和其它核电厂的重大事件中获得基本的经验教训，并承诺不再重犯类似错误。
- 有效地使用根本原因分析方法，对事件进行分析，制定纠正行动计划并加以落实。
- 制定程序来识别和解决组织体系中存在的可能弱项，避免事件的扩大。
- 员工相信涉及核安全的问题必将得到持续的关注和解决。

8、评估和监督活动常态化

采用监督手段来强化安全和提升业绩。通过各种监督方法对核安全进行常态化的监督和检查。

特征：

- 自我评估和独立的监督相结合是一种综合平衡的方法。这种平衡需定期审查和调整。
- 实施定期的核安全文化评估，以此做为改进的基础。
- 组织认识到仅专注片面的业绩指标是不够的，还要关注识别那些可能预示业绩下滑的指标并做出响应。
- 重视各方面人员（包括质保人员、评估人员、独立监督人员和普通员工等）提出的意见和建议。
- 定期向高层管理人员和董事会成员汇报监督结果，以使他们深入了解核电厂的安全业绩。

3 健康的核安全文化特征

健康的核安全文化特征

《健康的核安全文化特性》（Traits of a Healthy Nuclear Safety Culture GL 2013-1）是世界核电运营者协会（WANO）在2013年5月发布的文件，其主要内容介绍了WANO此前发布的《卓越核安全文化八大原则》（GL 2006-2）及国际原子能机构（IAEA）发布的安全文化特征与之的关系以及各特性之间的交叉引用。

本导则有助于理解各机构发布的多个版次安全文化导则的共同点，以及如何在安全文化领域发挥重要作用。本文中文译文仅供参考。

0 Introduction 简介

This Addendum II, Cross-References, provides cross-references from WANO principle PL 2013-1 Traits of a Healthy Nuclear Safety Culture, to the previous GL 2006-2 Principles for a Strong Nuclear Safety Culture and the International Atomic Energy Agency safety culture attributes. This cross-reference can help in understanding how the common language was developed and can be useful in change management efforts in this important area. For convenience, the bulleted attributes in the Principles for a Strong Nuclear Safety Culture were annotated with a letter in this cross-reference. For example, use Table 4 to identify that the original principle 4.C.a, "Plant personnel apply a rigorous approach to problem-solving", is captured in the attribute PI.3, "Resolution: The organisation takes effective corrective actions to address issues in a timely manner commensurate with their safety significance".

附录II中为WANO准则"PL 2013-1 健康的核安全文化特性"、早前的"GL 2006-2 强有力的核安全文化准则"以及国际原子能机构（IAEA）的安全文化特征提供交叉引用。该交叉引用有助于理解共同语言是如何开发的，以及它如何在对该重要领域进行变革管理时发挥作用的。为了方便起见，在本交叉引用中，使用字母对"卓越核安全文化八大原则"中强调标出的特性做了注解。例如，使用表4来说明原准则4.C.a（即"工厂人员使用缜密的方法解决问题"）在特性PI.3（即"解决方法：根据安全问题的重要性，单位及时采取有效的纠正措施来解决问题"）中得到了表现。

Table 1: WANO Principles to Traits 表1： WANO准则-特性

WANO Principle WANO准则	**Trait 特性**
Everyone is personally responsible for nuclear safety. 核安全人人有责。	Personal Accountability 个人的义务
Leaders demonstrate commitment to safety. 领导做安全的表率。	Leadership Accountability 领导的义务
Trust permeates the organisation. 建立组织内部的高度信任。	Safety Communication 安全交流
	Respectful Work Environment 互敬礼貌的工作环境
	Environment for Raising Concerns 提出顾虑的环境
Decision-making reflects safety first. 决策体现安全第一。	Decision-Making 决策
Nuclear technology is recognised as special and unique. 认识核技术的特殊性和独特性。	Work Processes 工作流程
A questioning attitude is cultivated. 培育质疑的态度。	Questioning Attitude 质疑的态度
Organisational learning is cultivated. 倡导学习型组织。	Continuous Learning 持续学习
	Problem Identification and Resolution 识别并解决问题
Nuclear safety undergoes constant examination. 评估和监督活动常态化。	Continuous Learning 持续学习
Problem Identification and Resolution 识别并解决问题	

Table 2: WANO Principles to Traits 表2： WANO准则-特性

Trait 特性	**WANO Principle WANO准则**
Personal Accountability 个人的义务	Everyone is personally responsible for nuclear safety. 核安全人人有责。
Questioning Attitude 质疑的态度	A questioning attitude is cultivated. 培育质疑的态度。
Safety Communication 安全交流	Leaders demonstrate commitment to safety. 领导做安全的表率。
Leadership Accountability 领导的义务	Leaders demonstrate commitment to safety. 领导做安全的表率。
Decision-Making 决策	Decision-making reflects safety first. 决策体现安全第一。
Respectful Work Environment 互敬礼貌的工作环境	Trust permeates the organisation. 建立组织内部的高度信任。
Continuous Learning 持续学习	Organisational learning is cultivated. 倡导学习型组织。
	Nuclear safety undergoes constant examination. 评估和监督活动常态化。
Problem Identification and Resolution 识别与解决问题	Organisational learning is cultivated. 倡导学习型组织。
Environment for Raising Concerns 提出顾虑的环境	Trust permeates the organisation. 建立组织内部的高度信任。
Work Processes 工作流程	Nuclear technology is recognised as special and unique. 认识核技术的特殊性和独特性。

Table 3: Traits to WANO Principles 表3：特性-WANO准则

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
PA.	Personal Accountability – All individuals take personal responsibility for safety. Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority and team responsibilities emphasise the overriding importance of nuclear safety. 个人的义务：所有的人都将承担安全责任，明确界定并清楚理解核安全的责任和权限。汇报关系、职务授权以及团队责任都将强调核安全是重中之重。			
	PA.1	Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organisation exercise accountability for shortfalls in meeting standards. 标准：个人应理解遵守核标准的重要性，各级组织若未能达到标准应负责任。	1F	All personnel understand the importance of adherence to nuclear safety standards. All levels of the organisation exercise healthy accountability for shortfalls in meeting standards. 所有员工认识到遵守核安全标准的重要性。各级组织对未能达到标准的领域负相应的责任。
			3H	Complete, accurate and forthright information is provided to oversight, audit and regulatory organisations. 向监督、审查和监管机构提供完整、准确和及时的信息。
	PA.2	Job Ownership: Individuals understand and demonstrate personal responsibility for the behaviours and work practices that support nuclear safety. 主人翁精神：每个员工需要理解并在维护核安全的行为和工作实践中展现个人责任感。	1B	Support groups, such as human resources, labour relations, and business and financial planning, also understand their roles in contributing to nuclear safety. 非生产直接相关的部门也应明白它们在核安全管理中的作用。
	PA.3	Teamwork: Individuals and work groups communicate and coordinate their activities within and across organisational boundaries to ensure nuclear safety is maintained. 团队合作：个人及工作组相互交流合作且不应以组织为界限来确保核安全。	4Ea	Candid dialogue and debate are encouraged when safety issues are being evaluated. 讨论安全问题时，鼓励公开对话和讨论。
QA.	Questioning Attitude – Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies and activities to identify discrepancies that might result in errors or inappropriate actions. All employees are watchful for assumptions, values, conditions or activities that can have an undesirable effect on plant safety. 质疑的态度：个人应避免自满，不断挑战现有条件、假定、异常情况和行为，从而识别出可能导致失误或不当行为的差异。对于给电厂带来不良影响的假定、标准、条件或行为，所有员工都应保持警惕。			
	QA.1	Nuclear Is Recognised as Special and Unique: Individuals understand that complex technologies can fail in unpredictable ways. 认同核技术的特殊性和独特性：个人应认识到，复杂的技术或许会带来出乎意料的故障。	N/A	
	QA.2	Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. 挑战未知：遇到不确定工况时，个人应停止工作。继续工作前，应进行风险评估和管理。	6A	While individuals expect successful outcomes of daily activities, they recognise the possibility of mistakes and worst-case scenarios. Contingencies are developed to deal with these possibilities. 员工希望每天的工作有圆满结果，但他们同时也应认识到犯错误和出现最坏情况的可能性，因此应有应急预案来应对这些可能性。
			6C	Personnel do not proceed in the face of uncertainty. 在面对不确定性事件时，员工应停止继续操作。
			6E	Employees understand that complex technologies can fail in unpredicted ways. They are aware that latent problems can exist, and they make conservative decisions considering this potential. 员工认识到复杂技术可能以不可预见的方式而失效，并作出保守决策。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
	QA.3	Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they believe something is not correct. 挑战假设：员工遇到他们认为不正确的事时，应挑战先前假设并提出对立观点。	6F	Group-think is avoided through diversity of thought and intellectual curiosity. Opposing views are encouraged and considered. 通过思维的多元化来避免群体思维，鼓励和重视不同的意见。
	QA.4	Avoid Complacency: Individuals recognise and plan for the possibility of mistakes, latent issues and inherent risk, even while expecting successful outcomes. 避免自满情绪： 尽管预期会取得成功的结果，但个人应该承认可能出现的错误、潜在问题和固有风险并做出应对计划。	N/A	
CO.	Safety Communication – Communications maintain a focus on safety. Safety communication is broad and includes plant-level communication, job-related communication, worker-level communication, equipment labelling, operating experience and documentation. Leaders use formal and informal communication to convey the importance of safety. The flow of information up the organisation is viewed as just as important as the flow of information down the organisation. 安全沟通：沟通保持了对安全的关注。安全沟通的范围很广，包括电厂级沟通、工作相关沟通、员工级沟通、设备标识、运行经验以及记录。领导应使用正式和非正式沟通来传达安全的重要性。组织中上下信息的流通同样重要。			
	CO.1	Work Process Communications: Individuals incorporate safety communications in work activities. 工作过程沟通：个人应将安全沟通纳入工作活动中。	N/A	
	CO.2	Bases for Decisions: Leaders ensure that the bases for operational and organisational decisions are communicated in a timely manner. 决策依据：领导应确保就运行决策和组织决策的依据及时地进行交流。	2F	The bases, expected outcomes, potential problems, planned contingencies and abort criteria for important operational decisions are communicated promptly to workers. 把重要运行决策的依据、预期的后果、潜在的问题、应急预案以及行动中止的准则及时传达给员工。
			3I	Managers regularly communicate to the workforce important decisions and their bases, as a way of building trust and reinforcing a healthy safety culture. Worker understanding is periodically checked. 作为建立信任和强化良好安全文化的一种方式，管理人员定期与员工沟通重要决策及其决策的依据，并定期了解员工的理解程度。
	CO.3	Free Flow of Information: Individuals communicate openly and candidly, both up, down and across the organisation, and with oversight, audit and regulatory organisations. 信息自由流通：个人在整个组织内可自由坦诚地与上下级以及监督、审核和监管机构沟通。	N/A	
	CO.4	Expectations: Leaders frequently communicate and reinforce the expectation that nuclear safety is the organisation's overriding priority. 期望：领导应经常地传递和强化核安全是组织的第一要务的期望。	2E	Leaders recognise that production goals, if not properly communicated, can send mixed signals on the importance of nuclear safety. They are sensitive to detect and avoid these misunderstandings. 管理层认识到，如果沟通不当，生产目标可能会对核安全重要性发出误导信息。他们要敏锐地察觉和避免这样的误解。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
LA.	Leadership Accountability – Leaders demonstrate a commitment to nuclear safety in their decisions and behaviours. Executives and senior managers are the leading advocates of nuclear safety and demonstrate their commitment both in word and action. The nuclear safety message is communicated frequently and consistently, occasionally as a stand-alone theme. Leaders throughout the nuclear organisation set an example for safety. Corporate policies emphasise the overriding importance of nuclear safety. 领导问责：领导应在他们的决策和行为中体现对核安全的承诺。公司的高管和高级经理应为核安全的首要倡导者，并在言行中体现他们的承诺。应经常一贯地传达核安全信息，并偶尔用作独立的主题。在安全问题上，整个组织中的领导都应以身作则。公司政策中应强调核安全高于一切。			
	LA.1	Resources: Leaders ensure that personnel, equipment, procedures and other resources are available and adequate to support nuclear safety. 资源：领导应保证人员、设备、程序和其他资源充足可用以确保核安全。	1Cb	Staffing levels are consistent with the demands related to maintaining safety and reliability. 人员配备水平应与维持核电厂安全可靠运行的需求相一致。
			2H	Selection and evaluation of managers and supervisors consider their abilities to contribute to a strong nuclear safety culture. 选择与评价经理和主管时，要考察他们推进核安全文化的能力。
	LA.2	Field Presence: Leaders are commonly seen in working areas of the plant, observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly. 领导下现场：领导应经常出现在电厂的工作区域，检查、指导并加强贯彻标准和期望。如对标准和期望有所偏差，应立即纠正。	2Aa	Managers and supervisors practice visible leadership in the field by placing "eyes on the problem", coaching, mentoring, and reinforcing standards. 经理和主管的作用体现在通过现场关注问题，指导、监督和强化标准。
			2C	Managers and supervisors provide appropriate oversight during safety-significant tests or evolutions. 经理和主管应适当监督与安全相关的重要试验和活动。
	LA.3	Incentives, Sanctions and Rewards: Leaders ensure incentives, sanctions and rewards are aligned with nuclear safety policies and reinforce behaviours and outcomes that reflect nuclear safety as the overriding priority. 激励、处罚与奖励措施：领导应确保激励、处罚、奖励措施与核安全政策、强化行为以及结果保持一致，后者应能体现核安全高于一切。	1Fb	All levels of the organisation exercise healthy accountability for shortfalls in meeting standards. 各级组织对未能达到标准的领域负相应的责任。
			1H	The system of rewards and sanctions is aligned with strong nuclear safety policies and reinforces the desired behaviours and outcomes. 奖惩制度不但要与核安全政策的关注重点一致，同时还应能不断强化期望的行为和业绩。
			3G	Senior management incentive programmes reflect a bias toward long-term plant performance and safety. 针对高级管理层的激励机制侧重于反映核电厂长期业绩和安全。
	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 战略性安全承诺：领导应确保工厂的首要目标一致，并能体现核安全是高于一切的首要任务。	1Aa	The line of authority and responsibility for nuclear safety is defined from the board of directors to the individual contributor. 规定从董事会成员到每个员工的核安全责任与权限。
			1D	Board members and corporate officers periodically take steps to reinforce nuclear safety, including visiting sites to assess management effectiveness first hand. 董事会成员和公司领导定期采取措施定期强化核安全，包括现场巡视，以便直接评估核安全管理的有效性。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
			1E	The line organisation, starting with the chief executive officer, is the primary source of information and the only source of direction. Other parties, such as oversight organisations and committees, review boards and outside advisors, who provide management information essential to effective self-evaluation, are not allowed to dilute or undermine line authority and accountability. 从总经理开始的指挥管理体系是核电厂唯一的指挥渠道。来自指挥体系之外的建议不能淡化或转移指挥体系的权利和责任。
			1G	Relationships among utilities, operating companies and owners, are not allowed to obscure or diminish the line of responsibility for nuclear safety. 核电厂与各上级部门之间的关系不得模糊或削弱核安全责任的界限。
			8E	Senior executives and board members are periodically briefed on the results of oversight group activities to gain insights into station safety performance. 定期向高层管理人员和董事会成员汇报监督结果，以使他们深入了解核电厂的安全业绩。
	LA.5	Change Management: Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority. 变革管理：评估和实施变革时，领导应使用系统性的程序，从而保证核安全仍是高于一切的首要任务。	3F	The effects of impending changes (such as those caused by sale or acquisition, bargaining unit contract renegotiations and economic restructuring) are anticipated and managed such that trust in the organisation is maintained. 预见和管理即将发生的变革，确保维持组织内部的信任。
	LA.6	Roles, Responsibilities and Authorities: Leaders clearly define roles, responsibilities and authorities to ensure nuclear safety. 职务、职责与权限：领导应明确规定自身作用、职责与权限，以确保核安全。	1Ab	Each of these positions has clearly defined roles, responsibilities and authorities designated in writing and understood by the incumbent. 每个岗位都以书面的形式对其任务、职责和权限做出规定，并未在岗人员所理解。
			3Eb	Supervisors are recognised as an important part of the management team, crucial to translating safety culture into practical terms. 主管是管理团队的重要组成部分，这对于用安全文化来促进团队关系是至关重要的。
	LA.7	Constant Examination: Leaders ensure that nuclear safety is constantly scrutinised through a variety of monitoring techniques, including assessments of nuclear safety culture. 持续检查：领导应确保通过各种监督手段（比如核安全文化评估）对电厂的核安全状况进行持续检查。	N/A	
	LA.8	Leader Behaviours: Leaders exhibit behaviours that set the standard for safety. 领导的行为表现：领导的行为表现应为安全设立标准。	2G	Informal opinion leaders in the organisation are encouraged to model safe behaviour and influence peers to meet high standards. 鼓励企业内有较大影响力的资深员工在安全方面作出表率并影响同行去达到同样的高标准。
			7F	Employees have confidence that issues with nuclear safety implications are prioritised, tracked and resolved in a timely manner. 员工相信涉及核安全的问题必将得到持续的关注和解决。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
DM.	Decision-Making – Decisions that support or affect nuclear safety are systematic, rigorous and thorough. Operators are vested with the authority and understand the expectation, when faced with unexpected or uncertain conditions, to place the plant in a safe condition. Senior leaders support and reinforce such conservative decisions. 决策制定：能保证或者影响核安全的决策应是系统的、缜密的、彻底的。运营商应得到授权并认识到如下情况：当面临非预期或不确定的情况时，应使电场处于安全条件下。高层领导应支持并强化这种保守的决策。			
	DM. 1	Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. 程序一致：个人应运用一致的、系统的方法做决策，同时应将风险预测视作合理行为。	4Ca	Plant personnel apply a rigorous approach to problem-solving. 核电厂员工采取严格的步骤来解决问题。
	DM. 2	Conservative Bias: Individuals use decision-making practices that emphasise prudent choices over those that are simply allowable. For example, a proposed action is determined to be safe before proceeding, rather than determined to be unsafe before stopping. 保守倾向：相较于容许范围内的决策做法，个人应使用强调谨慎选择的决策做法。例如，实施一项提议措施前应确认它是安全的，不能在开始后确认其具有危险性而中止措施。	4Cb	Conservative actions are taken when understanding is incomplete. 在不完全理解时采取保守决策。
			4F	Decision-making practices reflect the ability to distinguish between "allowable" choices and prudent choices. 保守决策时应具备辨识"可接受的选择"和"慎重的选择"的能力。
			4G	When previous operational decisions are called into question by new facts, the decisions and associated underlying assumptions are reviewed to improve the quality of future decisions. 当情况发生变化时，应重新评价原决策和相关的基本假设，以提高今后的决策水平。
	DM. 3	Accountability for Decisions: Individual or Single-point accountability is maintained for nuclear safety decisions. 决策问责：核安全决策中应保持个人或单点问责制度。	4D	Single-point accountability is maintained for important safety decisions, allowing for on-going assessment and feedback as circumstances unfold. 针对重要安全事项的决策，指定专人负责，以对决策的执行情况进行持续的跟踪和反馈。
WE.	Respectful Work Environment – Trust and respect permeate the organisation, creating a respectful work environment. A high level of trust is established in the organisation, in part, fostered through timely and accurate communication. Differing professional opinions are encouraged, discussed and resolved in a timely manner. Employees are informed of steps taken in response to their concerns. 互敬礼貌的工作环境：单位内部充满信任和尊重，以创造互敬礼貌的工作环境。通过及时、准确的交流沟通，在一定程度上促进了组织内部高度信任的建立。应鼓励不同的专业性意见，并及时讨论和解决。对于员工的关心应采取回应措施，并告知员工。			
	WE. 1	Respect is Evident: Everyone is treated with dignity and respect. 表现尊重：每个人都应享有尊严与尊重。	1Ca	People and their professional capabilities, values and experiences are regarded as the nuclear organisation's most valuable asset. 员工及其专业能力、价值观和经验应被视为核电厂最宝贵的资源。
			3A	People are treated with dignity and respect. 尊重员工的人格和尊严。
	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are also encouraged and respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。	2B	Management considers the employee perspective in understanding and analysing issues. 管理层在理解和分析问题时考虑员工的观点。
			3C	Employees are expected and encouraged to offer innovative ideas to help solve problems. 期望和鼓励员工提出新思路来帮助解决问题。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
			3Da	Differing opinions are welcomed and respected.欢迎和尊重不同的意见。
			4B	Managers, supervisors and staff clearly understand and respect each other's roles in decision-making. 经理、主管及员工清楚地理解和尊重各方在决策中的作用。
			4Eb	Robust discussion and healthy conflict are recognised as natural results of diversity of expertise and experience. 应认识到，多样化的专业知识与不同的经历，自然会导致热烈的讨论与善意的矛盾。
			8D	The insights and fresh perspectives provided by quality assurance, assessment, employee concerns and independent oversight personnel are valued. 重视各方面人员（包括质保人员、评估人员、独立监督人员和普通员工等）提出的意见和建议。
	WE.3	High Level of Trust: Trust is fostered among individuals and work groups throughout the organisation. 高度信任：应在整个组织内提高个人与工作组之间的信任。	3Ea	Supervisors are skilled in responding to employee questions in an open, honest manner. 主管善于以坦诚开放的方式应对员工的问题。
	WE.4	Conflict Resolution: Fair and objective methods are used to resolve conflicts. 解决矛盾：应通过公平、客观的方式解决矛盾。	3Db	When needed, fair and objective methods are used to resolve conflict and unsettled differing professional opinions. 欢迎和尊重不同的意见，必要时，用公平和客观的方法来解决冲突。
CL.	Continuous Learning – Opportunities to continuously learn are valued, sought out and implemented. Operating experience is highly valued and the capacity to learn from experience is well developed. Self-assessments, training and benchmarking are used to stimulate learning and improve performance. Nuclear safety is kept under constant scrutiny through a variety of monitoring techniques, some of which provide an independent or "fresh look". 持续学习：应重视、寻求并实现持续学习的机会。应高度重视运行经验，充分开发从经验中学习的能力。应通过自我评价、培训以及同行业标准比较来促进学习并提高绩效。应通过各种监测技术不断审查核安全，而其中一些技术将提供一个独立或全新的视角。			
	CL.1	Operating Experience: Relevant internal and external operating experience is systematically and effectively collected, evaluated and lessons learned are implemented in a timely manner by the organisation. 运行经验：组织应系统、有效、及时地收集、评估和实施相关内部外部运行经验信息。	7A	The organisation avoids complacency and cultivates a continuous learning environment. The attitude that "it can happen here" is encouraged. 组织要避免自满，培养不断学习的氛围，着重培育"事件可能在这里发生"的意识。
			7C	Individuals are well informed of the underlying lessons learned from significant industry and station events, and they are committed to not repeating these mistakes. 员工能从行业和其它核电厂的重大事件中获得基本的经验教训，并承诺不再重犯类似错误。
	CL.2	Self-Assessment: The organisation routinely conducts self-critical and objective assessments of its programmes, practices and performance. 自我评价：单位应对其项目、事件及业绩进行常规的自我批评和客观评价。	8A	A mix of self-assessment and independent oversight reflects an integrated and balanced approach. This balance is periodically reviewed and adjusted as needed. 自我评估和独立的监督相结合是一种综合平衡的方法。这种平衡需定期审查和调整。
			8B	Periodic safety culture assessments are conducted and used as a basis for improvement. 实施定期的核安全文化评估，以此做为改进的基础。
	CL.3	Benchmarking: The organisation learns from other organisations in order to continuously improve knowledge, skills and safety performance. 同行业标准比较：本单位应向其他单位学习，以不断提高自身知识、技能与安全性能。	N/A	

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 培训：高质量的培训可以保持员工的知识量，并强化维护核安全的高标准。	2D	Managers and supervisors are personally involved in high-quality training that consistently reinforces expected worker behaviours. 经理和主管参与高质量的培训，始终如一地强化期望的员工行为。
			4A	The organisation maintains a knowledgeable workforce to support a broad spectrum of operational and technical decisions. Outside expertise is employed when necessary. 核电厂拥有一支有丰富学识和经验的员工队伍，以支持各类运行和技术决策。必要时聘请外部专家。
			5G	Employee mastery of reactor and power plant fundamentals, as appropriate to the job position, establishes a solid foundation for sound decisions and behaviours. 员工熟练掌握适合于工作岗位的反应堆及核电厂的基础知识，为可靠决策和良好行为打下坚实的基础。
			7B	Training upholds management standards and expectations. Beyond teaching knowledge and skills, trainers are adept at instilling nuclear safety values and beliefs. 通过培训加强宣贯管理标准和期望。除了传授知识和技能外，教员还要善于灌输核安全相关的价值观和理念。
PI.	Problem Identification and Resolution – Issues potentially impacting safety are promptly identified, fully evaluated and promptly addressed and corrected, commensurate with their significance. The identification and resolution of a broad spectrum of problems, including organisational issues, are used to strengthen nuclear safety and improve performance. 识别与解决问题：根据其重要性，应快速识别、充分评估、快速解决并纠正对安全有潜在影响的问题。应通过识别并解决大范围的问题（包括组织问题），从而加强核安全并提高绩效。			
	PI.1	Identification: The organisation implements a corrective action programme with a low threshold for identifying issues. Individuals identify issues in a timely manner in accordance with the programme expectations. 识别：单位应在低门槛的问题识别下，实施纠正行动计划。个人应根据计划的期望，及时识别出问题。	6D	Workers identify conditions or behaviours that have the potential to degrade operating or design margins. Such circumstances are promptly identified and resolved. 员工能够识别可能降低运行或设计裕度的工况或行为，并及时解决问题。
			8C	The pitfalls of focusing on a narrow set of performance indicators are recognised. The organisation is alert to detect and respond to indicators that may signal declining performance. 组织认识到仅专注片面的业绩指标是不够的，还要关注识别那些可能预示业绩下滑的指标并做出响应。
	PI.2	Evaluation: The organisation thoroughly evaluates issues to ensure that problem resolutions and solutions address causes and extents of conditions, commensurate with their nuclear safety significance. 评估：单位应根据核安全问题的重要性，全面评估问题，以确保其解决方案可以应对不同原因、不同程度的情况。	4Ca	Plant personnel apply a rigorous approach to problem-solving. 核电厂员工采取严格的步骤来解决问题，在不完全理解时采取保守决策。
			6B	Anomalies are recognised, thoroughly investigated, promptly mitigated and periodically analysed in the aggregate. 识别异常工况、深入调查、及时缓解并定期进行分析总结。
			7D	Expertise in root cause analysis is applied effectively to identify and correct the fundamental causes of events. 有效地使用根本原因分析方法，对事件进行分析，制定纠正行动计划并加以落实。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
	PI.3	Resolution: The organisation takes effective corrective actions to address issues in a timely manner, commensurate with their nuclear safety significance.解决方案：单位应根据核安全问题的重要性，及时采取有效的纠正行动应对。	2Ab	Deviations from station expectations are corrected promptly. 及时纠正偏离电站期望值的行为。
			7E	Processes are established to identify and resolve latent organisational weaknesses that can aggravate relatively minor events, if not corrected. 制定程序来识别和解决组织体系中存在的可能弱项，避免事件的扩大。
	PI.4	Trending: The organisation periodically analyses information from the corrective action programme and other assessments in the aggregate to identify adverse trends or conditions. 趋势分析：对于纠正计划以及总体计划中其他评估里的信息，单位应定期分析，以识别不良趋势或情况。	N/A	
RC.	Environment for Raising Concerns – A safety-conscious work environment (SCWE) is maintained where personnel feel free to raise nuclear safety concerns without fear of retaliation, intimidation, harassment or discrimination. Station managers create, maintain and periodically evaluate policies and processes that allow personnel to freely raise concerns. 提出顾虑的环境：应保持注重安全的工作环境（SCWE），员工在其中能随时提出对核安全的顾虑，而无须担心受到报复、恐吓、骚扰或歧视。场地管理人员应开发并保持允许员工随意提出顾虑的政策和程序，并定期对其进行评估。			
	RC.1	SCWE Policy: The organisation implements a policy that supports individual rights and responsibilities to raise safety nuclear concerns and does not tolerate harassment, intimidation, retaliation or discrimination for doing so. SCWE政策：组织应有效实施维护个人权利、保证个人责任的政策，提高对核安全的关注，确保员工不会为此受到骚扰、恐吓、报复或歧视。	3B	Personnel can raise nuclear safety concerns without fear of retribution and have confidence their concerns will be addressed. 员工可以提出核安全方面的问题，不必害怕惩罚，相信所提的问题会得到回应。
	RC.2	Alternate Process for Raising Concerns: The organisation implements a process for raising and resolving concerns that is independent of line management influence. Nuclear safety issues may be raised in confidence and with an expectation that they be resolved in a timely and effective manner. 提出问题的备用流程：组织应具备不受各级管理层影响的提出问题和解决问题的流程，非公开地提出安全问题并及时有效地解决问题。	N/A	
WP.	Work Processes – The process of planning and controlling work activities is implemented so that nuclear safety is maintained. Work management is a deliberate process in which work is identified, selected, planned, scheduled, executed, closed and critiqued. The entire organisation is involved in and fully supports the work management process. 工作流程：应执行工作活动的规划和控制流程，以维护核安全。工作管理是一项慎重的流程，在其中对工作进行确定、选择、规划、安排、执行、中止以及评论。整个单位都应参与到工作管理流程中，并对其完全支持。			
	WP.1	Work Management: The organisation implements a process of planning, controlling and executing work activities such that nuclear safety is the overriding priority. The process includes the identification and management of nuclear safety risk commensurate with the work to be performed. 工作管理：单位应执行工作活动的规划、控制和执行流程，以确保核安全是高于一切的首要目标。流程包括了对待完成工作相关的核安全风险进行识别与管理。	5A	Activities that could affect core reactivity are conducted with particular care and caution. 实施可能引起堆芯反应性变化的活动时应格外谨慎。

Trait 特性	Attribute 特征	Description 描述	Principle 原则	Description 描述
	WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and the operability and function of safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。	5B	Features designed to maintain critical safety functions, such as core cooling, are recognised as particularly important. 对专设安全设施功能的维持给予特别关注。
			5Ca	Design and operating margins are carefully guarded and are changed only with great thought and care. 严守设计和运行的安全裕度，只有慎重考虑后方可改变。
			5Cb	Special attention is placed on maintaining fission product barriers and defence-in-depth. 特别关注维持裂变产物屏障的完整性和纵深防御的功能。
			5D	Equipment is meticulously maintained, well within design requirements. 精心维护设备，使其性能在设计要求范围内。
			5E	Insights from probabilistic risk analyses are considered in daily plant activities and plant change processes. 核电厂的日常活动和变更要考虑概率风险分析的结论。
	WP.3	Documentation: The organisation creates and maintains complete, accurate and up-to-date documentation. 记录文件：单位应创建记录，并保持记录完整、准确、最新。	5F	Plant activities are governed by comprehensive, high-quality processes and procedures. 核电厂活动受全面的高质量的过程和程序控制。
	WP.4	Procedure Adherence: Individuals properly follow processes, procedures and work instructions. 程序遵守：个人应正确遵守流程、程序以及工作指南。	N/A	

Table 4: WANO Principles to Traits WANO准则-特性

Principle 准则	Description 描述	Attribute 特质	Description 描述
1Aa	The line of authority and responsibility for nuclear safety is defined from the board of directors to the individual contributor. 规定从董事会成员到每个员工的核安全责任及权限。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 对安全的战略承诺：领导确保核电厂事物以反映核安全排列优先等级为首要任务。
1Ab	Each of these positions has clearly defined roles, responsibilities and authorities designated in writing and understood by the incumbent. 每个岗位都以书面的形式对其任务、职责和权限做出规定，并为在岗人员所理解。	LA.6	Roles, Responsibilities and Authorities: Leaders clearly define roles, responsibilities and authorities to ensure nuclear safety. 作用、责任和权力：领导须明确规定作用、责任和权力以确保核安全。
1B	Support groups, such as human resources, labour relations, and business and financial planning, also understand their roles in contributing to nuclear safety. 非生产直接相关的部门也应明白它们在核安全管理中的作用。	PA.2	Job Ownership: Individuals understand and demonstrate personal responsibility for the behaviours and work practices that support nuclear safety. 主人翁精神：每个员工需要理解并在维护核安全的行为和工作实践中展现个人责任感。
1Ca	People and their professional capabilities, values and experiences are regarded as the nuclear organisation's most valuable asset. 员工及其专业能力、价值观和经验应被视为核电厂最宝贵的资源。	WE.1	Respect is Evident: Everyone is treated with dignity and respect. 尊重：每个人都得到尊重，尊严得到维护。
1Cb	Staffing levels are consistent with the demands related to maintaining safety and reliability. 人员配备水平应与维持核电厂安全可靠运行的需求相一致。	LA.1	Resources: Leaders ensure that personnel, equipment, procedures and other resources are available, and adequate to support nuclear safety. 资源：领导应保证人员、设备、程序和其他资源充足可用以确保核安全。
1D	Board members and corporate officers periodically take steps to reinforce nuclear safety, including visiting sites to assess management effectiveness first-hand. 董事会成员和公司领导采取措施定期强化核安全，包括现场巡视，以便直接评估核安全管理的有效性。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 对安全的战略承诺：领导确保核电厂事物以反映核安全排列优先等级为首要任务。
1E	The line organisation, starting with the chief executive officer, is the primary source of information and the only source of direction. Other parties, such as oversight organisations and committees, review boards and outside advisors, who provide management information essential to effective self-evaluation, are not allowed to dilute or undermine line authority and accountability. 从总经理开始的指挥管理体系是核电厂唯一的指挥渠道。来自指挥体系之外的建议不能淡化或转移指挥体系的权力和责任。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 对安全的战略承诺：领导确保核电厂事物以反映核安全排列优先等级为首要任务。
1F	All personnel understand the importance of adherence to nuclear safety standards. All levels of the organisation exercise healthy accountability for shortfalls in meeting standards. 所有员工认识到遵守核安全标准的重要性。各级组织对未能达到标准的领域负相应的责任。	PA.1	Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organisation exercise accountability for shortfalls in meeting standards. 标准：个人应理解遵守核标准的重要性，各级组织若未能达到标准应负责任。

Principle 准则	Description 描述	Attribute 特质	Description 描述
1Fb	All levels of the organisation exercise healthy accountability for shortfalls in meeting standards. 各级组织 各级组织对未能达到标准的领域负相应的责任。	LA.3	Incentives, Sanctions and Rewards: Leaders ensure incentives, sanctions and rewards are aligned with nuclear safety policies and reinforce behaviours and outcomes that reflect safety as the overriding priority. 激励、处罚与奖励措施：领导应确保激励、处罚、奖励措施与核安全政策、强化行为以及结果保持一致，后者应能体现核安全高于一切。
1G	Relationships among utilities, operating companies and owners are not allowed to obscure or diminish the line of responsibility for nuclear safety. 核电厂与各上级部门之间的关系不得模糊或削弱核安全责任的界限。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 对安全的战略承诺：领导确保核电厂事物以反映核安全排列优先等级为首要任务。
1H	The system of rewards and sanctions is aligned with strong nuclear safety policies and reinforces the desired behaviours and outcomes. 奖惩制度不但要与核安全政策的关注重点一致，同时还应能不断强化期望的行为和业绩。	LA.3	Incentives, Sanctions and Rewards: Leaders ensure incentives, sanctions and rewards are aligned with nuclear safety policies, and reinforce behaviours and outcomes that reflect safety as the overriding priority. 激励、处罚与奖励措施：领导应确保激励、处罚、奖励措施与核安全政策、强化行为以及结果保持一致，后者应能体现核安全高于一切。
2Aa	Managers and supervisors practice visible leadership in the field by placing "eyes on the problem," coaching, mentoring and reinforcing standards. 经理和主管的作用体现在通过现场关注问题，指导、监督和强化标准。	LA.2	Field Presence: Leaders are commonly seen in working areas of the plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly. 领导下现场：领导应经常出现在电厂的工作区域，检查、指导并加强贯彻标准和期望。如对标准和期望有所偏差，应立即纠正。
2Ab	Deviations from station expectations are corrected promptly. 及时纠正偏离电站期望值的行为。	PI.2	Evaluation: The organisation thoroughly evaluates issues to ensure that problem resolutions and solutions address causes and extents of conditions, commensurate with their safety significance. 评估：组织应全面评估事态，确保问题解决方案达到安全标准，并能解决根源问题，防止事态恶化。
2B	Management considers the employee perspective in understanding and analysing issues. 管理层在理解和分析问题时考虑员工的观点。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
2C	Managers and supervisors provide appropriate oversight during safety-significant tests or evolutions. 经理和主管应适当监督与安全相关的重要试验和活动。	LA.2	Field Presence: Leaders are commonly seen in working areas of the plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly. 领导下现场：领导应经常出现在电厂的工作区域，检查、指导并加强贯彻标准和期望。如对标准和期望有所偏差，应立即纠正。
2D	Managers and supervisors are personally involved in high-quality training that consistently reinforces expected worker behaviours. 经理和主管参与高质量的培训，始终如一地强化期望的员工行为。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 培训：高质量培训能培养知识渊博的劳动力，保证高标准维护核安全。

Principle 准则	Description 描述	Attribute 特质	Description 描述
2E	Leaders recognise that production goals, if not properly communicated, can send mixed signals on the importance of nuclear safety. They are sensitive to detect and avoid these misunderstandings. 管理层认识到，如果沟通不当，生产目标可能会对核安全重要性发出误导信息。他们要敏锐地察觉和避免这样的误解。	CO.4	Expectations: Leaders frequently communicate and reinforce the expectation that nuclear safety is the organisation's overriding priority. 期望：领导应经常地传递和强化核安全是组织的第一要务的期望。
2F	The bases, expected outcomes, potential problems, planned contingencies and abort criteria, for important operational decisions, are communicated promptly to workers. 把重要运行决策的依据、预期的后果、潜在的问题、应急预案以及行动中止的准则及时传达给员工。	CO.2	Bases for Decisions: Leaders ensure that the bases for operational and organisational decisions are communicated in a timely manner. 决策依据：领导应确保就运行决策和组织决策的依据及时地进行交流。
2G	Informal opinion leaders in the organisation are encouraged to model safe behaviour and influence peers to meet high standards. 鼓励企业内有较大影响力的资深员工在安全方面作出表率并影响同行去达到同样的高标准。	LA.8	Leader Behaviours: Leaders exhibit behaviours that set the standard for safety. 领导人行为：领导人自身行为为核安全树立了标准。
2H	Selection and evaluation of managers and supervisors consider their abilities to contribute to a strong nuclear safety culture. 选择和评价经理和主管时，要考察他们推进卓越核安全文化的能力。	LA.1	Resources: Leaders ensure that personnel, equipment, procedures and other resources, are available and adequate to support nuclear safety. 资源：领导应保证人员、设备、程序和其他资源充足可用以确保核安全。
3A	People are treated with dignity and respect. 尊重员工的人格和尊严。	WE.1	Respect is Evident: Everyone is treated with dignity and respect. 尊重：每个人都得到尊重，尊严得到维护。
3B	Personnel can raise nuclear safety concerns without fear of retribution and have confidence their concerns will be addressed. 员工可以提出核安全方面的问题，不必害怕惩罚，相信所提的问题会得到回应。	RC.1	SCWE Policy: The organisation effectively implements a policy that supports individual rights and responsibilities to raise safety concerns and does not tolerate harassment, intimidation, retaliation or discrimination for doing so. SCWE政策：组织应有效实施维护个人权利、保证个人责任的政策，提高对核安全的关注，确保员工不会为此受到骚扰、恐吓、报复或歧视。
3C	Employees are expected and encouraged to offer innovative ideas to help solve problems. 期望和鼓励员工提出新思路来帮助解决问题。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
3Da	Differing opinions are welcomed and respected. 欢迎和尊重不同的意见。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions, and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
3Db	When needed, fair and objective methods are used to resolve conflict and unsettled differing professional opinions. 必要时，用公平和客观的方法来解决冲突。	WE.4	Conflict Resolution: Fair and objective methods are used to resolve conflicts. 解决冲突：应采取公正客观的方法解决冲突。
3Ea	Supervisors are skilled in responding to employee questions in an open, honest manner. 主管善于以坦诚开放的方式应对员工的问题。	WE.3	High Level of Trust: Trust is fostered among individuals and work groups throughout the organisation. 高度信任：应在整个组织内提高个人与工作组之间的信任。

Principle 准则	Description 描述	Attribute 特质	Description 描述
3Eb	Supervisors are recognised as an important part of the management team, crucial to translating safety culture into practical terms. 主管是一个管理团队的重要组成部分，这对于用安全文化来促进团队关系是至关重要的。	LA.6	Roles, Responsibilities and Authorities: Leaders clearly define roles, responsibilities and authorities to ensure nuclear safety. 作用、责任和权力：领导须明确规定作用、责任和权力以确保核安全。
3F	The effects of impending changes (such as those caused by sale or acquisition, bargaining unit contract renegotiations and economic restructuring) are anticipated and managed such that trust in the organisation is maintained. 预见和管理即将发生的变革，确保维持组织内部的信任。	LA.5	Change Management: Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority. 变化管理：为了保证核安全为第一要务，领导应该运用一套评估和落实变化的系统过程。
3G	Senior management incentive programmes reflect a bias toward long-term plant performance and safety. 针对高级管理层的激励机制侧重于反映核电厂长期业绩和安全。	LA.3	Incentives, Sanctions and Rewards: Leaders ensure incentives, sanctions and rewards are aligned with nuclear safety policies and reinforce behaviours and outcomes that reflect safety as the overriding priority. 激励、处罚与奖励措施：领导应确保激励、处罚、奖励措施与核安全政策、强化行为以及结果保持一致，后者应能体现核安全高于一切。
3H	Complete, accurate and forthright information is provided to oversight, audit and regulatory organisations. 向监督、审查和监管机构提供的信息完整、准确和及时。	PA.1	Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organisation exercise accountability for shortfalls in meeting standards. 标准：个人应理解遵守核标准的重要性，各级组织若未能达到标准应负责任。
3I	Managers regularly communicate to the workforce important decisions and their bases, as a way of building trust and reinforcing a healthy safety culture. Worker understanding is periodically checked. 作为建立信任和强化良好安全文化的一种方式，管理人员定期与员工沟通重要决策及其决策的依据，并定期了解员工的理解程度。	CO.2	Bases for Decisions: Leaders ensure that the bases for operational and organisational decisions are communicated in a timely manner. 决策依据：领导应确保就运行决策和组织决策的依据及时地进行交流。
4A	The organisation maintains a knowledgeable workforce to support a broad spectrum of operational and technical decisions. Outside expertise is employed when necessary. 核电厂拥有一支有丰富学识和经验的员工队伍，以支持各类运行和技术决策。必要时聘请外部专家。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 培训：高质量培训能培养知识渊博的劳动力，保证高标准维护核安全。
4B	Managers, supervisors and staff clearly understand and respect each other's roles in decision-making. 经理、主管及员工清楚地理解和尊重各方在决策中的作用。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
4Ca	Plant personnel apply a rigorous approach to problem-solving. 核电厂员工采取严格的步骤来解决问题。	DM.1	Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated, as appropriate. 程序一致：个人应运用一致的、系统的方法做决策，同时应将风险预测视作合理行为。
4Ca	Plant personnel apply a rigorous approach to problem-solving. 核电厂员工采取严格的步骤来解决问题。	PI.3	Resolution: The organisation takes effective corrective actions to address issues in a timely manner, commensurate with their safety significance. 解决问题：依据安全级别，组织应及时采取有效措施处理问题。

Principle 准则	Description 描述	Attribute 特质	Description 描述
4Cb	Conservative actions are taken when understanding is incomplete. 在不完全理解时采取保守决策。	DM.2	Conservative Bias: Individuals use decision-making practices that emphasise prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. 保守偏见：个人的决策制定实践应强调进行审慎选择，而不是简单的可容许的选择。所提议的行动应是为了确保工作进行的安全行动，而不是为了妨碍工作而不安全行动。
4D	Single-point accountability is maintained for important safety decisions, allowing for on-going assessment and feedback as circumstances unfold. 针对重要安全事项的决策，指定专人负责，以对决策的执行情况进行连续的跟踪和反馈。	DM.3	Accountability for Decisions: Single-point accountability is maintained for nuclear safety decisions. 决策责任：核安全决策采用单点责任制。
4Ea	Candid dialogue and debate are encouraged when safety issues are being evaluated. 评估安全问题时，鼓励公开对话和讨论。	PA.3	Teamwork: Individuals and work groups communicate and coordinate their activities within and across organisational boundaries to ensure nuclear safety is maintained. 团队合作：个人及工作组相互交流合作且不应以组织为界限来确保核安全。
4Eb	Robust discussion and healthy conflict are recognised as natural results of diversity of expertise and experience. 由于专长与经验有别，热烈的讨论以及必要的摩擦是正常现象。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
4F	Decision-making practices reflect the ability to distinguish between "allowable" choices and prudent choices. 保守决策时应具备辨识"可接受的选择"和"慎重的选择"的能力。	DM.2	Conservative Bias: Individuals use decision-making practices that emphasise prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. 保守偏见：个人的决策制定实践应强调进行审慎选择，而不是简单的可容许的选择。所提议的行动应是为了确保工作进行的安全行动，而不是为了妨碍工作而不安全行动。
4G	When previous operational decisions are called into question by new facts, the decisions and associated underlying assumptions are reviewed to improve the quality of future decisions. 当情况发生变化时，应重新评价原决策和相关的基本假设，以提高今后的决策水平。	DM.2	Conservative Bias: Individuals use decision-making practices that emphasise prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. 保守偏见：个人的决策制定实践应强调进行审慎选择，而不是简单的可容许的选择。所提议的行动应是为了确保工作进行的安全行动，而不是为了妨碍工作而不安全行动。
5A	Activities that could affect core reactivity are conducted with particular care and caution. 实施可能引起堆芯反应性变化的活动时应格外谨慎。	WP.1	Work Management: The organisation implements a process of planning, controlling and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work. 工作管理：组织执行一个以核安全为首要任务的计划、控制和实施工作活动的流程。该工作流程包括与工作相称的风险识别和管理。

Principle 准则	Description 描述	Attribute 特质	Description 描述
5B	Features designed to maintain critical safety functions, such as core cooling, are recognised as particularly important. 对专设安全设施功能的维持给予特别关注。	WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。
5Ca	Design and operating margins are carefully guarded and are changed only with great thought and care. 严守设计和运行的安全裕度，只有慎重考虑后方可改变。	WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。
5Cb	Special attention is placed on maintaining fission product barriers and defence-in-depth. 特别关注维持裂变产物屏障的完整性和纵深防御的功能。	WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。
5D	Equipment is meticulously maintained, well within design requirements. 精心维护设备，使其性能在设计要求范围内。	WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。
5E	Insights from probabilistic risk analyses are considered in daily plant activities and plant change processes. 核电厂的日常活动和变更要考虑概率风险分析的结论。	WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。

Principle 准则	Description 描述	Attribute 特质	Description 描述
5F	Plant activities are governed by comprehensive, high-quality processes and procedures. 核电厂活动受全面的高质量的过程和程序控制。	WP.3	Documentation: The organisation creates and maintains complete, accurate and up-to-date documentation. 文件：该组织创建以及保持完整、正确、最新的文件。
5G	Employee mastery of reactor and power plant fundamentals, as appropriate to the job position, establishes a solid foundation for sound decisions and behaviours. 员工熟练掌握适合于工作岗位的反应堆及核电厂的基础知识，为可靠决策和良好行为打下坚实的基础。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 培训：高质量培训能培养知识渊博的劳动力，保证高标准维护核安全。
6A	While individuals expect successful outcomes of daily activities, they recognise the possibility of mistakes and worst-case scenarios. Contingencies are developed to deal with these possibilities. 员工希望每天的工作有圆满结果，但他们同时也应认识到犯错误和出现最坏情况的可能性，因此应有应急预案来应对这些可能性。	QA.2	Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. 挑战未知：遇到不确定工况时，个人应停止工作。继续工作前，应进行风险评估和管理。
6B	Anomalies are recognised, thoroughly investigated, promptly mitigated and periodically analysed in the aggregate. 识别异常工况、深入调查、及时缓解并定期进行分析总结。	PI.3	Resolution: The organisation takes effective corrective actions to address issues in a timely manner commensurate with their safety significance. 解决问题：依据安全级别，组织应及时采取有效措施处理问题。
6C	Personnel do not proceed in the face of uncertainty. 在面对不确定性事件时，员工应停止继续操作。	QA.2	Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. 挑战未知：遇到不确定工况时，个人应停止工作。继续工作前，应进行风险评估和管理。
6D	Workers identify conditions or behaviours that have the potential to degrade operating or design margins. Such circumstances are promptly identified and resolved. 员工能够识别可能降低运行或设计裕度的工况或行为，并及时解决问题。	PI.1	Identification: The organisation implements a corrective action programme with a low threshold for identifying issues. Individuals identify issues completely, accurately and in a timely manner, in accordance with the programme. 确认问题：对于确认问题，组织应实施一套正确的低门槛的行动方案。根据行动方案，员工要正确及时发现所有问题。
6E	Employees understand that complex technologies can fail in unpredicted ways. They are aware that latent problems can exist and they make conservative decisions considering this potential. 员工认识到复杂技术可能以不可预见的方式而失效，并作出保守决策。	QA.2	Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. 挑战未知：遇到不确定工况时，个人应停止工作。继续工作前，应进行风险评估和管理。
6F	Group-think is avoided through diversity of thought and intellectual curiosity. Opposing views are encouraged and considered. 通过思维的多元化来避免群体思维，鼓励和重视不同的意见。	QA.3	Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they believe something is not correct. 挑战假设：员工遇到他们认为不正确的事时，应挑战先前假设并提出对立观点。
7A	The organisation avoids complacency and cultivates a continuous learning environment. The attitude that "it can happen here" is encouraged. 组织要避免自满，培养不断学习的氛围，着重培育"事件可能在这里发生"的意识。	CL.1	Operating Experience: The organisation systematically and effectively collects, evaluates and implements relevant internal and external operating experience in a timely manner. 运行经验：组织应系统、有效、及时地收集、评估和实施相关内部外部运行经验信息。
7B	Training upholds management standards and expectations. Beyond teaching knowledge and skills, trainers are adept at instilling nuclear safety values and beliefs. 通过培训加强宣贯管理标准和期望。除了传授知识和技能外，教员还要善于灌输核安全相关的价值观和理念。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 培训：高质量培训能培养知识渊博的劳动力，保证高标准维护核安全。

Principle 准则	Description 描述	Attribute 特质	Description 描述
7C	Individuals are well informed of the underlying lessons learned from significant industry and station events, and they are committed to not repeating these mistakes. 员工能从行业和其它核电厂的重大事件中获得基本的经验教训，并承诺不再重犯类似错误。	CL.1	Operating Experience: The systematically and effectively collects, evaluates, and implements lessons from relevant internal and external operating experience information in a timely manner. 运行经验：组织应系统、有效、及时地收集、评估和实施相关内部外部运行经验信息。
7D	Expertise in root cause analysis is applied effectively to identify and correct the fundamental causes of events. 有效地使用根本原因分析方法，对事件进行分析，制定纠正行动计划并加以落实。	PI.3	Resolution: The organisation takes effective corrective actions to address issues in a timely manner commensurate with their safety significance. 解决问题：依据安全级别，组织应及时采取有效措施处理问题。
7E	Processes are established to identify and resolve latent organisational weaknesses that can aggravate relatively minor events if not corrected. 制定程序来识别和解决组织体系中存在的可能弱项，避免事件的扩大。	PI.2	Evaluation: The organisation thoroughly evaluates issues to ensure that problem resolutions and solutions address causes and extents of conditions commensurate with their safety significance 评估：组织应全面评估事态，根据安全级别，确保方案能解决根源问题，防止事态恶化。.
7F	Employees have confidence that issues with nuclear safety implications are prioritised, tracked, and resolved in a timely manner. 员工相信涉及核安全的问题必将得到持续的关注和解决。	LA.8	Leader Behaviours: Leaders exhibit behaviours that set the standard for safety. 领导人行为：领导人自身行为为核安全树立了标准。
8A	A mix of self-assessment and independent oversight reflects an integrated and balanced approach. This balance is periodically reviewed and adjusted as needed. 自我评估和独立的监督相结合是一种综合平衡的方法。这种平衡需定期审查和调整。	CL.2	Self-Assessment: The organisation routinely conducts self-critical and objective assessments of its programmes, practices, and performance. 自我评估：组织定期对其计划、实践和结果进行自我批判和目标评估。
8B	Periodic safety culture assessments are conducted and used as a basis for improvement. 实施定期的核安全文化评估，以此做为改进的基础。	CL.2	Self-Assessment: The organisation routinely conducts self-critical and objective assessments of its programmes, practices and performance. 自我评估：组织定期对其计划，实践和结果进行自我批判和目标评估。
8C	The pitfalls of focusing on a narrow set of performance indicators are recognised. The organisation is alert to detect and respond to indicators that may signal declining performance. 组织认识到仅专注片面的业绩指标是不够的，还要关注识别那些可能预示业绩下滑的指标并做出响应。	PI.1	Identification: The organisation implements a corrective action programme with a low threshold for identifying issues. Individuals identify issues completely, accurately, and in a timely manner in accordance with the programme. 确认问题：对于确认问题，组织应实施一套正确的低门槛的行动方案。根据行动方案，员工要正确及时发现所有问题。
8D	The insights and fresh perspectives provided by quality assurance, assessment, employee concerns, and independent oversight personnel are valued. 重视各方面人员（包括质保人员、评估人员、独立监督人员和普通员工等）提出的意见和建议。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions, and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
8E	Senior executives and board members are periodically briefed on the results of oversight group activities to gain insights into station safety performance. 定期向高层管理人员和董事会成员汇报监督结果，以使他们深入了解核电厂的安全业绩。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 对安全的战略承诺：领导确保核电厂事物以反映核安全排列优先等级为首要任务。
N/A		QA.1	Nuclear Is Recognised as Special and Unique: Individuals understand that complex technologies can fail in unpredictable ways. 认同核技术的特殊性和独特性：个人应认识到，复杂的技术或许会带来出乎意料的故障。

Principle 准则	Description 描述	Attribute 特质	Description 描述
		QA.4	Avoid Complacency: Individuals recognise and plan for the possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes. 避免自满情绪： 尽管预期会取得成功的结果，但个人应该承认可能出现的错误、潜在问题和固有风险并做出应对计划。
N/A		CO.1	Work Process Communications: Individuals incorporate safety communications in work activities. 工作过程沟通：个人应将安全沟通纳入工作活动中。
N/A		CO.3	Free Flow of Information: Individuals communicate openly and candidly, both up, down, and across the organisation, and with oversight, audit, and regulatory organisations. 信息自由流通：个人在整个组织内可自由坦诚地与上下级以及监督、审核和监管机构沟通。
N/A		LA.7	Constant Examination: Leaders ensure that nuclear safety is constantly scrutinised through a variety of monitoring techniques, including assessments of nuclear safety culture. 持续检查：领导应确保通过各种监督手段（比如核安全文化评估）对电厂的核安全状况进行持续检查。
N/A		CL.3	Benchmarking: The organisation learns from other organisations to continuously improve knowledge, skills, and safety performance. 标杆管理：本组织应向其他组织学习，不断改进知识、技能和安全性能。
N/A		PI.4	Trending: The organisation periodically analyses information from the corrective action programme and other assessments in the aggregate to identify adverse trends or conditions. 趋势：组织应定期分析从补救措施计划和总体计划中其它评估得来的信息，确认不利的趋势或条件。
N/A		RC.2	Alternate Process for Raising Concerns: The organisation implements a process for raising and resolving concerns that is independent of line management influence. Safety issues may be raised in confidence and are resolved in a timely and effective manner. 提出问题的备用流程：组织应具备不受各级管理层影响的提出问题和解决问题的流程，非公开地提出安全问题并及时有效地解决问题。
N/A		WP.1	Work Management: The organisation implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work. 工作管理：组织执行一个以核安全为首要任务的计划、控制和实施工作活动的流程。该工作流程包括与工作相称的风险识别和管理。
N/A		WP.4	Procedure Adherence: Individuals follow processes, procedures, and work instructions. 程序遵守：个人应正确遵守流程、程序以及工作指南。

表5 特征-IAEA特点

Trait 特点	Attribute 特性	Description 描述	IAEA 国际原子能机构	Description 描述
PA. 个人问责制	Personal Accountability – All individuals take personal responsibility for safety. Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, and team responsibilities emphasise the overriding importance of nuclear safety. 个人责任—所有个人要对安全负责。核安全责任和权利需明确界定和清晰理解。上下级关系，重要职位权力和团队责任都强调核安全是重中之重。			
	PA.1	Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organisation exercise accountability for shortfalls in meeting standards. 标准：个人应理解遵守核标准的重要性，各级组织若未能达到标准应负责任。	C.3	There is a high level of compliance with regulations and procedures. 严格遵守规章条例和程序。
			D.9	Housekeeping and material conditions reflect commitment to excellence. 材料状况及整洁度反应与卓越绩效的遵守程度。
	PA.2	Job Ownership: Individuals understand and demonstrate personal responsibility for the behaviours and work practices that support nuclear safety. 主人翁精神：每个员工需要理解并在维护核安全的行为和工作实践中展现个人责任感。	A.4	Individuals are convinced that safety and production go hand in hand. 个人应相信安全和生产密切相关。
			C.5	'Ownership' for safety is evident at all organisational levels and for all individuals. 各级组织和所有个人需对安全负责。
	PA.3	Teamwork: Individuals and work groups communicate and coordinate their activities within and across organisational boundaries, to ensure nuclear safety is maintained. 团队合作：个人及工作组相互交流合作且不应以组织为界限来确保核安全。	D.8	Cross-functional and interdisciplinary cooperation and teamwork are present. 要体现跨领域、跨学科的合作。
QA. 质疑态度	Questioning Attitude – Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies and activities, in order to identify discrepancies that might result in error or inappropriate action. All employees are watchful for assumptions, values, conditions or activities that can have an undesirable effect on plant safety. 质疑的态度—个人不应满足，要一直对现有情况、假设、异常和活动持质疑态度，来发现可能导致错误或不妥情况的差异。所有员工要对会影响核电站的假设、数值、状况和活动保持警惕。			
	QA.1	Nuclear Is Recognised as Special and Unique: Individuals understand that complex technologies can fail in unpredictable ways. 认同核技术的特殊性和独特性：个人应认识到，复杂的技术或许会带来出乎意料的故障。	N/A	
	QA.2	Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. 挑战未知：遇到不确定工况时，个人应停止工作。继续工作前，应进行风险评估和管理。	N/A	
	QA.3	Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they believe something is not correct. 挑战假定：若个人确信某事有误，应挑战假设并提出反对看法。	E.1	A questioning attitude prevails at all organisational levels. 各级组织应具备质疑的态度。
	QA.4	Avoid Complacency: Individuals recognise and plan for the possibility of mistakes, latent issues and inherent risk, even while expecting successful outcomes. 避免自满情绪： 尽管预期会取得成功的结果，但个人应该承认可能出现的错误、潜在问题和固有风险并做出应对计划。	N/A	
CO.	Safety Communication – Communications maintain a focus on safety. Safety communication is broad and includes plant-level communication, job-related communication, worker-level communication, equipment labelling, operating experience and documentation. Leaders use formal and informal communication to convey the importance of safety. The flow of information up the organisation is seen as important as the flow of information down the organisation. 安全通信—通信重点保证安全。安全通信范围广，包括工厂设备级基础通信、工作相关通信、工人间通信、设备贴标、运行经验和文档。组织的信息流上报和下发都同等重要。			

Trait 特点	Attribute 特性	Description 描述	IAEA 国际原子能机构	Description 描述
	CO.1	Work Process Communications: Individuals incorporate safety communications in work activities. 工作过程沟通：个人应将安全沟通纳入工作活动中。	N/A	
	CO.2	Bases for Decisions: Leaders ensure that the bases for operational and organisational decisions are communicated in a timely manner. 决策依据：领导应确保就运行决策和组织决策的依据及时地进行交流。	N/A	
	CO.3	Free Flow of Information: Individuals communicate openly and candidly, both up, down and across the organisation, and with oversight, audit and regulatory organisations. 信息自由流通：个人在整个组织内可自由坦诚地与上下级以及监督、审核和监管机构沟通。	B.8	Management shows a continual effort to strive for openness and good communication throughout the organisation. 管理层要始终在整个组织间进行公开良好的交流。
	CO.4	Expectations: Leaders frequently communicate and reinforce the expectation that nuclear safety is the organisation's overriding priority. 期望：领导应经常地传递和强化核安全是组织的第一要务的期望。	N/A	
LA. 领导责任制	Leadership Accountability – Leaders demonstrate a commitment to safety in their decisions and behaviours. Executive and senior managers are the leading advocates of nuclear safety and demonstrate their commitment both in word and action. The nuclear safety message is communicated frequently and consistently, occasionally as a stand-alone theme. Leaders throughout the nuclear organisation set an example for safety. Corporate policies emphasise the overriding importance of nuclear safety. 领导问责：领导应在他们的决策和行为中体现对核安全的承诺。公司的高管和高级经理应为核安全的首要倡导者，并在言行中体现他们的承诺。应频繁并一贯地传达核安全的信息，并偶尔用作独立的主题。在安全问题上，整个核单位中的领导都应以身作则。公司政策应强调核安全是重中之重。			
	LA.1	Resources: Leaders ensure that personnel, equipment, procedures and other resources are available and adequate to support nuclear safety. 资源：领导应保证人员、设备、程序和其他资源充足可用以确保核安全。	A.2	Safety is a primary consideration in the allocation of resources. 安全是资源分配时考虑的主要因素。
			B.5	Management ensures that there are sufficient competent individuals. 管理层应保证充足能胜任工作的后备人员。
	LA.2	Field Presence: Leaders are commonly seen in working areas of the plant observing, coaching and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly. 领导下现场：领导应经常出现在电厂的工作区域，检查、指导并加强贯彻标准和期望。如对标准和期望有所偏差，应立即纠正。	B.3	There is visible leadership showing the involvement of management in safety-related activities. 在有关于安全的活动中，应有领导层参与管理。
	LA.3	Incentives, Sanctions and Rewards: Leaders ensure incentives, sanctions and rewards are aligned with nuclear safety policies and reinforce behaviours and outcomes that reflect safety as the overriding priority. 激励、处罚与奖励措施：领导应确保激励、处罚、奖励措施与核安全政策、强化行为以及结果保持一致，后者应能体现核安全高于一切。	D.6	Factors affecting work motivation and job satisfaction are considered. 考虑影响工作动机和工作满意度的因素。
	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 战略性安全承诺：领导应确保核电厂的重心能体现核安全高于一切。	A.3	The strategic business importance of safety is reflected in the business plan. 战略业务安全的重要性要体现在业务策略中。
			B.1	Senior management is clearly committed to safety. 高级管理层要明确对安全负责。
			B.2	Commitment to safety is evident at all management levels. 各管理层要对安全负责。
			C.1	An appropriate relationship with the regulatory body exists, which ensures that the accountability for safety remains with the licensee. 同管理机构保持联系，确保或许可人对安全负责。

Trait 特点	Attribute 特性	Description 描述	IAEA 国际原子能机构	Description 描述
	LA.5	Change Management: Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority. 变革管理：领导进行系统化改进来评估实施改变，核安全仍是重中之重。	B.7	Safety implications are considered in change management processes. 潜在安全问题应在变革管理过程中考虑进去。
	LA.6	Roles, Responsibilities and Authorities: Leaders clearly define roles, responsibilities and authorities to ensure nuclear safety. 角色、职责与权限：领导明确定义角色、职责和权限来保证核安全。	C.2	Roles and responsibilities are clearly defined and understood. 角色和职责应明确定义和理解。
			C.4	Management delegate responsibility with appropriate authority to enable clear accountabilities to be established. 管理层委托责任给合适权力人员或部门，确立明晰的责任。
	LA.7	Constant Examination: Leaders ensure that nuclear safety is constantly scrutinised through a variety of monitoring techniques, including assessments of nuclear safety culture. 持续检查：领导应确保通过各种监督手段（比如核安全文化评估）对电厂的核安全状况进行持续检查。	N/A	
	LA.8	Leader Behaviours: Leaders exhibit behaviours that set the standard for safety. 领导行为：领导行为应成为维护核安全的准则。	D.7	Good working conditions exist with regard to time pressures, work load and stress. 良好工作条件包括进度压力、工作量和压力。
DM. 决策制定	Decision-Making – Decisions that support or affect nuclear safety are systematic, rigorous and thorough. Operators are vested with the authority and understand the expectation, when faced with unexpected or uncertain conditions, to place the plant in a safe condition. Senior leaders support and reinforce conservative decisions. 决策制定：能保证或者影响核安全的决策应是系统的、缜密的、彻底的。运营商应得到授权并认识到如下情况：当面临非预期或不确定的情况时，应使电场处于安全条件下。高层领导应支持并强化这种保守的决策。			
	DM. 1	Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. 程序一致：个人应运用一致的、系统的方法做决策，同时应将风险预测视作合理行为。	A.5	A proactive and long-term approach to safety issues is shown in decision making. 为保障安全，积极长期性途径要在决策制定中表现出来。
	DM. 2	Conservative Bias: Individuals use decision-making practices that emphasise prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. 保守偏见：个人通过决策制定的方式来强调谨慎的选择优于允许性选择。提出的行动应是安全可行的，而不是不安全要停止的。	N/A	
	DM. 3	Accountability for Decisions: Single-point accountability is maintained for nuclear safety decisions. 决策责任：核安全决策中应保持单点责任制。	N/A	
WE. 工作环境	Respectful Work Environment – Trust and respect permeate the organisation, creating a respectful work environment. A high level of trust is established in the organisation, fostered, in part, through timely and accurate communication. Differing professional opinions are encouraged, discussed and resolved in a timely manner. Employees are informed of steps taken in response to their concerns. 良好的工作环境— 组织内充满信任和尊重造就良好的工作环境。组织内高度信任一部分是通过及时准确交流建立、培养的。鼓励不同专业意见，并及时讨论解决。员工们会获知他们所关心问题的进展。			
	WE. 1	Respect is Evident: Everyone is treated with dignity and respect. 表现尊重：每个人都应得到尊重。	N/A	
	WE. 2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。	A.6	Safety conscious behaviour is socially accepted and supported (both formally and informally). 具有安全意识的行为得到广泛接受和支持（正式和非正式）。
			B.6	Management seeks the active involvement of individuals in improving safety. 管理层寻求个人积极参与来提高安全。
	WE. 3	High Level of Trust: Trust is fostered among individuals and work groups throughout the organisation. 高度信任：应在整个组织内提高个人与工作组之间的信任。	B.10	Relationships between managers and individuals are built on trust. 经理和个人的关系建立在信任之上。
			D.1	Trust permeates the organisation. 组织内充满信任。
	WE. 4	Conflict Resolution: Fair and objective methods are used to resolve conflicts. 解决冲突：运用公正客观的方法解决冲突。	B.9	Management has the ability to resolve conflicts, as necessary. 管理层必须有能力解决冲突。

Trait 特点	Attribute 特性	Description 描述	IAEA 国际原子能机构	Description 描述
CL. 继续学习	Continuous Learning – Opportunities to continuously learn are valued, sought out and implemented. Operating experience is highly valued and the capacity to learn from experience is well developed. Training, self-assessments and benchmarking are used to stimulate learning and improve performance. Nuclear safety is kept under constant scrutiny through a variety of monitoring techniques, some of which provide an independent "fresh look". 持续学习：应重视、寻求并实现持续学习的机会。应高度重视运行经验，充分开发从经验中学习的能力。应通过自我评价、培训以及同行业标准比较来促进学习并提高绩效。应通过各种监测技术不断审查核安全，而其中一些技术将提供一个独立或全新的视角。			
	CL.1	Operating Experience: The organisation systematically and effectively collects, evaluates and implements lessons from relevant internal and external operating experience information, in a timely manner. 运行经验：组织应系统、有效、及时地收集、评估和实施相关内部外部运行经验信息。	E.4	Organisational and operating experience (both internal and external to the facility) are used. 使用组织和运行经验（包括设施的内外部经验）。
	CL.2	Self-Assessment: The organisation routinely conducts self-critical and objective assessments of its programmes, practices and performance. 自我评估：组织定期对其项目、实施和成绩进行自我批评和客观评价。	E.3	Internal and external assessments, including self-assessments, are used. 使用内外部评估及自我评估。
	CL.3	Benchmarking: The organisation learns from other organisations to continuously improve knowledge, skills and safety performance. 同行业标准比较：本单位应向其他单位学习，以不断提高自身知识、技能与安全性能。	N/A	
	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 训练：用高质量训练保证工人知识储备和核安全的高标准。	B.4	Leadership skills are systematically developed. 有计划地有系统地发展领导技能。
			D.5	Individuals have the necessary knowledge and understanding of the work processes. 个人要了解工作程序，要具备必要的知识。
			E.7	There is systematic development of individual competences. 有计划、有系统地开发个人能力。
PI. 问题识别	Problem Identification and Resolution – Issues potentially impacting safety are promptly identified, fully evaluated and promptly addressed and corrected, commensurate with their significance. The identification and resolution of a broad spectrum of problems is used to strengthen safety and improve performance. 问题识别和解决—根据问题的重要性 ，及时发现、全面评估、迅速处理改正对安全有潜在影响的问题。一系列广泛问题的识别和解决能增强安全、提升表现。			
	PI.1	Identification: The organisation implements a corrective action programme with a low threshold for identifying issues. Individuals identify issues completely, accurately and in a timely manner, in accordance with the programme. 识别：组织在问题识别上实行低门槛的纠正措施计划。个人根据该计划对问题进行全面、准确、及时识别。	E.2	Open reporting of deviations and errors is encouraged. 鼓励公开报道偏差和错误。
			E.5	Learning is facilitated through the ability to recognise and diagnose deviations, to formulate and implement solutions and to monitor the effects of corrective actions. 发现、判断偏离，明确表达和实施解决方案，监控改正后效果有利于学习。
	PI.2	Evaluation: The organisation thoroughly evaluates issues to ensure that problem resolutions and solutions address causes and extents of conditions, commensurate with their safety significance. 评估：根据安全问题的重要性，单位应对问题进行全面评估以保证问题分析和解决方案能全面从根本上解决问题。	N/A	
	PI.3	Resolution: The organisation takes effective corrective actions to address issues in a timely manner, commensurate with their safety significance. 解决：根据安全问题的重要性，单位应采取有效的纠正措施及时解决问题。	N/A	
	PI.4	Trending: The organisation periodically analyses information from the corrective action programme and other assessments in the aggregate to identify adverse trends or conditions. 趋势分析：对于纠正计划以及总体计划中其他评估里的信息，单位应定期分析，以识别不良趋势或情况。	E.6	Safety performance indicators are tracked, trended, evaluated and acted upon. 对安全性能指标进行跟踪，并开展趋势分析、评估并开发纠正行动。

Trait 特点	Attribute 特性	Description 描述	IAEA 国际原子能机构	Description 描述
RC. 提出忧虑	Environment for Raising Concerns – A safety-conscious work environment (SCWE) is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment or discrimination. The station creates, maintains and evaluates policies and processes that allow personnel to freely raise concerns. 提升关注的大环境— 维持一个具有安全意识的工作环境（SCWE），职员可以自由提出对于安全问题的忧虑，而不受报复、恐吓、骚扰和歧视。该站营造、保持并对允许职员提出安全问题忧虑的政策和过程进行评估。			
	RC.1	SCWE Policy: The organisation implements a policy that supports individual rights and responsibilities to raise safety concerns and does not tolerate harassment, intimidation, retaliation or discrimination for doing so. SCWE政策：组织应有效实施维护个人权利、保证个人责任的政策，提高对核安全的关注，确保员工不会为此受到骚扰、恐吓、报复或歧视。	N/A	
	RC.2	Alternate Process for Raising Concerns: The organisation implements a process for raising and resolving concerns that is independent of line management influence. Safety issues may be raised in confidence and are resolved in a timely and effective manner. 提出问题的备用流程：组织应具备不受各级管理层影响的提出问题和解决问题的流程，非公开地提出安全问题并及时有效地解决问题。	N/A	
WP. 工作程序	Work Processes – The process of planning and controlling work activities is implemented so that safety is maintained. Work management is a deliberate process in which work is identified, selected, planned, scheduled, executed, closed and critiqued. The entire organisation is involved in and fully supports the process. 工作流程：应执行工作活动的规划和控制流程，以维护核安全。工作管理是一项慎重的流程，在其中对工作进行确定、选择、规划、安排、执行、中止以及评论。整个单位都应参与到工作管理流程中，并对其完全支持。			
	WP. 1	Work Management: The organisation implements a process of planning, controlling and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work. 工作管理：工作管理：单位应执行工作活动的规划、控制和执行流程，以确保核安全是高于一切的首要目标。工作流程包括对工作中风险的识别和管理。	D.4	The quality of processes, from planning to implementation and review, is good. 从计划、实施到回顾，工作程序的质量过关。
	WP. 2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。	N/A	
	WP. 3	Documentation: The organisation creates and maintains complete, accurate and up-to-date documentation. 文档：组织要创建、保存完整、准确和最新的文档。	D.3	The quality of documentation and procedures is good. 文档和执行过程质量过关。
	WP. 4	Procedure Adherence: Individuals follow processes, procedures and work instructions. 程序遵守：个人应正确遵守流程、程序以及工作指南。	N/A	

NOTE:
注解：

1. The following were not incorporated because of their broad nature:

1. 以下条款定义宽泛，因此不包涵在表格中。

A.1 The high priority given to safety is shown in documentation, communications and decision-making.

A.1 在文档、交流通信和决策制定中要高度体现安全的重要性。

D.2 Consideration for all types of safety, including industrial safety and environmental safety, and of security is evident.

D.2 工业安全和环境安全等各类安全问题以及保密性要得到考虑和重视。

6 表6：IAEA特点-特征

IAEA 国际原子能机构	Description 描述	WANO 世界核电运营者协会	Description 描述
A.2	Safety is a primary consideration in the allocation of resources. 资源配置中把安全作为首要考虑因素。	LA.1	Resources: Leaders ensure that personnel, equipment, procedures and other resources are available and adequate to support nuclear safety. 资源：领导应保证人员、设备、程序和其他资源充足可用以确保核安全。
A.3	The strategic business importance of safety is reflected in the business plan. 战略业务安全的重要性要体现在业务策略中。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 战略性安全承诺：领导应确保工厂的首要目标一致，并能体现核安全是高于一切的首要任务。
A.4	Individuals are convinced that safety and production go hand in hand. 个人应相信安全和生产密切相关。	PA.2	Job Ownership: Individuals understand and demonstrate personal responsibility for the behaviours and work practices that support nuclear safety. 主人翁精神：每个员工需要理解并在维护核安全的行为和工作实践中展现个人责任感。
A.5	A proactive and long term approach to safety issues is shown in decision making. 为保障安全，积极长期性途径要在决策制定中表现出来。	DM.1	Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated, as appropriate. 程序一致：个人应运用一致的、系统的方法做决策，同时应将风险预测视作合理行为。
A.6	Safety conscious behaviour is socially accepted and supported (both formally and informally). 具有安全意识的行为得到广泛接受和支持（正式和非正式）。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
B.1	Senior management is clearly committed to safety. 高级管理层要明确对安全负责。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 战略性安全承诺：领导应确保工厂的首要目标一致，并能体现核安全是高于一切的首要任务。
B.2	Commitment to safety is evident at all management levels. 各管理层要对安全负责。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 战略性安全承诺：领导应确保工厂的首要目标一致，并能体现核安全是高于一切的首要任务。
B.3	There is visible leadership showing the involvement of management in safety-related activities. 在有关于安全的活动中，应有领导层参与管理。	LA.2	Field Presence: Leaders are commonly seen in working areas of the plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly. 领导下现场：领导应经常出现在电厂的工作区域，检查、指导并加强贯彻标准和期望。如对标准和期望有所偏差，应立即纠正。
B.4	Leadership skills are systematically developed. 有计划地有系统地发展领导技能。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 训练：高质量训练保证工人知识储备和核安全的高标准。
B.5	Management ensures that there are sufficient competent individuals. 管理层应保证充足能胜任工作的后备人员。	LA.1	Resources: Leaders ensure that personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety. 资源：领导应保证人员、设备、程序和其他资源充足可用以确保核安全。
B.6	Management seeks the active involvement of individuals in improving safety. 管理层寻求个人积极参与来提高安全。	WE.2	Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions and raise questions. Differing opinions are respected. 重视意见：应鼓励个人表达顾虑、提供建议、提出问题。尊重不同的意见。
B.7	Safety implications are considered in change management processes. 潜在安全问题应在变革管理过程中考虑进去。	LA.5	Change Management: Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority. 变革管理：领导进行系统化改进来评估实施改变，核安全仍是重中之重。

IAEA 国际原子能机构	Description 描述	WANO 世界核电运营者协会	Description 描述
B.8	Management shows a continual effort to strive for openness and good communication throughout the organisation. 管理层要始终在整个组织间进行公开良好的交流。	CO.3	Free Flow of Information: Individuals communicate openly and candidly, both up, down and across the organisation, and with oversight, audit and regulatory organisations. 信息自由流通：个人在整个组织内可自由坦诚地与上下级以及监督、审核和监管机构沟通。
B.9	Management has the ability to resolve conflicts as necessary. 管理层必须有能力解决冲突。	WE.4	Conflict Resolution: Fair and objective methods are used to resolve conflict. 解决冲突：运用公正客观的方法解决冲突。
B.10	Relationships between managers and individuals are built on trust. 经理和个人的关系建立在信任之上。	WE.3	High Level of Trust: Trust is fostered among individuals and work groups throughout the organisation. 高度信任：应在整个组织内提高个人与工作组之间的信任。
C.1	An appropriate relationship with the regulatory body exists, which ensures that the accountability for safety remains with the licensee. 同管理机构保持联系，确保或许可人对安全负责。	LA.4	Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. 战略性安全承诺：领导应确保工厂的首要目标一致，并能体现核安全是高于一切的首要任务。
C.2	Roles and responsibilities are clearly defined and understood. 角色和职责应明确定义和理解。	LA.6	Roles, Responsibilities and Authorities: Leaders clearly define roles, responsibilities and authorities to ensure nuclear safety. 职务、职责与权限：领导应明确规定自身作用、职责与权限，以确保核安全。
C.3	There is a high level of compliance with regulations and procedures. 严格遵守规章条例和程序。	PA.1	Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organisation exercise accountability for shortfalls in meeting standards. 标准：个人应理解遵守核标准的重要性，各级组织若未能达到标准应负责任。
C.4	Management delegate responsibility with appropriate authority to enable clear accountabilities to be established. 管理层委托责任给合适权力人员或部门，确立明晰的责任。	LA.6	Roles, Responsibilities, and Authorities: Leaders clearly define roles, responsibilities, and authorities to ensure nuclear safety. 角色、职责和权限：领导明确定义角色、职责和权限来保证核安全。
C.5	'Ownership' for safety is evident at all organisational levels and for all individuals. 各级组织和所有个人需对安全负责。	PA.2	Job Ownership: Individuals understand and demonstrate personal responsibility for the behaviours and work practices that support nuclear safety. 主人翁精神：每个员工需要理解并在维护核安全的行为和工作实践中展现个人责任感。
D.1	Trust permeates the organisation. 组织内充满信任。	WE.3	High Level of Trust: Trust is fostered among individuals and work groups throughout the organisation. 高度信任：应在整个组织内提高个人与工作组之间的信任。
D.3	The quality of documentation and procedures is good. 文档和执行过程质量过关。	WP.3	Documentation: The organisation creates and maintains complete, accurate and up-to-date documentation. 文档：组织要创建、保存完整、准确和最新的文档。
D.4	The quality of processes, from planning to implementation and review, is good. 从计划、实施到回顾，工作程序的质量过关。	WP.1	Work Management: The organisation implements a process of planning, controlling and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work. 工作管理：工作管理：单位应执行工作活动的规划、控制和执行流程，以确保核安全是高于一切的首要目标。工作流程包括对工作中风险的识别和管理。
D.5	Individuals have the necessary knowledge and understanding of the work processes. 个人要了解工作程序，要具备必要的知识。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 训练：用高质量训练保证工人知识储备和核安全的高标准。
D.6	Factors affecting work motivation and job satisfaction are considered. 考虑影响工作动机和工作满意度的因素。	LA.3	Incentives, Sanctions and Rewards: Leaders ensure incentives, sanctions and rewards are aligned with nuclear safety policies, and reinforce behaviours and outcomes that reflect safety as the overriding priority. 激励、处罚与奖励措施：领导应确保激励、处罚、奖励措施与核安全政策、强化行为以及结果保持一致，后者应能体现核安全高于一切。
D.7	Good working conditions exist with regard to time pressures, work load and stress. 良好工作条件包括进度压力、工作量和压力。	LA.8	Leader Behaviours: Leaders exhibit behaviours that set the standard for safety. 领导行为：领导行为应成为维护核安全的准则。

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D.8	Cross-functional and interdisciplinary cooperation and teamwork are present. 要体现跨领域、跨学科的合作。	PA.3	Teamwork: Individuals and work groups communicate and coordinate their activities within and across organisational boundaries to ensure nuclear safety is maintained. 团队合作：个人及工作组相互交流合作且不应以组织为界限来确保核安全。
D.9	Housekeeping and material conditions reflect commitment to excellence. 材料状况及整洁度反应与卓越绩效的遵守程度。	PA.1	Standards: Individuals understand the importance of adherence to nuclear standards. All levels of the organisation exercise accountability for shortfalls in meeting standards. 标准：个人应理解遵守核标准的重要性，各级组织若未能达到标准应负责任。
E.1	A questioning attitude prevails at all organisational levels. 各级组织应具备质疑的态度。	QA.3	Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they believe something is not correct. 挑战假定：个人若确信某事有误，应对假定提出挑战，并提出相反意见。
E.2	Open reporting of deviations and errors is encouraged. 鼓励公开报道偏差和错误。	PI.1	Identification: The organisation implements a corrective action programme with a low threshold for identifying issues. Individuals identify issues completely, accurately and in a timely manner, in accordance with the programme. 识别：组织在问题识别上实行低门槛的纠正措施计划。个人根据该计划对问题进行全面、准确、及时识别。
E.3	Internal and external assessments, including self-assessments, are used. 使用内外部评估及自我评估。	CL.2	Self-Assessment: The organisation routinely conducts self-critical and objective assessments of its programmes, practices and performance. 自我评估：组织定期对其项目、实施和成绩进行自我批评和客观评价。
E.4	Organisational and operating experience (both internal and external to the facility) are used. 使用组织和运行经验（包括设施的内外部经验）。	CL.1	Operating Experience: The organisation systematically and effectively collects, evaluates and implements lessons from relevant internal and external operating experience information, in a timely manner. 运行经验：组织应系统、有效、及时地收集、评估和实施相关内外部运行经验信息。
E.5	Learning is facilitated through the ability to recognise and diagnose deviations, to formulate and implement solutions and to monitor the effects of corrective actions. 发现、判断偏离，明确表达和实施解决方案，监控改正后效果有利于学习。	PI.1	Identification: The organisation implements a corrective action programme with a low threshold for identifying issues. Individuals identify issues completely, accurately and in a timely manner, in accordance with the programme. 识别：组织在问题识别上实行低门槛的纠正措施计划。个人根据该计划对问题进行全面、准确、及时识别。
E.6	Safety performance indicators are tracked, trended, evaluated and acted upon. 对安全性能指标进行跟踪，并开展趋势分析、评估并开发纠正行动。	PI.4	Trending: The organisation periodically analyses information from the corrective action programme and other assessments in the aggregate to identify adverse trends or conditions. 趋势分析：对于纠正计划以及总体计划中其他评估里的信息，单位应定期分析，以识别不良趋势或情况。
E.7	There is systematic development of individual competences. 有计划、有系统地开发个人能力。	CL.4	Training: High-quality training maintains a knowledgeable workforce and reinforces high standards for maintaining nuclear safety. 训练：用高质量训练保证工人知识储备和核安全的高标准。
N/A		QA.1	Nuclear Is Recognised as Special and Unique: Individuals understand that complex technologies can fail in unpredictable ways. 认同核技术的特殊性和独特性：个人应认识到，复杂的技术或许会带来出乎意料的故障。
N/A		QA.2	Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. 挑战未知：遇到不确定工况时，个人应停止工作。继续工作前，应进行风险评估和管理。
N/A		QA.4	Avoid Complacency: Individuals recognise and plan for the possibility of mistakes, latent issues and inherent risk, even while expecting successful outcomes. 避免自满情绪： 尽管预期会取得成功的结果，但个人应该承认可能出现的错误、潜在问题和固有风险并做出应对计划。
N/A		CO.1	Work Process Communications: Individuals incorporate safety communications in work activities. 工作过程沟通：个人应将安全沟通纳入工作活动中。

IAEA 国际原子能机构	Description 描述	WANO 世界核电运营者协会	Description 描述
N/A		CO.2	Bases for Decisions: Leaders ensure that the bases for operational and organisational decisions are communicated in a timely manner. 决策依据：领导应确保就运行决策和组织决策的依据及时地进行交流。
N/A		CO.4	Expectations: Leaders frequently communicate and reinforce the expectation that nuclear safety is the organisation's overriding priority. 期望：领导应经常地传递和强化核安全是组织的第一要务的期望。
N/A		LA.7	Constant Examination: Leaders ensure that nuclear safety is constantly scrutinised through a variety of monitoring techniques, including assessments of nuclear safety culture. 持续检查：领导应确保通过各种监督手段（比如核安全文化评估）对电厂的核安全状况进行持续检查。
N/A		DM.2	Conservative Bias: Individuals use decision-making practices that emphasise prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. 保守倾向：相较于容许范围内的决策做法，个人应使用强调谨慎选择的决策做法。例如，实施一项提议措施前应确认它是安全的，不能在开始后确认其具有危险性而中止措施。
N/A		DM.3	Accountability for Decisions: Single-point accountability is maintained for nuclear safety decisions. 决策问责：核安全决策中应保持个人或单点问责制度。
N/A		WE.1	Respect is Evident: Everyone is treated with dignity and respect. 表现尊重：每个人都应享有尊严与尊重。
N/A		CL.3	Benchmarking: The organisation learns from other organisations to continuously improve knowledge, skills and safety performance. 同行业标准比较：本单位应向其他单位学习，以不断提高自身知识、技能与安全性能。
N/A		PI.2	Evaluation: The organisation thoroughly evaluates issues to ensure that problem resolutions and solutions address causes and extents of conditions commensurate with their safety significance. 评估：根据安全问题的重要性，单位应对问题进行全面评估以保证问题分析和解决方案能全面从根本上解决问题。
N/A		PI.3	Resolution: The organisation takes effective corrective actions to address issues in a timely manner, commensurate with their safety significance. 解决：根据安全问题的重要性，单位应及时采取有效的纠正措施解决问题。
N/A		RC.1	SCWE Policy: The organisation implements a policy that supports individual rights and responsibilities to raise safety concerns, and does not tolerate harassment, intimidation, retaliation or discrimination for doing so. SCWE政策：组织应有效实施维护个人权利、保证个人责任的政策，提高对核安全的关注，确保员工不会为此受到骚扰、恐吓、报复或歧视。
N/A		RC.2	Alternate Process for Raising Concerns: The organisation implements a process for raising and resolving concerns that is independent of line management influence. Safety issues may be raised in confidence and are resolved in a timely and effective manner. 提出问题的备用流程：组织应具备不受各级管理层影响的提出问题和解决问题的流程，非公开地提出安全问题并及时有效地解决问题。

IAEA 国际原子能机构	Description 描述	WANO 世界核电运营者协会	Description 描述
N/A		WP.2	Design Margins: The organisation operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defence-in-depth and safety-related equipment. 设计裕度：该组织应在设计裕度的范围内运行和维护设备。设计裕度的制定与改变需要经过系统严格的过程。要特别注意维护安全屏障、纵深防御以及与安全相关的设备。
N/A		WP.4	Procedure Adherence: Individuals follow processes, procedures and work instructions. 程序遵守：个人应正确遵守流程、程序以及工作指南。

NOTE:

注解：

1. The following were not incorporated because of their broad nature:

1. 以下条款定义宽泛，因此不包涵在表格中。

A.1 The high priority given to safety is shown in documentation, communications and decision-making.

A.1 在文档、交流通信和决策制定中要高度体现安全的重要性。

D.2 Consideration for all types of safety, including industrial and environmental, and of security, is evident.

D.2 工业安全和环境安全等各类安全问题以及保密性要得到考虑和重视。

4 中核集团核安全文化同行评估实践

中核集团核安全文化同行评估实践

1、背景

美国核动力运行研究所（INPO）与世界核电运营者协会（WANO）是最早开展核安全文化同行评估的国际组织。2002年，美国Davis-Besse核电厂压力容器顶盖降级，压力容器控制棒驱动机构附近严重腐蚀，潜在后果非常严重。但该核电厂在历年的美国核管会（NRC）检查和INPO的评估中，均显示该核电厂运行业绩优秀。INPO在后续发布的重要运行经验报告（SOER）中分析指出，该电站在核安全文化领域存在缺陷，是导致该事件发生的根本原因，并在重大运行事件经验反馈中要求美国各核电厂开展核安全文化评估。WANO随后也发布了该SOER。

2004年和2005年，美国电站联盟（USA）发起了一系列的核电厂安全文化自评估活动，旨在满足WANO发布的重大运行事件经验反馈（SOER）02-4第0版和第1版第二条纠正行动的要求。核安全文化评估活动同时用于满足美国核管委（NRC）修订后的反应堆监督流程（ROP）中有关核安全文化领域的要求。

核安全文化评估的目的是确定一个核电厂核安全文化的优秀程度、对核安全的正确关注和核安全是否不受生产的影响。评估强调保持对核安全持续关注的领导力、行为和方法。核安全文化的评估模式、评估流程和评估结果均对照WANO卓越核安全文化八大原则和特征提出。

2、国内开展核安全文化评估方面的实践

在国际核安全文化评估的大背景下，自2009年起，中国核工业集团公司委派中国核能电力股份有限公司（以下简称“中国核电”）集中集团优势力量开展了核安全文化建设研究，并于国内外权威机构就核安全文化评估体系的建立进行了广泛的交流合作，在借鉴美国核动力运行研究所（INPO）核安全文化评估方法的基础上，将卓越核安全文化准则进行本土化，推出了用于指导中核集团开展核安全文化推广与同行评估的《核安全文化八大原则》，并在中核集团已建立一套完整的评估体系在所属电厂予以实施，主要概况如下：

（1）2011年8月，中国核电组织了对中国大陆首座核电站——秦山核电厂（现为中核运行一厂）的核安全文化评估，这也是国内首次核安全文化专项评估，为实现核安全文化的可知、可评、可测进行了积极探索。为保证评估活动的顺利进行，中国核电在评估前举行了WANO核安全文化评估培训班，来自美国核动力运行研究所（INPO）和WANO东京中心的专家进行了授课。在现场四天的评估时间中，评估队通过问卷调查、查阅文件包、人员访谈、会议观察以及集中分析讨论等形式，并依据卓越核安全文化八大原则，对电厂进行了全面客观的核安全文化评估。

（2）2012年7月，中国核电组织对江苏核电有限公司进行了核安全文化评估。本次评估活动在总结对秦山核电厂评估经验的基础上，在评估方式、访谈人员选取范围和比例等方面进行了改进。通过此次评估，也使核安全文化评估导则和手册更加成熟，逐步形成中国核电品牌要素之一。

（3）2013年11月，中国核电组织开展了对成员公司的第三次核安全文化评估，即对中核核电运行管理有限公司运行、维修两个领域的核安全文化评估。也探索了核安全文化评估拓展到领域评估的方向，实现了核安全文化评估的多维度发展。

（4）2013年12月，中核辽宁核电有限公司在中国核电的支持下，开展了核安全文化自评估，本次自评估证明了国内核安全文化的评估体系可有效运用于电厂安全文化的自评，是国内在建核电厂通过内部安全文化自评估提升安全文化水平的首次尝试。

3、评估过程中发现的主要特征

目前，随着我国运行核电机组的增长，核安全文化建设的需求也不断突出，近期我国核电运行和建设过程中也发生了一些事件（如某核电建设期间脚手架倒塌，导致人员伤亡、某核电厂建设期间主管道焊接错误，导致不符合项并返工、某运行核电厂大修期间失去厂外电源，机组进入应急、某运行核电厂大修期间，安全注入系统动作等）。这些事件在很大程度上与核电厂的核安全文化直接相关，核电厂核安全文化的好坏，直接影响建设业绩和安全运营业绩。上述事件也凸显了以下的特点：

1）核安全文化稀释：随着核电快速发展，对核专业人员需求量也越来越大。大量外部非核领域人员加入，包括燃煤电厂员工、非核领域承包商、农民工，稀释了核电企业原有的核安全文化。更有甚者，少数人提出核电运营“去核化”，鉴于核技术的特殊性和独特性，我们必须保证核电运行的特殊性和独特性特点得到充分的认识和理解。

2）核安全文化的流失：根据国家核电规划，每年计划有6-8个核电机组开工建设，预计到2015年底，中国将有40余台核电机组同时开工建设，超过法国1979年时32台机组同时建设的高峰数量。大量运行机组的有经验人员流失，同时带走的也是已经形成的核安全文化和氛围，减弱了核安全文化“磁场的强度”。

3）核安全文化的冲突：在大量外部非核领域人员加入和核电骨干人员稀释的情况下，原有核安全文化和常规电厂安全文化之间不可避免的出现文化上的冲突。许多非核领域工作人员没有意识到核技术的特殊性和独特性。

评估过程中发现，虽然各国际组织与核电运营单位非常重视核安全文化，但由于对核安全文化理解存在偏差，间接削弱了核安全文化指导工作的力量。因此，有必要将核安全文化评估从粗犷的定性判断逐渐转入更为细致的定量评价，找出核电企业核安全文化建设弱项，及时提出整改行动计划并加以落实。从而实现对核电企业核安全文化健康状况的定期“体检”，实现核安全文化健康状态的可评、可测和可知，促进核电厂安全运营业绩持续提升。

5 参加IAEA30年运行安全评审服务改进技术会议的总结报告

参加IAEA30年运行安全评审服务改进技术会议的总结报告

中国核能行业协会　龙茂雄

2013年是国际原子能机构（IAEA，简称机构）开展运行安全评审服务（OSART）30周年。30年前机构在韩国古里核电站组织了第一次OSART评审，30年后，机构于2013年10月29日至11月1日再次来到韩国釜山，组织召开IAEA30年运行安全评审服务改进的技术会议。来自机构、中、美、法、日、韩及世界核电运营者协会（WANO）等20余个国家和国际组织的50余位专家参加了会议，经国防科工局系统二司的推荐，中国核能行业协会龙茂雄及来自大亚湾核电运行公司的两名专家参加了本次会议。会议主席为瑞典的一名资深核电专家。

一、OSART基本情况

OSART是IAEA为各成员国提供评审的服务，旨在通过同行评估的方式提升各成员国核电厂的安全水平。OSART同行评估主要依据IAEA安全标准、国际良好实践，通过现场巡视、访谈、观察、查阅文件，为受评方在核安全方面存在的问题提出改进的意见与建议。受评方根据评审结果制定整改计划，整改完成后，机构将组织回访队进行跟踪回访。OSART评估活动后，IAEA不会就安全业绩情况将受评核电厂与其他核电厂进行排名比对。

OSART活动的服务对象主要为核电厂及其他核设施。OSART评估应由各成员国政府进行申请，评估后政府机构将收到评估报告，通常各国政府可根据需要将报告向社会公布，以提升公众对核电的信任程度。机构其他成员国，可通过OSMIR数据库了解到各核电厂实施OSART评估的情况，其中包括改进措施建议及各核电厂管理强项。IAEA还将根据OSART评估发现的核电运行的问题与良好实践对其出版的安全准则、标准等文件进行修改与升版，并根据核电厂遇到的共性问题开展相关活动。

2011年3月，日本发生了福岛核事故。为此，IAEA于同年召开了核安全部长级大会，并制定了《IAEA核安全行动计划》。《行动计划》指出，“各拥有核电厂的成员国，应自愿在未来3年举行至少一次的OSART评估。OSART首次对长期运行的核电厂进行关注。”

从1983年到2013年10月，IAEA已在世界34个国家开展了176次OSART评估活动，其中包括130次运行核电厂OSART评估、22次Pre-OSART评估活动。法国共接受了25次评估，是接受机构评估最多的国家，法国代表还表示，今后每年法国19座核电厂将至少接受1次OSART评估。我国自从1989年秦山一期核电厂接受OSART同行评估以来，截止2013年8月中核集团、中广核集团核电厂已接受了11次OSART、Pre-OSART评估（含回访活动），涉及了M310、CNP300、CPR1000、VVER等多种堆型。

二、会议主要内容与参会情况

会议在回顾了2011年OSART改进会议提出的有关意见和建议的落实情况后，主要分为三个部分展开。一是机构官员的专题报告，二是成员国代表做报告，三是分组讨论。

（一）机构专题报告。机构官员分别就IAEA核安全行动计划，最近OSART评估结果与经验，OSART评估的成就与未来，面向电力公司的OSART评估，IAEA综合核基础结构评估服务（INIR）等作了详细报告，较全面地介绍了机构在福岛事故后制定的核安全行动计划，2010-2012年开展的OSART评估活动经验，以及机构在加强OSART服务方面的新想法和举措等。

（二）成员国代表报告。来自法国、瑞典、中国、日本、韩国、捷克等成员国代表作了报告，介绍本国接受OSART评估的经验。我代表中国参会人员作了报告，主要介绍了我国核电厂同行评估及经验交流委员会（简称委员会）的基本情况，协会（委员会）开展运行同行评估和建设项目同行评估的经验等，受到与会代表的关注，机构官员在会后专门向我索取协会编写的《核电建设项目同行评估业绩目标与准则》，美国INPO代表则希望与中方开展建设评估的交流与合作。

（三）分组讨论。会议代表分成两个组，分别以OSART评估改进和核安全文化为议题进行讨论。我参加了OSART评估改进讨论组。在讨论过程中，我结合二司委托的OSART研究课题，向会议提出了以下意见和建议：一是建议OSRAT报告能照顾到受评电厂整改的需要，在总体评估报告的基础上，提供一份侧重于技术性描述的报告，给受评电厂整改用；二是机构在针对非英语国家组织的评估，为克服语言和文化上的差异，建议机构多与所在国评估组织或其它核电厂合作，采用联合评估的方式进行；三是注意评估后对受评电厂的技术支持，并可组织受评电厂到同类业绩优秀的核电厂进行对标访问。会议主席在进行会议总结时，向机构建议，今后组织OSART评估时，要考虑与所在国评估组织进行合作，以便提升评估效果。

会议还安排代表参观了韩国古里核电站。

三、体会与建议

这是我第一次参加机构OSART方面的会议。由于核电厂同行评估与经验交流是协会成立以后的一项核心业务，我作为该项工作组织者之一，比较熟悉国内的核电厂同行评估工作。通过参加本次会议，比较深入地了解OSART评估的目的、主要内容、评估标准和成果，学习了OSART评估的成功经验，对于推动国内同行评估工作的改进和提高很有帮助。另有如下建议供参考。

（一）希望政府部门和核电集团更加重视同行评估工作。核电厂同行评估是美国三厘岛核事故，尤其是前苏联切尔诺贝利核事故后，国际核电同行为加强核电安全性而开发的一项富有针对性和实际意义的工作方法。机构OSART是同行评估的先行者，几十年来，评估产品早已超出电厂安全评估范畴，既有对监管当局的评估服务，也有对电力公司的评估服务；既有对运行核电厂的评估，也有对投运前电厂的评估。近年来，机构加强了对核电新兴国家开展核电基础结构的评估服务，福岛事故后，更有针对性地提出要关注长时间未建核电厂国家和核电新兴国家的新项目投运前的评估，以及快到设计寿命核电厂的评估。客观地看，机构的各类评估确实会增加受评方的负担，但实际效果还是显著的。希望我国相关政府部门和核电营运者能够重视同行评估，主动接受和安排同行评估。同时，随着我国核电厂越来越多，建议相关政府部门和核电集团应提前规划，有计划有步骤的向机构申请同行评估。

（二）积极推动与机构的联合评估。协会已经有与WANO开展联合评估的经验，未来也将更多地与WANO合作，对国内核电厂提供联合评估服务。希望有关政府部门能够在时机适宜时，积极推动协会与机构的联合评估工作，一方面能够减少受评电厂的负担，另一方面，能够充分发挥机构、协会各自优势，把评估工作做得更深入有效。

（三）多选派合适专家参加机构组织的评估活动。通过参加机构组织的评估活动，不仅可以亲身体会机构评估工作的组织与展开情况，还可以深入了解受评方的经验教训和良好实践，有利于我国核电厂的安全运行和业绩提升。

（四）要更多地关注核安全文化的培育与评估。本次会议中机构官员在做专题报告中，强调了核安全文化培育的重要性和现实意义，机构OSART已将核安全文化评估作为福岛事故后新增的评估领域。来自瑞典的代表（会议主席）介绍了该国由于自满于过去几十年良好的运行业绩，忽视安全文化的持续保持与改进，在2006年发生了一次全场断电事故，受到机构、WANO、国内监管当局和公众的广泛关注；韩国的代表更是详细地介绍了2012年古里核电站发生的一起全场断电事故，该事故在一个月后才报告韩国核安全监管当局，事件批露后，在韩国国内外引起对其核安全文化的强烈关注与反思；日本核安全协会（JANSI）的代表则结合福岛核事故经验教训，分析了核安全文化的培育和评估方法。

我国自大亚湾、秦山核电站投运以来，运行核电一直保持了较好的业绩和安全水平。如何让这种良好业绩持续下去，而不成为诱发自满的因素；如何在业内培养一种遵循客观规律、遵照工作程序的良好习惯，而不是片面追求业绩指标的先进；如何在我国核电行业（包括设计、制造、建造、运行、废物处理处置等各方面）内进一步强调核安全文化培育与保持的重要性，并通过务实的核安全文化评估来促进高标准的核安全文化持续改进，显得尤为重要。

最后，再次感谢国防科工局系统工程二司给予的向国际同行学习和交流机会。

二〇一三年十一月

封面图片：秦山核电基地

核电厂同行评估及经验交流委员会秘书处
中国核能行业协会核电评估部 编
地址：北京市西城区车公庄大街12号核建大厦，100037
电话：010-88305806/5866
Email：cnea_pg@163.com