2007 年核安全评论

2007 年核安全评论

IAEA/NSR/2007

国际原子能机构
2008 年 7 月 • 奥地利

前　言

《2007 年核安全评论》报告了世界范围内为加强核安全、辐射安全、运输安全和放射性废物安全以及应急准备所作的努力。

“分析性概述”辅以更详尽的附录：“2007 年世界范围内与安全有关的事件和活动”（附录一）和“国际原子能机构的安全标准：2007 年的活动”（附录二）。

《2007 年核安全评论（草案）》曾以 GOV/2008/2 号文件提交 2008 年 3 月理事会会议。《2007 年核安全评论》的最后文本系根据理事会的讨论结果编写。

正 文 摘 要

在国际原子能机构成立五十周年的 2007 年，核工业的安全实绩总体上依然保持了很高的水平，但所发生的并未对公众健康和安全造成显著影响的事件和事故继续成为新闻头条，并对营运者和监管者构成了挑战。因此，必须保持警惕，继续改进安全文化以及加强运行经验和其他安全经验，包括共享和利用从自然事件中获得的经验。

建立有关核安全、辐射安全、运输安全和废物安全各个方面的基础结构并保持其可持续性仍将是一个高度优先事项。着手启动核电计划的成员国需要成为全球核安全制度的积极参与者。统一安全标准、安全公约缔约方间同行评审机制以及通过网络共享安全知识和最佳实践都是促进持续加强全球核安全制度的关键要素。

技术和科学支助组织无论是监管组织的一部分还是一个独立组织皆通过为安全相关决策和活动提供技术和科学根据而越来越受到重视。有必要加强技术和科学支助组织之间的相互联系和合作。学术界和工业界专家社团在增进安全合作和能力建设方面也发挥了至关重要的作用。

着手启动核电计划的国家和扩大现有计划的国家都必须应对建设一支技术上合格的职工队伍的挑战。积极的知识转让计划是能力建设的关键，特别是鉴于核领域经验丰富的专业人员日趋老龄化而尤其如此。国家和地区安全网络以及最终的全球安全网络将极大地有助于促进这些努力。

世界市场和技术方面的变化正在对核工业和监管者产生前所未有的影响。当前的一项关键性挑战是适当地评定和处理这些变化的安全影响。随着核事业的全球化以及因此对核电厂供应、所有权和运行管理产生的影响，更有必要促进标准的国际一致性和有利于这些标准的适用，以及促进对安全的强有力领导和明确的安全责任。

电厂寿期管理和长期运行的国际经验强调了制订一项全面的寿期方案的必要性，并敦促原子能机构制订有关长期安全运行、定期安全评审和老化管理的安全标准。

近年来，在应急准备方面已经取得了长足的进展。既便如此，大多数成员国仍需要达到和维持一个令人满意的核和放射性应急准备水平，包括为一线响应人员做好准备工作。

地震安全虽不是一个新问题，但最近在日本柏崎核电厂附近发生的地震突显了在选址、新设计和在运行老化核电厂管理中考虑地震潜在后果的必要性。原子能机构向日本派遣了一个专家工作组，并正在建立地震安全、海啸危险评定和减灾管理知识中心，以期传播和共享最新知识并促进其应用，从而加强核安全。

若干新型多功能研究堆已经完成调试或正在进行设计，以作为地区和国际中心使用。安全评定需要涵盖将在这些设施上进行的各种广泛的试验和辐照活动。

由于预计到核电的扩展和新技术的应用，许多成员国将需要扩大其职业放射剂量评定能力，以便考虑所有类型的潜在照射。电子剂量测定作为一种法律上认可的测量所受剂量的方法，其发展也将需要新的方案和标准化。

政府和有关各方对退役以及废物和乏燃料管理的早期规划、充分筹资和长期战略必要性的认识不断增强。有必要建立国家和国际机制，以保存和维护用于确保退役安全的运行知识和经验。

国际上对制订有关各种类型放射性废物的国家放射性废物管理综合政策及实施处置战略抱有兴趣。建立一个全面的放射性废物分类制度很有必要，因此，目前正在对这一领域的原子能机构安全标准进行修订。

由于地质处置库设施的建造已经推迟，乏燃料贮存正变得越来越重要。其结果是，贮存时间被延长，而且正在考虑进行 100 年或更长时间的贮存。

放射性物质运输的安全记录仍然非常出色。拒绝运输放射性物质问题国际指导委员会正在协调为寻找解决拒绝运输相关问题的办法所作的努力。

可能会出现在没有废物和环境安全问题监管基础结构或在这些监管基础结构不充分的情况下进行新的铀矿开采活动的情况。在进行新的活动时，务必要考虑从过去和当前的恢复工作中汲取的经验教训。

目前，各国正越来越关注与核燃料循环或放射性物质传统的工业和医疗应用无关的活动常常产生的含天然来源放射性核素的废物问题。

有必要继续作出努力，用简明的语言与公众明确和及时地交流核问题和辐射问题。

目　录

分析性概述

A. 导言

《2007 年核安全评论》概述了世界范围内在核安全、辐射安全、运输安全和放射性废物安全以及应急准备方面的发展趋势和问题，并突出强调了 2007 年的发展情况。本评论辅以更详尽的附录 [1]。本报告还将讨论核保安问题，但仅在核保安与核安全有关的范围内进行。将以一份单独的报告完整地阐述核保安问题。

B. 全球安全趋势和问题

往往在很长一段时间间隔之后，随着对核电兴趣的增加以及许多成员国正在考虑建造第一座核电厂或扩大其现有核电计划，对安全的追求又成为议程中的首要问题。安全的主要责任在于对产生辐射危险的设施和活动负有责任的人员或组织。各国政府有责任建立和保持有效的法律和政府安全框架。技术可以转让，但安全文化却不能转让，必须要学习和植入这种文化。为了达到这一目的，实施强有力的领导以及建立安全知识和经验全球网络非常重要。国际安全公约和行为准则作为全球核安全制度的基石，为实现高水平安全提供了重要的指导框架和激励机制。遵守原子能机构“基本安全原则”所载总体安全原则不仅能够证明对安全和透明所作的承诺、促进公开交流，而且对于成功实施核计划也至关重要。自满情绪、过度节省费用、不经常报告甚至弄虚作假都是营运者和监管者务必时刻防范的危险。这类事件的一再发生表明了促进强有力的安全文化和经验共享应当始终被视为是一项“正在进行的工作”。

世界市场和技术方面的变化正在对核工业和监管者产生前所未有的影响。在迎接这些变化时，无论核工业界还是监管者传统上都表现得相当保守，因此，今后的一个关键挑战就是适当地评定和处理这些变化带来的安全影响。有必要在快速利用新技术与要求对其安全性进行充分认证和核实之间保持适当的平衡。“第四代倡仪”和“革新型核反应堆和燃料循环国际项目”都继续将安全问题列为新技术开发整体不可或缺的一部分。随着核事业的全球化以及因此对核电厂供应、所有权和运行管理产生的影响，更有必要促进标准的国际一致性和统一并有利于成员国的适用。

加强运行经验和其他安全经验包括克服地震等自然事件影响经验的国际共享和利用仍处在一系列挑战的前沿。虽然核工业的安全实绩总体上依然保持了很高的水平，但在核装置发生的事件和紧急情况或涉及放射性物质的这种事件和情况继续成为新闻提要的内容，并对营运者和监管者构成了挑战。纵然在大多数情况下核或辐射的安全影响或健康效应从技术上看微乎其微，但会影响到公众的认知，因此，挑战仍然是确

---

[1] “2007 年世界范围内与安全有关的事件和活动”（附录一）和“国际原子能机构的安全标准：2007 年的活动”（附录二）。

保维持透明度，进行及时和客观的交流以及在世界范围内汲取和共享经验教训。比任何其他业界都要明显的是，核工业和监管者方面的任何薄弱环节都能产生世界范围的影响。

尽管进行多重防范，但事件和紧急情况仍时有发生，并经常涉及失踪、被盗、受损或被发现的源。核装置上发生的哪怕相对很小的事件都可能引起公众的过度忧虑。当前发生导致产生跨国影响的严重紧急情况的可能性不大。近年来，对恶意使用放射性物质或攻击核装置引发事故或紧急情况的可能性的关切有增无减。在这类事件的初期阶段，通常不知道事件起因是否是偶然、蓄意或因疏忽所致。首要目标是减轻这类事件的放射性后果。但同样重要的是，应通过向公众提供及时、一致和权威性的信息来解决非放射性问题。许多成员国目前尚未做好应对这些紧急情况的充分准备。标准化和统一的方案对于确保在所有国家采取有效的防护行动以保持公众的信任是非常重要的。

目前，有越来越多的成员国已宣布准备建设核电厂和扩大先进核技术的医学应用。可靠的核安全基础结构作为采用或扩大核技术的一个先决条件的重要性怎么强调都不过分。在这种挑战方面面临的事实是，世界上除亚洲以外的大部分地区发展核能的机会都很有限。这已导致高质量的核专家队伍在缩小，核学科的大学毕业生不断减少。即使那些对核建设重燃兴趣的国家也面临着人员配备问题。虽然这些新的机会已产生了把工作人员吸引到核领域中来的激励作用，但在对专家的需求与建立核专家队伍之间仍存在着滞后问题。这种人员基础结构不只是影响到主管业主、营运者和监管者，还触及到研究与发展活动、教育和培训设施以及可靠的知识管理。需要扭转减少核安全和辐射安全领域安全研究资金的趋势。

随着核技术利用预期的增加，勘探、采矿和选冶以及运输活动也在增多。这样做的前提是，所有新活动和增加的活动都要接受适当的监管监督，并对公众有关安全和环境的关切给予充分重视。

解决拒绝运输核材料和放射性物质的问题对于核电和其他核应用的可持续利用仍然至关重要。

乏燃料管理和高放废物处置仍是核电工业面临的一个重大挑战。专家们一致认为，高放废物的地质处置既安全，技术上也可行。就大多数进展很快的项目而言，处置场址已经选定，并正在开展基建前期工作。即便如此，第一座这类设施仍将需要 10 多年的时间才能投入运行。在此期间，发展趋势是建造和利用地上临时贮存设施，许多成员国正在探索进行 100 年或更长时间临时贮存的可行性。在特种类型中低放废物处置相关领域已取得了一些的进展。对寻找更好的安全复用或处置高活度废放射源的方法也表现出了兴趣。

大多数成员国已采取步骤对那些为达到恶意目的利用核材料和核设施实施伤害的行为进行防范。但是，仍有许多工作要做，还需继续为加强核保安作出努力。安全和

保安相互交织，因而为确保保安进行的改革也会对安全产生影响，在一些情况下这种影响是积极的，而在有些情况下则是消极的。至关重要的是，应适当地评定安全改进对保安的影响和保安改进对安全的影响，以便达到适当的平衡和防范各种潜在威胁的最佳水平。国际核安全组正在编写其关于安全/保安协同作用的报告。

C. 安全基础结构

C.1. 趋势和问题

建立有关核安全、辐射安全、运输安全和废物安全各个方面的基础结构并保持其可持续性仍将是一个高度优先事项。即使由外国供应商负责核装置或辐射装置或活动的设计、建造、退役和运行，接受国也有义务确保拥有牢固的基础结构，以便能够保证持续重视安全问题。建立地区和国际网络以共享关于最佳实践信息的工作将在持续改进安全基础结构方面发挥关键的作用。还将出现对核和放射性安全教育和培训的广泛需求。

着手扩大核电计划和扩大利用辐射（如新的放射治疗或核医学计划）的国家将面临日益增加的对监管工作人员的需求，以履行对核设施和辐射设施必要的监管职能（审查许可证申请；进行监管检查；开展环境影响评定等）。启动核电的国家需要拥有并维持适当的辐射安全、废物安全和运输安全国家基础结构，并确保不以现有安全计划为代价将监管工作人员和资源转用于开展新活动。

安全基础结构有许多组成部分，包括法律框架和监管能力、应急准备和响应、受过教育和培训的人力资源、稳定的电网、适当的财政和工业资源以及在电力公司中培育适当的安全文化。简言之，对核电的承诺将带来许多责任，新加入者和扩展的计划必须及时采取适当行动履行这些责任。一些国家正表现出对建设新核电厂的地区性方案的兴趣。这些国家必须铭记以下事实：对安全的主要责任始终由营运者承担，设施所在国将需要拥有独立于任何合同安排的适当安全基础结构。

必须不断努力维护安全基础结构，并防止这种结构的质量随着时间的推移而下降。这种计划的安全实绩值得认真关注。全球各地对老化核装置依赖的增加越来越引起关注。仍有必要加强监测和监督，以保持安全裕度，继续总结、分析和汲取从以往实践中得到的教训，以及发展和强化强有力的安全管理系统和领导作用的重要性。

公众宣传、透明度和公开性是安全的重要方面。它们不仅促使公众更加知情和更多地参与安全计划，而且还有助于提高监管者、许可证持有者和整个核工业的信誉。

C.2. 国际活动

全球核安全制度是促进世界范围内实现高水平安全的框架。这一框架的核心内容是监管机构、许可证持有者和政府开展的各种活动，其目的是确保持续改进安全和加

强基于有法律约束力的安全公约和无法律约束力的行为准则的国际合作。国家安全标准与原子能机构安全标准之间的一致性在这方面尤为重要。

鉴于新加入者提出了大量援助请求，总干事设立了一个核电支助组，以协调原子能机构的基础结构活动，并确保所提供的服务与原子能机构的安全标准和其它相关文件保持一致。

尽管监管仍属于国家的责任，但国际和地区一级有技术针对性的监管论坛可以加强合作和协调，交流信息和最佳实践，并解决共同问题。有必要在加强保安的同时维护或改进安全，这是目前正在得到处理的一个领域。

归根结底，安全是建立在职工队伍和技术专家素质基础之上的。教育、培训以及研究与发展有必要成为加强国际安全合作努力的组成部分。

原子能机构基于原子能机构安全标准和自评定的安全评审服务如“综合监管评审服务”为成员国提供了促进相互学习和改进安全基础结构的重要手段。“综合监管评审服务”能促进更好地协调全球监管方案。业已证明，核工业成熟和经验丰富的国家以及核工业经验不那么丰富的国家都有机会进一步改进其监管系统和活动。对启动核电计划的新国家而言，发展一个全面而有效的法律和监管框架仍然是一项重大挑战。此外，“综合监管评审服务”还正在成为促进适用有法律约束力和无法律约束力的国际文书以及原子能机构安全标准的一个重要机制。安全标准正随着吸取从评审服务访问中得到的经验而持续得到改进，而且仍然是核领域所需高水平安全的国际参照。

C.3. 未来挑战

为了促进有效和高效利用有限的资源，原子能机构将有必要继续收集和分析从工作组访问和国家自评定中取得的数据，以确定国家、地区和全球的趋势和需求。

预期的核电复兴和辐射利用的普遍增加将对监管者和技术支助组织提出更高的要求，如增加对培训专家、开展能力建设以及对工作人员和流动散工进行监督的需求。

尽管核设备和核材料可以买卖和转让，但安全文化和与利用核技术有关的安全知识却必须经过学习，并根植于国家一级的所有活动中。遵守原子能机构颁布的“基本安全原则”应成为确保可持续利用核能和辐射技术的共同目标。

由于为安全相关决策和活动提供技术和科学依据，技术和科学支助组织无论是作为监管机构的一部分还是作为一个独立组织都越来越受到重视。国际计划如原子能机构的国际计划的落实有赖于技术和科学支助组织的积极参与。在这方面，有必要加强技术和科学支助组织之间的相互联系和合作。学术界和工业界专家社团在增进安全合作和能力建设方面也发挥了至关重要的作用。

与部件制造、建设和调试有关的许可证审批程序和监管检查计划将必须迎接新设计和新技术的挑战，核工业越来越多的多国性提出了建设新的更大的监管能力的要

求。对于多年未发放核装置许可证的成员国以及第一次考虑核方案的成员国而言，这可能都是一个特殊问题。

核发展计划可能面临制造能力、工程设计、建造和调试专门知识方面的严峻挑战。核安全和辐射安全界的人力资源在逐步老化。需要作出各种努力，以制订出发展和转让所有这些领域的知识的有效程序，并确保大学和研究机构的资源得以保存和可供使用。

D. 事件和紧急情况的应急准备、报告和响应

D.1. 趋势和问题

随着利用核能的预期上升和提高对加强涉及核材料和其他放射性物质的犯罪或恐怖活动可能产生的紧急情况应对安排必要性的认识，成员国正越来越多地将重点集中在应急准备上，特别是集中在基础结构和职能部分以及国际一致的运行标准上。

然而，许多成员国尚未做好应对这种紧急情况的充分准备。此外，如果没有共同方案或国际一致的运行标准，防护行动就可能因国而异，其结果是在公众中造成混乱和不信任并干扰恢复作业，从而有可能导致严重的社会经济和政治后果。

全球各地继续发生各种事件和紧急情况。2007 年，原子能机构的事件和应急中心得到或知悉 140 起涉及或怀疑涉及电离辐射事件的报告。原子能机构对 25 起事件采取了行动，如与外部对口方一道鉴别和核实信息，分享和提供正式信息或提供原子能机构服务。例如在 11 月，原子能机构应洪都拉斯当局的请求安排由美国提供地区性援助，以协助回收废金属货物集装箱中发现的一个放射源。工业射线照相术的应用特别是不遵守规定程序继续成为与 2007 年相关事件有关的辐射照射的主要原因。

2007 年，为了进一步巩固成员国在应急准备和响应领域加强合作和紧密团结协作的趋势，成员国举行了各种多边会议。例如，法国报告与邻国（比利时、德国、卢森堡、西班牙和瑞士）为制订应急准备和响应安排举行了多次双边和多边会议。芬兰和瑞典的核当局则启动了一项双边合作计划。

为了帮助成员国发展适当的响应能力，至关重要的是提供易于修改后供当地使用的切实可行的详细程序（并开展相关培训）。原子能机构与共同倡议组织国际消防技术委员会、泛美卫生组织和世卫组织一道出版了《放射性应急一线响应人员手册》[2]。该手册为将在发生放射性紧急情况头几个小时内做出响应的人员以及将支持早期响应活动的国家官员提供了实际指导。

---

[2] http://www-ns.iaea.org/tech-areas/emergency/emergency-response-actions.asp。

D.2. 国际活动

2007 年在里约热内卢举办了第四届泛美运动会。巴西利用这一机会就运动会前和举办期间的应急准备活动开展了大量的国际合作。特别是巴西当局利用原子能机构的应急准备和响应导则[3]开展运动会的筹备工作，并对其国家公安部队、排爆队和辐射防护官员进行了培训。

2007 年，拉丁美洲在原子能机构的支持下启动了拉丁美洲生物剂量测定网，该网络将密切配合国家应急响应系统的工作。

一场全面的国际应急响应演习（ConvEx-3）每隔三到五年进行一次，以检验和评价重大核紧急情况最初阶段的国际信息交流和援助协调情况。加拿大、古巴、墨西哥和美国的代表为举行 ConvEx-3（2008 年）演习举行了会议，该演习将以在墨西哥拉古纳贝尔德核电厂举行的演习为基础进行。

2007 年 7 月，根据《及早通报核事故公约》和《核事故或辐射紧急情况援助公约》（“及早通报公约”和“紧急援助公约”）确定的主管当局在维也纳举行了第四次会议，56 个成员国和三个国际组织的 96 名代表出席了会议。各主管当局在会上认可了两个工作组[4]调查结果的质量和彻底性，并一致认为工作组的建议是加强国际通讯和援助的可靠基础。

2007 年，东欧地区的主管当局在布达佩斯举行了第一次地区会议，11 个国家和原子能机构参加了会议，并一般地讨论了地区演习、应急响应数据库和信息交流问题。

GS-R-2 号“安全要求”《核或放射紧急情况的应急准备和响应》是核和放射性应急准备和响应的国际标准，许多成员国已将其用作相关立法的基础。例如，近 60%接受原子能机构援助的欧洲国家都遵守了 GS-R-2 号“安全要求”中的大部分要求。

2007 年，埃及、俄罗斯联邦和塔吉克斯坦接待了应急准备评审工作组访问。原子能机构应请求派遣了应急准备评审工作组，以便对照国际标准对成员国的应急准备和响应计划和能力作出独立的评定。

原子能机构与根据“及早通报公约”和“紧急援助公约”确定的联络点一道定期开展了演习。原子能机构制定了一项后续计划，以解决 2007 年演习期间突出存在的实绩问题。2007 年，许多成员国还开展了各个级别的演习、培训和研讨会，包括在阿根廷 Atucha 核电厂开展的有当地民众参加的国家级核应急演习。

---

[3] 特别是《放射性应急一线响应人员手册》和《为检验核或放射紧急情况而进行的演习之准备、实施和评价》。

[4] 国际通讯工作组和“加强核和放射紧急情况国际准备和响应系统国际行动计划”国际援助工作组。

D.3. 未来挑战

尽管近年来在应急准备方面已取得了长足的进展，但大多数成员国仍有待达到令人满意的准备水平。“加强核和放射紧急情况国际准备和响应系统国际行动计划”的成功完成是实现这一点的关键之一。此外，还必须作出大量的努力，以确保第一线响应者做好处理核和放射性事件和紧急情况的充分准备。

全面实施响应援助网将是国际社会面临的挑战之一。该网络将发展成为一个全球性网络和一个关于可根据“紧急援助公约”应请求调动的国家援助能力的宝贵信息库。为了促使响应援助网程序有效发挥作用，成员国必须在该网络登记其响应能力。为启动这一进程，原子能机构已致函“紧急援助公约”的 95 个缔约国，鼓励它们在该网络中进行登记。尽管许多技术组织似乎都急于进行登记，但成员国还必须作出推动响应援助网络工作的政策决定。

2005 年，主管当局会议要求秘书处设法谈判达成一项应急行为准则，以弥补“及早通报公约”和“紧急援助公约”法律框架存在的缺陷。在 2007 年的主管当局会议上，代表们注意到制订行为准则并未被普遍接受。因此，主管当局请原子能机构考虑加强全球法律基础结构的替代方案。确定替代方案将成为原子能机构和国际社会面临的重要挑战。

E. 核损害民事责任

E.1. 趋势和问题

落实有效的民事责任机制对核损害造成的人体健康和环境损害以及实际经济损失进行保险的重要性已成为各国更加关注的一个主题，特别是在全世界再次对核电发生兴趣的情况下尤其如此。与此同时，在现有国际核责任文书的执行方面仍存在着不确定性。此外，虽然一些国家是这些文书的缔约国，但许多国家却不是，而且各种文书条款之间的兼容性以及它们之间的关系被认为非常复杂。

总干事在 2003 年设立的国际核责任问题专家组（核责任问题专家组）继续审议和处理成员国对原子能机构主持制订的国际核责任文书的关切，以期促进成员国更好地理解和遵守整个国际核责任制度。

E.2. 国际活动

核责任问题专家组在 2007 年 6 月举行了第七次会议。会议期间，专家组除其他外，继续开展工作，处理了现有核责任制度中可能存在的空白和模糊之处，并通过确定进一步的步骤来解决这些问题。专家组还审议了在保险范围方面存在的缺陷，并考虑了通过营运者自愿采取国际集资的方式来增加核责任数额的可能办法。在讨论《1963 年核损害民事责任维也纳公约》（1963 年维也纳公约）中的责任限额问题时，

专家组认定，计账单位为该公约第五条第 3 款规定的“每盎司纯金合 35 美元”。因此，专家组认定，根据“1963 年维也纳公约”的规定，正确的最小责任数额取决于黄金的隔夜价格，它目前相当于大约 9300 万美元。

E.3. 未来挑战

总体而言，各国对国际核责任文书的遵守不够。在这方面，并且为了促进遵守，核责任问题专家组将继续发挥积极作用。已定于 2008 年 2 月在南非举行第三次核损害责任问题地区讲习班，并定于 2008 年 5 月举行专家组第八次会议。

在另一个平台上，欧洲委员会将研究如何统一欧盟成员国的核责任范围。欧洲委员会已要求一个由包括原子能机构在内的感兴趣的各方组成的特设小组在 2008 年上半年对欧盟的各种核责任制度进行评定并就实现统一的办法提出建议。目前，欧盟成员国要么属于“巴黎责任公约”，要么属于“维也纳责任公约”，要么这两项公约都不属于。除上述研究活动之外，对 1997 年《核损害补充赔偿公约》也表示了一些支持。

F. 核电厂安全

F.1. 趋势和问题

一个引人注目的趋势是越来越多的成员国正在考虑引进核电，与此同时，已在使用核电的国家则在考虑建设已作出设计改进或采用了新设计的核电厂。负责核电厂设计、建造、调试和运行的组织正在考虑建立新的组织安排和关系。这种安排需要包括与原子能机构安全标准相一致并且能够确保安全受到必要关注的强有力的安全基础结构。

许多核电厂营运者正在积极开展活动或考虑开展活动，以延长其电厂的寿期。已对绝大多数与延长寿期相关的硬件问题进行全面研究，并已制定评定结构、系统和部件的物理状态及开展定期安全评审的共同方法学。与知识保存和管理及安全文化传播相关的方法学则往往不太为人熟知，目前尚未制定出共同的方法学。

在运核电厂继续保持良好安全实绩令人鼓舞。但营运者和监管者有可能产生自满情绪，这继续令人担忧。核电厂继续发生重要事件，原子能机构的工作组访问继续发现管理预期和工作场所的现状之间存在着差距。

营运者和监管者并不总能有效地确定新问题的早期征兆和对它们作出积极响应。从全世界发生的事件中获得的信息并未在运行经验反馈过程中得到充分考虑，也没有得到充分利用，以确定薄弱环节或发出实绩下降的预警。许多核电厂和监管机构都没有明确的综合监督程序，对谁全面掌控运行经验反馈过程也没有一致认识。这阻碍着对现有运行经验的有效反馈。

由于以下原因，许多在运核电厂都在对安全进行重新评价和实施升级：技术的发

展；需要解决发现的安全问题；提出了新的监管要求；或新的数据或证据表明危险已超出设计时的危险。尽管进展情况总体良好，但还需要进一步发展安全评价方案。

拥有新安全特性的新型核电厂要求在确定论和概率论安全分析领域开发先进技术并对此加以应用。反过来，这也要求提高许多组织的分析能力，而且需要扩大核安全方面的现有技能及发展新技能，包括安全评定能力。为应对这一挑战，制定培训方案和建立专门的培训中心正变得日益重要。

在核电应用的所有阶段，包括核电厂的建设阶段，都需要更多地重视安全管理和质量管理。核电具有一些专门的特点，它们涉及到安全、保安和公众关切，任何领导人都必须认识到这些方面。

防火安全，包括可燃材料的适当贮存、防火措施的检查和测试及消防部门的应对措施的充分性，已被一些安全评审组确定为一个问题。对核电厂的内部火灾进行概率安全评定有助于对确定与设计特点和运行实践有关的薄弱环节。

F.2. 国际活动

原子能机构安全评审服务和世界核电营运者联合会的同行评价作为加强和维持其运行安全的一部分，继续为所有成员国的营运组织提供有用和重要的工具。运行安全评审组的后续访问显示，运行安全评审组访问期间确定的大约 95%的问题都已得到解决或在后续访问之前在解决方面取得了令人满意的进展。

原子能机构还对在安全实绩方面遇到意外问题的核电厂进行了运行安全评审组访问。这些访问根据原子能机构安全标准和国际良好实践提供了基准，随后，核电厂管理人员便可将其纳入其改进计划之中。电厂营运者目前还要求对安全文化进行具体评定。这些工作组访问的结果会提供给监管机构和公众，以促进公开性和透明度。

世界核电营运者联合会在 2005 年和 2006 年对电厂事件开展的分析发现了一些需要加以解决的关键问题。其中包括反应性管理、运行用水质量退化、流量加速腐蚀、材料装卸和取水口事件。世界核电营运者联合会因此发表了几份关于这些问题的报告。

原子能机构根据其安全标准制定了一项通用程序，用于审查新反应堆设计的安全文件，这项程序目前正被适用于一些新反应堆的设计。此外，对原子能机构场址评价、设计和长期运行服务也出现了强烈的需求。近来在以下两个项目取得的重要发展是与欧洲委员会和乌克兰开展的联合项目，以评审乌克兰水水动力反应堆核电厂的安全，以及对电厂寿期管理开展同行评审服务，以促进长期的安全运行。

正在经合组织核能机构的范围内开展“多国设计评价计划”试验项目。这一努力的主要目的是使安全反应堆的标准化设计能够成为现实的可能并鼓励这种设计，推动对许多国家的新反应堆的设计评审及促进国际上对安全目标的理解和接受。原子能机构参加了“多国设计评价计划”。预期该计划的结果将在 2008 年提供。

在地震安全评审领域，原子能机构在柏崎-刈羽核电厂所在的新泻县中越冲发生地震后向日本派遣了专家工作组。核电厂能否从此类事件中恢复，取决于营运者是否积极解决技术问题，也取决于监管者能否根据透明和国际公认的规则和程序作出决定及作出决定的效率。原子能机构正在建立一个地震安全、海啸危险评定和减灾管理知识中心，以便发展和共享新知识并促进其应用，从而加强核安全。

风险知情决策过程正在许多成员国得到越来越多的接受。原子能机构正在制定新的安全导则，而一些成员国正在检验该方案和导则。成员国还在更加广泛地利用“先进安全分析工具中心”，用于在安全评定、核安全知识管理以及培训方面进行合作和分享信息。

与经合组织核能机构联合运行的事件报告系统继续证明其作为信息中心在提供全世界从各种事件中获得的运行经验和教训方面的效用。事件报告系统在防止事件的发生和复发方面均发挥了重要作用。2007 年，秘书处对提交给事件报告系统的所有报告都进行了审查。目前正在创建一个通用软件平台，供登记、描述和分析核电厂、研究堆和燃料循环设施发生的所有事件使用。

F.3. 未来挑战

需要更加重视核电厂事件方面的运行经验反馈。反馈过程不仅应包括进行严格的根源分析和确定纠正行动，还应与核能界广泛分享信息，因为此类事件的复发会损害信誉和减少公众的信任。仍有些成员国不通过事件报告系统报告任何事件，甚至是已在国内和国际上被广泛曝光的事件也是如此。

维持并继续加强安全将需要核能界的努力。特别是老化管理和长期运行问题继续需要引起大力关注。除开发工具和过程以帮助进行决策外，还需要继续关注安全管理，以便发展和维持强有力的安全文化。

为了建设可持续的安全基础结构，正在引进核电的成员国将需要综合处理核电安全，包括场址的选择、设计和安全评价以及部件的制造、建设和调试。

此外，严重自然事件的发生也导致自然危害受到更多的关注，这包括需要审查这一领域的国际安全标准。

G. 研究堆安全

G.1. 趋势和问题

研究堆继续是世界各国核科学技术计划的基石，也是成员国核基础设施的重要组成部分。同往年一样，2007 年没有发生涉及研究堆的严重事故。

大约三分之二的现有在运研究堆已运行 30 年以上，因此，设备和系统的老化继续

是造成报告给原子能机构的事件的主要原因之一。仪器仪表和控制系统的过时陈旧是许多设施都存在的一个重要安全问题。许多设施利用不足，而其他设施则处于“延期关闭”状态，有待对其未来作出决定。这些问题往往由于财政资源不足而变得更加严重。

研究堆继续在根本没有或基本没有运行安排的情况下长期运行的问题正在引起人们的关切，他们因而担心运行人员是否能够继续妥善处理日常事件和预期运行事件。由于有经验的工作人员退休，而新工作人员的招聘不足，营运组织可资利用的研究堆安全运行的知识基础继续减少。

虽然许多营运组织都制定了分析其设施中所发生事件的措施，但营运组织和成员国之间的运行经验交流则存在局限性。结果，根源相同并对纵深防御构成挑战的事件继续发生。

G.2. 国际活动

2007 年 11 月在澳大利亚举行的研究堆安全管理和有效利用问题国际会议强调了《研究堆安全行为准则》在加强此类设施的安全方面的中心作用以及建立网络进一步交流运行经验的重要性。

原子能机构促进成员国适用该行为准则，并举行了一些地区讲习班，就该行为准则的要求提供更多指导，以便为 2008 年关于这一主题的国际会议做好准备工作。这些讲习班有助于来自监管机构和营运组织的学员进行自评价，并以此作为确定他们达到该行为准则要求的程度和查明需要进一步向其提供协助领域的一部分。

除了《研究堆安全行为准则》外，原子能机构还在大力促进成员国的地区合作，并将此作为加强安全和通过开展培训、进行信息交流和促进良好安全实践加强应用活动的一个手段。

2007 年开展的研究堆综合安全评定工作组访问为确定研究堆安全领域的总趋势作出了贡献。工作组访问本身也在发生部分变化，以便为原子能机构采购安全设备和服务提供更好的手段。

研究堆事件报告系统继续得到发展，它是通过就具有安全影响的事件交流安全相关信息加强运行安全的一个重要工具。2007 年 4 月 28 日至 5 月 1 日在维也纳举办了一次讲习班，加入该系统的成员国代表聚集一堂，就安全重要事件交流经验。但仍需作出进一步的努力，以便在这一领域进行最大程度和最大数量的信息交流。

G.3. 未来挑战

世界各地的许多研究堆都在使用陈旧过时的设备运行；许多研究堆正随着经验丰富的运行人员的退休而失去这方面的人员，而且许多研究堆都基本没有或根本没有运行安排。资金的不足有可能使研究堆营运者不能在安全方面实施发展工作。

尽管一些成员国具有自评定能力，能够对其研究堆进行安全评审，但仍需作出进一步的努力，以提高这种能力并使之符合原子能机构的安全标准。

需要与例如国际标准化组织和欧洲委员会等国际组织在研究堆领域进行更大的合作，还需要与在亚洲核安全网框架下运作的各专题小组进行密切合作和活动的整合。

H. 燃料循环设施的安全

H.1. 趋势和问题

燃料循环设施涵盖范围广泛的各种活动，包括采矿和冶炼、转化和浓缩、燃料制造、乏燃料临时贮存、后处理和废物整备。其中许多设施由私营部门运营，由于营运者经常相互竞争而使大量工艺和技术资料成为商业敏感信息。尽管这种敏感性过去往往延伸到安全领域，但现在却出现了更多分享特定技术安全实践信息的现象。

由于对核电重新发生兴趣，目前正在考虑建设新的商业燃料循环设施，其中一些具有创新设计。生产适合未来核电厂设计的新型核燃料也是需要加以解决的问题。在所有情况下，新设施的安全仍然至关重要。

燃料循环设施面临许多安全挑战，例如临界控制、危险物质封闭、化学危害以及易燃易爆。在一些成员国，许多设施和监管机构缺乏人力和财政资源。这种设施目前可以利用的国际安全导则尚不完整，需要进一步制订。目前正在努力通过制订一整套安全标准，开展以潜在危害为基础的分级适用方面的培训来改变这一状况。

H.2. 国际活动

2007 年 6 月，理事会核准了题为《燃料循环设施的安全》的“安全要求”。对与铀燃料制造设施、混合氧化物燃料制造设施以及转化和浓缩设施有关的三个新的“安全导则”正在进行最后审查。

原子能机构第一个燃料循环设施运行期间的安全评价工作组 2007 年 4 月至 5 月对巴西铀燃料制造设施成功地进行了访问。“燃料循环设施运行期间的安全评价”导则的修订将考虑到通过试验性工作组访问所汲取的经验教训。

2007 年 12 月，原子能机构在中国举办了涉及燃料循环设施运行安全的第一个国家培训班。

原子能机构正在与经合组织核能机构就燃料循环安全进行密切的合作，并且正在建立一个共同网络平台，该网络平台将涵盖核电厂事件通报系统、研究堆事件通报系统和燃料循环设施燃料事件通报和分析系统。

H.3. 未来挑战

拓展适用于所有燃料循环设施的“燃料循环设施运行期间的安全评价”服务范围需要做大量的工作。此外，燃料循环设施安全的自评定有必要成为共同的实践。

I. 辐射防护

I.1. 趋势和问题

J 章至 Q 章将对趋势和问题作详细的论述。

I.2. 国际活动

2007 年，经过原子能机构积极参加的长时间磋商，放射防护委通过了关于放射防护的新建议。对辐射防护安全标准未作根本改变，职业和公众照射的剂量限值仍维持不变。

2007 年，经合组织核能机构辐射防护和公众健康委员会庆祝其成立五十周年。在庆典大会上，与会者讨论了辐射防护所面临的决策和科学方面的挑战。

原子能机构于 2007 年着手与共同发起的国际组织和潜在的共同发起国际组织合作对“基本安全标准”进行修订，以纳入新的结论和需求以及放射防护委的新建议。原子能机构各安全标准委员会于 2007 年末对“基本安全标准”更新草案进行了审查，2008 年将继续起草和完善工作，预计 2009 年将可以提供适合于成员国磋商用的草案。

I.3. 未来挑战

一般来讲，所有成员国都需要对其国家辐射防护标准进行评定，以与放射防护委的新建议保持一致。J 章至 Q 章对辐射防护方面今后具体的挑战作了论述。

预计一些具体问题近期就会构成挑战。一个是是否有必要就可能不受监管控制的领域如住宅受氡气照射的辐射防护措施制订有关战略。另一个是拟订辅助决策的建议，以确保有适当的程序就例如在利用电离辐射进行保安检查时故意让人暴露在辐射之下的做法的正当性。

J. 职业辐射安全

J.1. 趋势和问题

对技术支持组织和适当的质量管理系统将会出现较大的需求。有必要就受天然存在的放射性物质照射的工作人员以及流动散工的监测问题提供新的导则。

核电生产的扩大以及全世界越来越多地利用放射源将导致更多的人受到职业照

射，并且还有必要扩大监测计划（如中子辐射监测和来自非密封放射材料/污染的内照射评价）。旧式核装置的老化将促进制订适当的辐射防护计划，以供在最初未作未来退役设计的工作场所实施。

J.2. 国际活动

与国际劳工组织和世界卫生组织等国际机构密切合作可以促进在全球统一实施职业辐射防护标准。

职业照射信息系统通过经合组织核能机构和原子能机构的一个联合秘书处进行管理，原子能机构为非经合组织国家运行职业照射信息系统技术中心，以促进加强 11 个国家的核电厂的辐射安全。

J.3. 未来挑战

由于核电的扩大和新技术的发展，成员国将需要扩大其职业评定能力，以便考虑其他类型的潜在照射，如中子照射和内照射。电子剂量测定发展成为一种法律上认可的测量所受剂量的方法将需要制订新的方案和标准化要求。此外，还需要制订更明确的导则，以帮助成员国制订务实的职业辐射防护监管分级方案，特别是就天然存在的放射性物质照射而言尤其如此。

设立地区杰出中心可以提高成员国在考虑到本国问题和协同问题的同时，通过全球性的工作场所安全方案解决职业辐射防护问题的能力。

K. 患者的放射防护

K.1. 趋势和问题

涉及患者的放射性事件继续有待报告，现代设备和新技术要求更加关注辐射安全，因为非故意照射的危险也会很大。利用复杂的放射治疗技术所需的警觉、知情和关注细节的程度比利用常规技术要高得多。运行中的正电子发射断层照相和计算机断层照相设施数量目前的增长速度一直比预期的快。同样，新的计算机断层照相扫描仪和与其相关的技术的增长率也一直高于预期。10 年前还无法利用的许多成像技术现在也比比皆是。这导致了民众辐射照射量的增加。有迹象表明，在一些国家，民众接受医疗照射的集体剂量超过了本底辐射剂量。辐射科学委的数据表明患者接受的人均辐射剂量出现了增加现象。

K.2. 国际活动

对医疗人员开展患者辐射防护方面的培训将为这一领域的全球倡议奠定基础。原子能机构支持开展这样的培训活动，因为它们可以因此导致在国际上推动实现可持续性和开展能力建设。2007 年在这方面的一个例子是建立了亚洲辐射防护心脏病学家网

络，该网络发表了一份关于辐射防护的通讯，这对心脏病学家来说尚属首次。全球性的培训活动现在包括了医生，他们虽然通常不接受辐射防护培训，但却开展荧光透视（如泌尿科医生、整形外科医生、肠胃科医生）。原子能机构对这一领域的支助从2006 年开始，2007 年通过在亚洲成功开设的课程得到了进一步加强。

K.3. 未来挑战

原子能机构的患者辐射防护网站[5]一直为全世界的健康专业人员提供信息，以帮助他们实现对患者的辐射防护。该网站还应提供关于患者的补充资料。

缺乏非故意照射事件的报告一直是医学领域的一个大问题，它限制了汲取经验教训的机会。开发患者高剂量照射病例教学报告系统仍然是一个挑战。

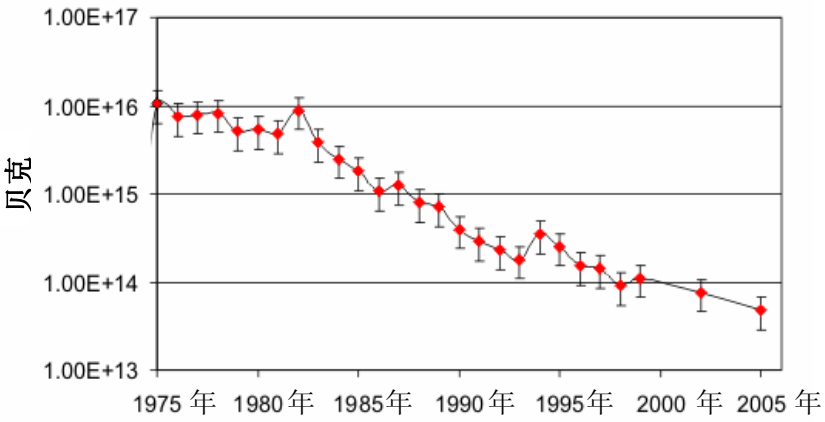
许多成员国需要执行经修订的国家法律法规，或加强现有的要求，以确保适当和可持续的国家辐射安全基础结构的所有要素能够为提供患者辐射防护的目的而落实到位。

L. 保护公众和环境

L.1. 趋势和问题

通过参与拟订 2007 年放射防护委的建议和与成员国在修订“基本安全标准”的框架内进行磋商，以及通过正在进行的与放射防护委和联合国各组织的长期协作，原子能机构为正在进行的保护公众和环境的国际统一制度的制定工作提供了协助。

如图一所示，从核装置液体排放中发出放射性核素 β 和 γ 的放射性活度总量自 20 世纪 80 年代以来已大幅度下降。



图一：世界范围内从核装置液体排放中发出的放射性核素 β 和 γ 的放射性活度总量演变情况（源自放射性核素向大气和水环境排放数据库）。

L.2. 国际活动

2007 年，原子能机构与辐射科学委合作组织了维也纳国际环境放射性会议。这次会议题为“从测量和评定到监

[5] http://rpop.iaea.org。

管”的第二单元会议反映了该主题领域范围的广泛性以及对一些迥然不同的学科领域包括监管、评定、监测、取样和测量的兴趣。就控制由于环境中放射性引起的对人类的照射而言，上述每一学科都有直接关系并彼此相互联系。会议试图涉及所有这些问题以及它们之间的相互联系。

欧洲委员会的 ERICA [6] 项目旨在通过生成相关数据库以支持评定及通过发展评定和风险表征方法进行生物体和生态系统的保护，该项目已于 2007 年 2 月圆满完成。欧洲委员会的新项目 PROTECT [7] 将接续 ERICA 项目，并利用该项目的成果探讨制定监管一级的保护框架并对其适用情况进行检验。

原子能机构“放射性核素向大气和水环境中排放数据库”网络版现已开放供公众使用。可以为研究或了解的目的推断出全球性或地区性的放射性排放趋势。

应 1972 年《防止倾倒废物及其他物质污染海洋公约》（伦敦公约）缔约方的请求，原子能机构启动了源于倾倒活动以及海上事故和损失的放射性核素存量数据库的更新程序。

L.3. 未来挑战

需要对与控制放射性排放有关的安全标准进行更新，以反映当前的最佳实践并纳入放射防护委新建议中的基本要素。

M. 放射源的安全和保安

M.1. 趋势和问题

已经开始在医学领域用非放射性的电离辐射源替代放射源。然而，从总体来看，在许多应用领域和许多国家，放射源继续发挥着重要而有益的作用，全世界的监管控制和相关安全基础结构仍然需要得到加强。

M.2. 国际活动

根据《放射源的进口和出口导则》补充文件中的建议，各国当局已经开始在进出口一类和二类放射源之前进行沟通。

原子能机构 2007 年 6 月组织了一个不限人数的技术和法律专家会议，以分享各国执行《放射源安全和保安行为准则》及其补充导则《放射源的进口和出口导则》情况的信息。与该准则和导则无法律约束力的性质相适应，出席会议和提交论文都是以自愿为基础的。来自 70 个成员国和两个非成员国的 122 名专家以及来自欧洲委员会、欧

---

[6] 电离污染物的环境危险：评定和管理。

[7] 从监管的角度保护环境免于电离辐射。

洲安全和合作组织（欧安组织）和粮农组织的观察员出席了会议。加拿大和美国提供了预算外资金，以特别资助无力与会的国家的专家出席会议。来自 53 个国家的专家借此机会提交了论文，讲述他们执行上述行为准则和导则的经验。与会者赞赏讨论的开放性质，并鼓励原子能机构今后在可得资金情况下举行类似会议，或许每三年举行一次。会议得出了一系列结论，主席报告[8]对此作了概述。

正在对发展中国家加强国际援助，以使易受攻击的废放射源变得安全可靠。援助内容包括支持建立经过核实的源库存、返还某些类型的源、对安全可靠地长期贮存做出安排的国家项目提供资金，以及建设搜寻和回收无看管源的国家能力。

图二：电离辐射警示 — 补充标志。

新的辐射警示标志作为国际标准化组织的第 21482 号标准“电离辐射警示 — 补充标志”予以公布，以补充现行的三叶形电离辐射符号。为了设计一个任何地方的任何人都能理解为“危险 — 远离”的通用辐射警示标志，原子能机构作了长期全面的努力。这一新标志就是这种努力的成果。它旨在补充而不是替代关于一类、二类和三类源的三叶型电离辐射符号。原子能机构将对成员国正确实施新标志提供援助。

M.3. 未来挑战

仍然需要协助成员国努力特别通过加强监管基础结构实施上述行为准则和导则的规定。越来越多的成员国正在请求原子能机构评价其与辐射源控制有关的法律和监管体系。原子能机构将继续在综合监管评审服务计划的范围内开展这种评价（以前称“放射源辐射安全和保安基础结构评价”）。

由于探测能力迅速发展，在国家边境口岸探测到了数量日益增多的无看管源。这突显出特别是发展中国家迫切需要建立适当的监管和技术基础结构，以便适当地管理、回收、贮存和处置废源。

如何在不减少放射源的各种应用给社会带来的各种好处的情况下加强对放射源的控制仍然是一项挑战。

N. 放射性物质的运输安全

N.1. 趋势和问题

有关放射性物质安全运输的一系列条例和导则材料已接近完成。TS-G-1.1（ST-2）

---

[8] http://www.iaea.org/About/Policy/GC/GC51/GC51Documents/English/gc51-3-att1_en.pdf。

号“安全导则”《国际原子能机构放射性物质安全运输条例咨询材料》和 TS-G-1.3 号“安全导则”《放射性物质运输辐射防护计划》满足了持续记录运输活动中安全的需要。目前正在审查管理系统（质量保证）和遵章保证导则以及与 TS-R-1 号“安全要求”《放射性物质安全运输条例》有关的时间表。

与联合国相关机构协调一致是原子能机构标准活动的一个基本组成部分。缺乏协调一致的要求可能导致国际标准在世界各地适用时产生误解以及得不到遵守的情况。缺乏协调一致是促进放射性物质运输的一个重要障碍。

拒绝运输放射性物质问题国际指导委员会负责协调为找到解决拒绝运输相关问题的方法所作的国际努力。2007 年，该委员会制定了一项全面的国际活动行动计划，其中包括将大幅度减少拒绝运输情况和减轻困难的各种活动，与相关组织建立联系以及提高对放射性物质在公众健康、工业和电力生产领域用途的认识。

N.2. 国际活动

2007 年 7 月，原子能机构在乌拉圭举办了拒绝和拖延运输放射性物质问题地区讲习班。参加讲习班的 16 个国家就传播关于放射性物质运输准确信息的必要性达成了共识。无论国家一级还是地区一级当局之间的沟通都需要得到加强。如果在地区一级存在高效的沟通系统，已报告的一些拒绝和拖延事件本来都是可以避免的。今后的行动包括适合一线人员（货物装卸人员、海关、货运代理人、承运人）的教育和培训计划以及国家监管机构、其他当局和运输组织的参与。

国际组织正在处理“运输条例”与《联合国危险货物运输建议》之间的协调问题。2006 年 2 月和 2007 年 9 月分别举行了多次会议。联合国条例的第 15 次修订版包括了相关的修改，2009 年版“运输条例”也将如此。

2007 年 9 月，一些承运国和沿岸国在原子能机构的参与下在维也纳举行了第三轮非正式讨论，以期保持对话和磋商，在放射性物质海上安全运输方面增进相互理解、建立信任和加强沟通。

N.3. 未来挑战

更多地利用放射性物质将增加对安全和保安的关切，而这反过来则有可能使拒绝和拖延运输的事例增多。有必要解决在放射性物质运输的安全和保安问题上缺乏共同导则的问题，同时需要对放射性物质现有的包装设计或运输制订统一的安全和保安方案。

应当讨论原子能机构和联合国各自的运输条例逐步采用全面统一结构的进程问题。这一举措将进一步促进在世界范围内了解并遵守原子能机构的运输条例和联合国的运输条例。

O. 放射性废物管理和处置安全

O.1. 趋势和问题

国际上已表现出对建立全面的国家放射性废物管理政策和执行战略的兴趣，因为它们将确保所有放射性废物都得到适当管理并找到处置各类放射性废物的安全方案。以尊重国际安全标准并注意到当地情况的方式将放射性废物类型与处置方案联系起来的共同框架概念多年来一直在演进。这一概念的重要内容是放射性废物分类综合系统，而这正是目前正在修订的原子能机构安全标准中的一个领域。

一些放射性废物不适合近地表处置，但也不需要地质处置所规定的达到隔离和包容的程度。几十米至几百米的中等深度处置被认为提供了安全方面的良好前景。

退役活动的增加表明近期需要处置大量放射性含量低的放射性废物。这种废物不需要采取现代近地表放射性废物处置设施特有的牢固封隔措施。

人们现在还越来越关注含天然来源放射性核素的废物问题，这种废物往往产生于同核燃料循环或放射性物质传统的工业和医疗应用无关的活动。

由于地质处置设施推迟建造，乏燃料贮存正变得越来越重要。其结果是贮存时间被延长，并且正在考虑进行 100 年或更长时间的贮存。

O.2. 国际活动

成员国正越来越多地要求原子能机构作出安排，以便按国际标准对放射性废物管理计划和设施进行国际同行评审。2007 年对智利、哥伦比亚、危地马拉、巴基斯坦和委内瑞拉玻利瓦尔共和国的计划进行了评审。在大韩民国，对未来近地表处置设施的安全方面进行了评审。在罗马尼亚，评审内容包括已规划好的近地表处置设施的场址表征和处置库概念设计。

2007 年完成了三个关于统一安全评定程序的国际项目，它们是：“安全评定方法学在放射性废物近地表处置设施中的应用”、“核设施退役期间安全评价和示范国际项目”以及“辐射安全环境仿真模型国际项目”。这些项目所取得的成果和开发的手段都发布在原子能机构网站[9]上，可供公众使用。

2007 年，经合组织核能机构和原子能机构组织了题为“放射性废物深部处置的安全案例：我们处在什么位置？”的专题讨论会。人们越来越关注安全案例的结构和表述方法以及监管机构对其进行评审的国际统一问题。会议明确达成一致的意见是，国际统一的方法将是有利的，各国要求的不同大大妨碍了社会更广泛地接受。

---

[9] http://www-ns.iaea.org/projects/asam.htm ； http://www-ns.iaea.org/tech-areas/waste-safety/desa/start.asp ； http://www-ns.iaea.org/projects/emras/。

2007 年 10 月在瑞士伯尔尼举行了题为“地质处置库：共同的目标，不同的道路”的国际会议。这次会议由无害环境安全处置放射性物质国际协会组织举行。在国际一级达成了共识，即在深部地质处置库处置高放废物提供了所需的长期安全和保安。用于实施这种处置库的可靠技术基础已经建立起来。现在有必要致力于讨论前进的道路，并讨论如何利用地质处置概念在技术上的灵活性帮助达到社会和政治上的要求和期望。

对原子能机构网基废物管理数据库进行了重新设计，以便更好地满足用户需求，特别是编写了关于《乏燃料管理安全和放射性废物管理安全联合公约》国家报告的需求。网基废物管理数据库载有表一所显示的关于国家放射性废物管理计划、其他计划和活动、政策以及放射性废物存量的信息，如放射性废物综合存量信息。该系统对主要核计划都作了介绍，而且该系统目前存有占全球核能产量 70%的 61 个成员国四年的存量数据。这些数据都是通过在线系统提交的。

表一：截至 2005 年底世界范围内放射性废物的存量
（以千立方米计）

	贮　存		处　置	
	未处理	已处理	未处理	已处理
短寿命 中低放废物	1 923	1 696	15 460	4 280
长寿命 中低放废物	13 434	105	42	63
高放废物	363	27	0	0.01

O.3. 未来挑战

在一些国家出现了中等深度处置的概念，这将使得有必要制订出适合这一领域的适当的安全标准。

就地质处置而言，几个国家已经取得了良好的进展。然而，在许多国家还是可以看到拖延的现象。这种拖延通常与技术问题没有关系，而是大多与政治/社会进程的拖延或重启有关。此外，对再循环重新发生兴趣和对多国解决方案的信任也正在推后需要处置库的时机。人们注意到，以后对地质处置能力的需求特别是对规模较小的核计划的需求是推迟实施关于启用处置设施计划的另一个原因。

P. 退役

P.1. 趋势和问题

各国政府及相关各方对为退役、废物和乏燃料管理及早进行规划、提供适当资金和制订长期战略的必要性的认识日益提高，现在有必要发展国家和国际机制，以维护和保存对退役安全具有重要意义的运营知识和退役经验。此外，由于世界范围内发展核装置的计划最近出现增加，重要的是将已经从退役中汲取的教训用作对所有新的核装置的设计、运行和维护所作的投入。简单的、经过证明和可利用的退役技术一般比新的和创新的技术更可取，因此，灵活和分级的退役监管方案现在需要得到进一步发展和支持。

所有相关各方确定明确的退役终点十分必要，特别是就解除材料控制和场址复用而言尤其如此。这种机制将有助于建立公众信任、调动工作人员积极性和考虑与退役有关的社会影响。十分重要的是退役项目要有确定的解控路线以及适当的废金属处理/再利用基础设施和措施，以减少需要作为放射性废物贮存、处理或处置的材料。

P.2. 国际活动

原子能机构的研究堆退役示范项目（R^2D^2P 项目）已经启动，目的是为拥有小规模核计划的国家的专家提供培训。菲律宾研究堆（PRR-1 号研究堆）的退役是开展这种活动的一个示范项目。PRR-1 号研究堆的退役表征和拟订退役计划方面的退役工作正在取得进展。此外，在“R^2D^2P 项目”下，还将在澳大利亚高通量堆开展从运行到退役过渡的示范。“R^2D^2P 项目”今后的活动可能包括可以提供补充示范的其他研究堆，如重水堆。

从退役中汲取的教训是全世界的一个重要专题，为此 2007 年组织开展了两项国际性活动：美国核学会的“退役、去污和重新利用专题会议”和电力研究所的“电力研究所第六次国际退役和放射性废物讲习班”。

设在俄罗斯联邦的国际放射性废物项目专家联络组组织了两个讲习班：一个是审查俄罗斯西北部核清理项目的初步成果讲习班；一个是关于俄罗斯远东的核遗产问题包括核潜艇和核服务船拆除以及污染场址恢复问题讲习班。

原子能机构建立了一个国际退役网络，目的是向启动退役项目的国家提供实际培训，并促进分享关于正在退役的设施和场址采用退役技术的经验。

P.3. 未来挑战

各国政府及相关各方对为退役及早进行规划、提供适当资金、提供政府支持和制订长期战略的必要性的认识仍然需要进一步提高。更有效地利用“联合公约”的同行评审机制可能是实现这一目的的一个途径。

来自退役活动的材料在脱离监管机构进一步的监管控制时的价值称为清洁解控值。统一适用这种清洁解控值以及确定一致同意的表面污染值的目标仍有待实现。

今后最大的退役挑战是随着核工业的扩大为退役项目保持足够合格的资源。

Q. 受污染场址的恢复

Q.1. 趋势和问题

对核电生产的持续需求已导致铀资源勘探和开发活动的增加。因此，已经出现了对铀矿开采和加工所有阶段产生的残留物进行安全管理的需要，同时对以前遗留场址的恢复需求也依然很大。

人们对天然存在的放射性物质所涉及的残留物安全问题的认识日益提高。其中许多问题都牵涉到遗留场址以及残留物管理和废物方面的挑战。已经认识到有必要制订天然存在的放射性物质残留物管理方面的专门导则。

随着当前核工业的扩大，缺乏拥有适当背景、培训和经验的工作人员的问题已变得十分明显。在世界各地，现在都缺少支撑扩大中的铀矿开采工业发展的工作人员。有助于开发适当合格工作人员资源的培训教材和课程则是当前的另一个优先事项。

Q.2. 国际活动

原子能机构一直在不断地在地区和国家一级向中亚国家提供援助，以协助哈萨克斯坦、吉尔吉斯斯坦、塔吉克斯坦和乌兹别克斯坦对铀矿开采遗留场址的恢复和管理进行规划。发展和加强这些国家的制度化能力仍然是一项优先活动。

原子能机构对加蓬原奥科铀矿的恢复后场址进行了评审。

对铀矿开采的兴趣日增已导致原子能机构向马拉维派遣了一个实情调查工作组，以调查一个建议的新铀矿的监管情况和现场情况，并导致在纳米比亚举行一次技术会议，讨论了铀矿开发问题。

联合国各组织（包括世界银行、联合国开发计划署和原子能机构）对阿塞拜疆和吉尔吉斯斯坦天然存在的放射性物质污染场址进行了若干次国际实情调查访问，目的是拟订恢复项目、迁移铀尾矿和加强公众与环境安全。还拟订了一个对科威特石油和天然气工业中天然存在的放射性物质残留物进行管理的项目。

为了帮助应对铀矿开发和天然存在的放射性物质残留物管理方面的新挑战，在原子能机构的主持下成立了有铀矿和磷酸盐矿开采业生产商以及生产国监管机构参加的若干国际组，目的是制订阐述良好实践的导则和培训教材，以确保公众和环境长期得到保护。

Q.3. 未来挑战

在未来若干年市场稳定下来之前，对就新铀矿开发相关的废物和环境安全问题提供援助和支持的需求可能大幅度增加。可能会出现虽然没有监管基础结构但却在进行铀矿开采的情况，也有可能出现尽管基础结构不充分但却正在努力重新启动以前废弃的铀生产设施或开始采矿的地点。

Appendix 1

Safety related events and activities worldwide during 2007

A. Introduction

This report identifies those safety related events or issues during 2007 that were of particular importance, provided lessons that may be more generally applicable, had potential long-term consequences, or indicated emerging or changing trends. It is not intended to provide a comprehensive account of all safety related events or issues during 2007.

B. International instruments

B.1. Conventions

B.1.1. Convention on Nuclear Safety (CNS)

In 2007, Malta acceded to and Nigeria ratified the CNS, which had 60 Contracting Parties at the end of 2007[10], including all Member States operating nuclear power plants.

The Organizational Meeting for the 4th Review Meeting of the Contracting Parties was held in Vienna from 24 to 25 September 2007, with 44 Contracting Parties participating.

The Meeting elected Mr. Maurice T. Magugumela of South Africa as President of the 4th Review Meeting and Ms. Ann McGarry of Ireland and Mr. Juan Eibenschutz of Mexico as Vice- Presidents. The Meeting also established six Country Groups for the 4th Review Meeting and allocated Contracting Parties to Country Groups. The Country Groups then met separately and elected Country Group Coordinators and Officers.

The 4th Review Meeting of the Contracting Parties will be held in Vienna from 14 to 25 April 2008.

B.1.2. Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Early Notification and Assistance Conventions)

In 2007, Mali ratified and Montenegro succeeded to the Early Notification and Assistance Conventions. The Early Notification Convention had 101 parties and the Assistance Convention had 99 parties at the end of 2007.

---

[10] For Malta, the CNS entered into force on 13 February 2008

In 2007, no notification messages were submitted under the provisions of the Early Notification Convention. However, in relation to five events, advisory messages were exchanged under the *Emergency Notification and Assistance Technical Operations Manual* (ENATOM) arrangements or came as requests for information from the official designated counterparts under the conventions.

In two cases, the Agency was requested to provide assistance pursuant to the Assistance Convention. In one of these cases, the Agency deployed a source recovery assistance mission in cooperation with the requesting State Party and with the State Party which delivered assistance.

In eight cases, the Agency has also offered its good offices in accordance with Article 5(d) of the Assistance Convention.

B.1.3. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)

The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear activities and to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities. In 2007, Nigeria and Tajikistan[11] acceded to the Joint Convention, which had 45 parties at the end of 2007. Considering that the vast majority of Member States have some requirements for radioactive waste management, it is hoped that more States adhere to the Joint Convention. The Agency conducted a workshop for members of the Asian Nuclear Safety Network in Sydney in September 2007 regarding the benefits of adherence to the Joint Convention. The Agency promotes the Joint Convention at all Agency meetings related to spent fuel and radioactive waste management.

The Third Review Meeting will be held from 11 to 22 May 2009.

B.2. Codes of Conduct

B.2.1. Code of Conduct on the Safety of Research Reactors

The provisions and guidance in the Code of Conduct have been integrated into appropriate Agency safety review services, technical cooperation projects and extrabudgetary programmes. Application of the Code of Conduct is being accomplished through implementation of national safety regulations. Member States are being encouraged to make full use of the Agency's safety standards relevant to research reactors and the legal and governmental infrastructure for nuclear, radiation, radioactive waste, and transport safety.

As recommended by the December 2005 open-ended meeting that, inter alia, periodic meetings be held to exchange information and discuss experience in application of the Code of Conduct, two regional meetings[12] were held in 2007 for Asia and the Pacific and Latin America and Caribbean regions. These meetings allowed participating countries to exchange information and views on the recommendations contained in the Code of Conduct, to discuss the results of self assessments made on the status of research reactor safety and to identify needs for assistance in applying the Code of Conduct.

Preparations were started for an international meeting on the application of the Code of Conduct in 2008, close to the Fourth Review Meeting of the Contracting Parties to the CNS.

---

[11] For Tajikistan, the Joint Convention entered into force on 11 March 2008.

[12] Regional meetings for Africa and Eastern Europe were held in 2006.

B.2.2. Code of Conduct on the Safety and Security of Radioactive Sources

By the end of 2007, 90 States had expressed their political support and intent to work toward following the Code of Conduct on the Safety and Security of Radioactive Sources and 45 States had expressed support for the supplementary Guidance on the Import and Export of Radioactive Sources.

From 25 to 29 June 2007, the Agency held an open-ended meeting of technical and legal experts for sharing of information as to States' implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources. This meeting is described in greater detail in Section G.8.

C. Cooperation between national regulatory bodies

There are a number of forums in which regulators can exchange information and experience with their counterparts in other countries. Some of these are regional, some deal with particular reactor types and others are based on the size of the nuclear power programme. All of these forums meet regularly to exchange information of common interest and some are developing exchange mechanisms involving the Internet for more rapid means of communication. Selected safety issues of wide interest to regulators are discussed at a meeting of senior regulators held in association with the Agency's General Conference each year.

C.1. International Nuclear Regulators Association (INRA)

INRA comprises the most senior officials of a number of well-established national nuclear regulatory organizations in Europe, America and Asia who wish to exchange perspectives on important issues with the purpose of influencing and enhancing nuclear safety and radiological protection from a regulatory perspective. INRA met twice in 2007 in Spain and discussed, inter alia, waste management, the CNS, safety culture, International Commission on Radiological Protection Recommendations, emergency planning and management, new build approaches and the Agency's Integrated Regulatory Review Service programme.

C.2. G8-Nuclear Safety and Security Group (G8-NSSG)

Under the presidency of Germany, the G8-NSSG met three times in 2007. The Agency, European Commission, Nuclear Energy Agency of the Organisation for Economic Co-operation and Development and the European Bank for Reconstruction and Development (ERBD) also attend these meetings. The G8-NSSG discussions focussed on: Chernobyl NPP projects for the shelter and interim spent fuel storage administered by the EBRD; implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on import/export control; the global initiative to combat nuclear terrorism; safety improvement programmes for Armenian and Ukrainian water cooled, water moderated power reactors; Russian technical regulations for nuclear safety and radiation protection; EU programmes and perspectives for the period 2007–2013; global nuclear safety network; and safety aspects of multinational approaches to the nuclear fuel cycle. The group provided input on safety and security issues to the G8 summit held in July 2007 in Heiligendamm, Germany.

At the last meeting in November 2007, the main themes to be addressed during the 2008 Japanese G8 presidency were introduced. In addition to continuing present activities, the proposed priorities include

support to nuclear power infrastructure and earthquake and nuclear safety. Japan also announced that it will support Agency efforts to assist countries embarking in nuclear power programmes focussing on 3Ss (Safety, Security and Safeguards) approach.

C.3. Western European Nuclear Regulators Association (WENRA)

WENRA was established in 1999 and currently includes the heads of nuclear regulatory authorities of 17 European countries having at least one nuclear power plant. One of its main objectives is to develop a harmonized approach to selected nuclear safety and radiation protection issues and their regulation, particularly within the European Union. To this end, two working groups have been established: the Reactor Harmonization Working Group (RHWG) and the Working Group on Waste and Decommissioning (WGWD).

In January 2007, WENRA published the *WENRA Reactor Safety Reference Levels* covering 15 safety issues relevant for the harmonization of reactor safety. In March 2007, modifications to the January 2007 documents were issued based on comments received from WENRA members. Also in March 2007, the WENRA Working Group on Waste and Decommissioning published the *Decommissioning Safety Reference Levels Report*.

WENRA continues to closely follow the progress regarding revisions to IAEA safety standards in order to revise their reference levels if necessary.

C.4. The Ibero-American Forum of Nuclear and Radiological Regulators

The Forum met in July 2007 in Mexico, with the chief regulators from Argentina, Brazil, Cuba, Mexico, Spain and Uruguay attending. At that meeting, the Forum reviewed ongoing projects, including the implementation of the Ibero-American Radiation Safety Network. At the meeting, the presidency was transferred from Mexico to Uruguay.

The Agency continued to support the activities of the Forum in the frame of an extrabudgetary programme dedicated to nuclear and radiation safety. In 2007, the project on probabilistic safety assessment applied to radiotherapy treatment with linear accelerators was finalized. The project was successful in identifying potential accident sequences and grading them in terms of risks and provided recommendations to prioritize the use of resources to avoid accidental exposure. Considerable progress was also achieved with the development of a methodology for self-assessment of the regulatory system for protection of patients against radiation exposure and harmonization of procedures for import/export of radioactive sources, which is scheduled to be available at the end of 2008. The Forum held a workshop to exchange regulatory experience in nuclear safety, and is considering a project related to life extension of NPPs. Synergies between the Forum and the Agency were further explored, including the dissemination of results of the Forum's projects to other Member States and making them available for application through the Agency's technical cooperation programme.

C.5. Cooperation Forum of State Nuclear Safety Authorities of Countries which operate WWER[13] Reactors

The Forum conducts annual meetings where senior staff of regulatory bodies in countries that operate WWER reactors discuss regulatory and safety issues related to operation of WWERs. The 14th Annual Meeting of the Forum was conducted in July 2007 in Dubna, Russian Federation. The Forum members

[13] Water cooled, water moderated power reactor

reported on their countries' recent changes in nuclear legislation; and exchanged information related to nuclear safety regulation, atomic energy utilization and operational events. Other topics discussed included the status of the Agency's safety standards revisions, the Agency's IRRS programme, and new developments in PSAs. The Forum working groups reported on activities completed since the previous annual meeting in the areas of digital instrumentation and control systems, evaluation of operating experience, and the regulatory use of PSA. The 15th Annual Meeting will be hosted by Ukraine in 2008.

C.6. Network of Regulators of Countries with Small Nuclear Programmes (NERS)[14]

The current membership of NERS includes Argentina, Belgium, Czech Republic, Finland, Hungary, Netherlands, Pakistan, Slovakia, Slovenia, South Africa and Switzerland. The Tenth Annual Meeting of NERS was held in Egmond aan Zee, the Netherlands from 7 to 8 June 2007 and the meeting agenda included the following items:

- Regulatory Body preparation for new build: maintenance and development of nuclear safety competences (including manpower management).
- Management of safety culture with a special view to the changing ownership structure of nuclear facilities.
- A round table of actual capacity of the regulatory body and how it is financed.

The Czech Republic will be the next chair of NERS, with the annual meeting to be held in Prague in June 2008.

C.7. The senior regulators from countries which operate CANDU-type nuclear power plants

The annual meeting of senior regulators of countries operating CANDU-type reactors (Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania) was hosted by the Canadian Nuclear Safety Commission in Ottawa, Canada in November 2007. The issues discussed covered a large variety of topics, including: regulatory issues related to new pressurized heavy water reactor designs, plant and life extension; comparison of PSA practices, large Loss of Coolant Accident response and positive void coefficient; regulatory tools for independent verification of licensees' submissions; categorization of the CANDU safety issues using risk-informed decision-making process; recent developments and operational feedback from significant events; and reporting for the next review meeting of the Contracting Parties for the CNS.

C.8. The International Nuclear Event Scale (INES)

More than 60 Member States are currently members of the INES and use it to communicate the safety significance of events at the national level. Member States also used the INES to communicate on events that are rated at Level 2 or higher or that are of international media interest — through the Nuclear Event Web-based System (NEWS) — to the media, the public and to the international scientific community.

Currently, the INES covers a wide range of practices, including industrial uses such as radiography, uses of radiation sources in hospitals, operations at nuclear facilities, and transport of radioactive material. Since the publication of the INES Manual 2001 edition, there have been additional guidance

[14] www.ners.info

and clarifications to the methodology. Therefore, the 51st regular session of the General Conference encouraged the Secretariat to continue its efforts in consolidating the INES procedures for rating nuclear and radiological events into a revised manual.

The Agency, jointly with the OECD/NEA and INES members, is undertaking a major revision of the INES manual. In 2007, the draft revised document was sent to INES National Officers for final comment. In the new manual, the underlying INES methodology has not changed. However, the criteria used for rating radioactive sources and transport events have been reviewed and consolidated according to additional guidance which was in pilot use for almost two years and then approved by IAEA Member States in 2006. The new Manual also incorporates other clarifications approved since the publication of the 2001 edition of the INES manual, such as the clarification on the rating of fuel damage events and includes more examples and uses terminology consistent with the various areas of application of INES.

D. Activities of international bodies

Several international expert bodies issue authoritative findings and recommendations on safety related topics. The advice provided by these bodies is an important input to the development of the Agency's safety standards and other international standards and is frequently incorporated in national safety related laws and regulations. The recent activities of a number of these bodies are reviewed in this section.

D.1. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

The United Nations General Assembly established UNSCEAR in 1955 to assess and report levels and effects of exposure to ionizing radiation. UNSCEAR's Programme of Work is approved by the General Assembly, and has extended typically over a 4–5 year period. The UNSCEAR Secretariat, which is provided through the United Nations Environment Programme (UNEP), engages specialists to analyse information, study relevant scientific literature and produce scientific reviews for scrutiny at UNSCEAR's annual sessions. At the end of the cycle, the United Nations publishes the substantive reports, which are recognized as authoritative scientific reviews and provide the scientific foundation for the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). UNSCEAR also reports annually to the General Assembly. The last publications of UNSCEAR were issued in the years 2000 and 2001.

UNSCEAR held its 55th session in Vienna from 21 to 25 May 2007. It considered documents related to: public and worker exposure; medical radiation exposures; exposures from radiation accidents; health effects due to radiation from the Chernobyl accident; and non-human biota. UNSCEAR expects that these documents will all receive final review and approval in 2008. The Committee also approved its annual report[15] for consideration by the General Assembly.

[15] *Official records of the General Assembly, Sixty-second Session, Supplement No. 46 (A/62/46)*, which can be downloaded from http://www.unscear.org/unscear/en/general_assembly_all.html.

UNSCEAR is developing a longer term strategic plan and proposal for its future programme of work for submission to the General Assembly in 2008. The strategic plan will act as a planning tool for future programme budgets, and will need to consider the context of UNSCEAR in the face of global challenges, such as increasing interest in the nuclear power option as a possible response to concerns regarding carbon emissions, and the fast pace of developments in biological science. It also needs to consider streamlining the future development of documents and to ensure their relevance, quality and rapid dissemination; modernizing the processes and mechanisms to conduct the work of UNSCEAR; optimizing the use of expertise between formal sessions; and improving coordination of data collection and dissemination with countries and other relevant organizations.

The next session of UNSCEAR is planned for 10 to 18 July 2008.

D.2. International Commission on Radiological Protection (ICRP)

The ICRP is an independent group of experts that issues recommendations on the principles of radiation protection. ICRP Recommendations have provided the basis for national and international standards including the BSS. Appointments to the ICRP and its Committees are made for periods of four years, and the current cycle began in July 2005. Five committees deal with radiation effects, doses from radiation exposure, protection in medicine, application of ICRP Recommendations, and protection of the environment.

At its meeting in Essen, Germany from 19 to 21 March 2007, the ICRP approved a new set of fundamental Recommendations on the protection of man and the environment against ionizing radiation. The new Recommendations take account of new biological and physical information and trends in the setting of radiation standards. While much more information is available now than in 1990, the overall estimate of the risk of various kinds of harmful effects after exposure to radiation remains fundamentally the same. The three basic principles of radiological protection are still justification of activities that could cause or affect radiation exposures, optimisation of protection in order to keep doses as low as reasonably achievable, and the use of dose limits. The new Recommendations feature an improved and streamlined presentation, give more emphasis to protection of the environment, and provide a platform for developing an updated strategy for handling emergency situations and situations of pre-existing radiation exposures. These Recommendations replace the ICRP's previous Recommendations from 1990.

In October 2007, the Secretariat participated in meetings of the ICRP Main Commission and committees dealing with: radiation effects; doses from radiation exposures; protection in medicine; applications of ICRP recommendations for protection of the population during nuclear or radiological emergencies, protection of population living in contaminated areas; and naturally occurring radioactive material (NORM).

D.3. International Commission on Radiation Units and Measurements (ICRU)

The ICRU, a sister organization of the ICRP, provides internationally acceptable recommendations concerning concepts, quantities, units, and measurement procedures for users of ionizing radiation in medicine, basic science, industry, and radiation protection. The current ICRU programme is focused on four areas:

- Diagnostic radiology and nuclear medicine;
- Radiation therapy;
- Radiation protection;
- Radiation in science.

D.4. International Nuclear Safety Group (INSAG)

The INSAG is a group of experts in the field of safety working in regulatory organizations, research and academic institutions and the nuclear industry. It was chartered by the Director General to be an independent body to provide authoritative advice and guidance on nuclear safety approaches, policies and principles. In particular, INSAG will provide recommendations and opinions on current and emerging nuclear safety issues to the Agency, the nuclear community and the public.

INSAG was reconstituted in 2007 as INSAG VII. In that connection, ten members continue from INSAG VI while seven members were newly appointed. A complete listing of INSAG members including a short biography is available on http://www-ns.iaea.org/committees/insag.asp.

INSAG met twice in 2007, including one meeting in Mumbai, India, and continued its discussions and preparation of reports on the topics of operational experience feedback, safety/security interface and infrastructure for nuclear safety.

For the second year in a row, an INSAG forum was conducted in conjunction with the regular session of the General Conference in September. It is anticipated that the INSAG forum will be a yearly feature of the General Conference. This year the subjects of the Forum — operational experience feedback and safety/security interface — were examined by a knowledgeable panel of experts who solicited audience participation in order to assist INSAG in preparing papers on the subjects.

INSAG Chairman Richard Meserve also issued his fourth 'State of Nuclear Safety' letter to the Director General. The letter was distributed along with other high level correspondence as part of the General Conference. The letter is available on the INSAG website.

E. Activities of other international organizations

E.1. Institutions of the European Union

The High Level Group on Nuclear Safety and Waste Management was established by the European Commission Decision of 17 July 2007 (2007/530/Euratom) to assist the EU institutions in progressively developing common understanding and eventually additional European rules in the fields of the safety of nuclear installations and the safety of the management of spent fuel and radioactive waste. The Group may set up working groups or subgroups to study specific subjects and submit a report of its activities to the European Commission, the European Parliament and the Council of the European Union every two years. The Group comprises senior officials from national regulatory or nuclear safety authorities from the 27 Member States. The first meeting of the Group, held on 12 October 2007, was opened by the EU Energy Commissioner, followed by discussions on the working method and the purpose of the Group. The members will develop more detailed proposals at the next meeting. In principle, the Group will convene several times a year to discuss and follow up the agreed work programme.

The European Community supports nuclear safety-related research through the Framework Programme of the European Atomic Energy Community (Euratom). Euratom's Seventh Research Framework Programme (2007–2011) was launched in 2007, with a budget of around 2750 million euros. Just under one-third of this is earmarked for research in the field of nuclear fission, to be carried out either by means of a programme of indirect actions or by the Joint Research Center, focusing on

the safe exploitation and development of fission reactor systems, the management of radioactive waste, radiation protection and safety and security related to non-proliferation.

On 21 September 2007, the European Commission launched the Sustainable Nuclear Energy Technology Platform (SNE-TP). Its scope includes nuclear installation safety and nuclear systems including partitioning and transmutation and the fuel cycle, related research infrastructures and human resources. It is built around three pillars: the safety of current generations of light-water reactors; the development of the next generation fast reactors with closed fuel cycles and full actinide recycling; very-high temperature reactors for the co-generation of both electricity and process heat for industrial applications.

Since 1 January 2007, external cooperation on nuclear safety, as well as on physical protection and safeguards, is mainly financed through the new Instrument for Nuclear Safety Cooperation. The Council Regulation no. 300/2007 establishes a framework for the financial assistance provided by the Community to support the promotion of a high level of nuclear safety, radiation protection and the application of efficient and effective safeguards of nuclear material in third countries, covering the period 2007-2013. The Community assistance granted through this instrument is complementary to any other assistance provided under other EU instruments.

The measures that will be supported are related to the following main fields:

- The promotion of an effective nuclear safety culture at all levels;
- The promotion of effective regulatory frameworks, procedures and systems to ensure adequate protection against ionising radiations from radioactive materials;
- The establishment of the necessary regulatory framework and methodologies for the implementation of nuclear safeguards;
- The establishment of effective arrangements for the prevention of accidents with radiological consequences as well as the mitigation of such consequences should they occur, and for emergency-planning, preparedness and response, civil protection and rehabilitation measures;
- The promotion of international cooperation in the above fields, including in the framework of the IAEA.

E.2. Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA)

The Nuclear Energy Agency is a semi-autonomous body within the OECD maintaining and developing, through international cooperation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy. It operates mainly through a number of committees covering specific areas.

The Steering Committee for Nuclear Energy adopted a statement on the need for qualified human resources in the nuclear field. This statement, available on the OECD/NEA website[16], reflects the concerns about the difficulties nuclear institutions in many OECD/NEA member countries are experiencing in recruiting qualified specialists.

In 2007, the Committee on Nuclear Regulatory Activities (CNRA) group of senior regulators started preparing a report which will present the main elements that a regulator should address to ensure nuclear safety. The primary focus of this report is to underline the responsibilities and activities of the

[16] http://www.nea.fr/html/general/press/2007/2007-05.html

regulator to promote and ensure safety based on an integrated evaluation, to balance it against stakeholder expectations, to address regulatory interaction with licensees, and finally how to communicate the results. The discussion at the OECD/NEA Regulatory Forum (Forum on Assuring Nuclear Safety 2007, Paris, France, 12 to 13 June 2007), bringing together many top regulators, industry managers and safety research leaders to address the needs and challenges of a changing environment for nuclear energy, will also be reflected in the CNRA report.

Stage 2 of the Multinational Design Evaluation Programme (MDEP) continued to progress and will meet the deadline of completing the feasibility phase early in 2008. The MDEP Policy Group invited the OECD/NEA to act as the technical secretariat for this initiative and agreed to launch two pilot projects on the 'Licensing Basis and Scope of Design Safety Review' and 'Component Manufacturing Oversight'.

The OECD/NEA is currently running 16 joint projects on nuclear safety research, including two new multilateral projects, THAI[17] and BIP[18], for 2007.

Regarding fuel cycle facilities, the Committee on the Safety of Nuclear Installations (CSNI) organised an international workshop in October 2007 in Wilmington, North Carolina, USA. The workshop addressed how to ensure the safety of current and new fuel cycle facilities, discussing potential future issues based on the preliminary results of the CSNI survey on fuel cycle safety, such as fire, human factors and ageing.

On the occasion of the 50th anniversary of the Committee on Radiation Protection and Public Health (CRPPH), a special session 'Radiation Protection in Today's World: Moving Forward Together' was held on 31 May 2007. There was broad agreement on the radiation protection challenges, including: increasing relevance of balancing local, national and international needs when making decisions; the need to take new approaches to applying the precautionary principle to worker and public protection; the need to specifically consider application of the radiation protection system to particular applications (decommissioning, discharges, expansion of medical use of radiation, emergencies and malevolent acts); and knowledge management. Presentations by regulatory authorities and international organisations identified the issues of: the central role of stakeholder involvement in decision making; the importance of preparing to address radiation protection issues that could arise from the possibly extensive new build of nuclear reactors; and the need for strong and consistent international support for coherent application of radiation protection standards (in particular the new ICRP recommendations and their consistent application in the revised BSS through a collaborative partnership of all co-sponsoring organizations). Participants agreed on the importance of addressing the radiological protection of the environment in an internationally coherent fashion, on the need to address radiation protection issues in waste and transportation, and the need for increased attention and funding for R&D activities.

The current CRPPH programme of work, approved by the Committee at its May 2007 meeting, includes several new or extended expert groups. One extended group (Expert Group on Best Available Techniques) will continue its work on issues surrounding new build, notably investigating best available techniques for abatement of discharges, and is expected to continue its activities over the next three years with input from regulatory authorities and industry. This work, together with input from the new Expert Group on Occupational Exposures, will nurture discussions on radiological protection objectives that could be used by designers and operators of nuclear power plants in terms of

---

[17] The Thermal-hydraulics of Hydrogen, Aerosols and Iodine Project

[18] Behaviour of Iodine Project

new build, and that could also be used as expectation values by regulatory authorities assessing new license applications.

In addition, a new expert group, the Expert Group on Stakeholder Involvement and Organisational Structures, has been established to examine organisational challenges arising from increased engagement of stakeholders, building on last year's scoping study which concluded that engagement of stakeholders has become common practice.

The CRPPH continues its programmes in the areas of emergency management and occupational exposure. Its Working Party on Nuclear Emergency Matters, based on experience from the 2006 INEX 3 exercise, has created two new expert groups to study the areas of recovery efforts, mostly in the intermediate and later phases of an emergency situation, and decision making, again mostly in the later phases and involving input from affected stakeholders. Also, the Working Party is collaborating with the Nuclear Law Committee to identify areas for information exchange and common work to address the interfaces between emergency management and nuclear liability.

In 2001, the Radioactive Waste Management Committee (RWMC) issued the document entitled, *Reversibility and Retrievability in Geologic Disposal of Radioactive Waste*. In light of current interest in the topic, RWMC has decided to revise the document and a working group has been formed. The RWMC Forum on Stakeholder Confidence released three major reports in 2007. The first: *Fostering a Durable Relationship between a Waste Management Facility and Its Host Community*, notes that the societal durability of an agreed solution is essential for the success of any long-term radioactive waste management project. A second report: *Stakeholder Involvement in Decommissioning Nuclear Facilities* reviews stakeholder concerns and best practice in addressing them. The lessons learnt can contribute to better foresight in siting and building new facilities. Finally, the report *Cultural and Organisational Changes in RWM Organisations* provides insight on the different environments in which waste management organizations work.

E.3. World Association of Nuclear Operators (WANO)

Every organization in the world that operates an NPP is a member of WANO. This association has been set up to help its members achieve the highest practicable levels of operational safety by giving them access to the wealth of operating experience from the world-wide nuclear community. WANO is non profit making and has no commercial ties. It is not a regulatory body and has no direct association with governments.

In 2007, WANO conducted peer reviews at 43 NPPs, bringing the total number of peer reviews to 357 since the programme began in 1992. WANO's long-term goal is to conduct a WANO peer review of member nuclear stations such that each nuclear unit is reviewed at least once per six years, either as an individual unit or as part of a peer review that includes other units at a station. In addition, each station is encouraged to host an outside review at least every three years (allowing a WANO peer review to count as an outside review.) An outside review includes OSARTs, WANO follow-up peer reviews, national organizational reviews such as Institute of Nuclear Power Operations (INPO) and Japan Nuclear Technology Institute (JANTI) reviews.

WANO continues to emphasize technical support missions, which focus on providing assistance in selected areas, with more than 150 technical support missions undertaken during 2007.

A central operating experience team with representatives from all four WANO regional centres continues to develop operating experience products and information for members. This team produces Significant Event Reports, Significant Operating Experience Reports, and Hot Topics to keep members informed of important events and trends occurring in the industry. In addition, WANO

maintains a "Just-in-time" operating experience database that gives plant staff access to relevant operating experience immediately prior to undertaking specific operations and maintenance activities.

WANO held its Biennial General Meeting (BGM) in Chicago, USA from 24 to 25 September 2007. Every two years, senior nuclear utility executives and representatives from WANO members meet at the BGM to review progress and provide guidance for the future aims and objectives of WANO. The theme of the 2007 BGM was "Closing the gap – turning today's promise into tomorrow's reality".

F. Safety legislation and regulations

In 2007, many Member States either passed or updated their nuclear safety legislation and/or regulations. Examples of this, which were reported during meetings of the Commission on Safety Standards in 2007, include:

- In July 2007, the National Institute of Radiation Protection of Denmark issued Order No. 985 on sealed sources. The Order implements EU Directive 2003/122/EURATOM of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources and the Agency's Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources. In addition to requirements for safety, the order also specifies security requirements based on Agency guidance.
- In Switzerland, the nuclear safety inspectorate (HSK) is part of the Swiss Federal Office of Energy (SFOE), although at a technical level it acts independently from the rest of the Office. To achieve formal independence of the HSK from the SFOE, a new Federal Nuclear Safety Inspectorate Act (ENSIG) was developed. Under ENSIG, the Swiss supervisory authorities (the Inspectorate and the Section for Protection Against Sabotage of Nuclear Installations, which was attached to the SFOE) will be separated from the SFOE and converted to a single institution with formal, institutional and financial independence. The new law was discussed in parliament and approved by both chambers on 22 June 2007. After a three month period for a referendum had passed without objection, the law was approved by the Swiss Federal Council on 17 October 2007. At the same time, six members of the board of the Swiss Federal Nuclear Safety Inspectorate (ENSI) were elected by the Council. The board will take up its duties on 1 January 2008, whereas the Inspectorate will become formally independent of SFOE on 1 January 2009, when the name will change from HSK to ENSI.

G. Safety significant conferences in 2007

G.1. International Symposium on the Safety Cases for Deep Disposal of Radioactive Waste – Where Do We Stand?

The OECD/NEA and the Agency organized this international symposium, which was held from 23 to 25 January 2007 in Paris, France. There is increasing interest in international harmonization of approaches to structuring and presenting safety cases and their review by regulatory authorities. The meeting clearly agreed that an internationally harmonized approach would be beneficial and that achieving broader societal acceptance was considerably handicapped by the variation of national requirements.

G.2. Fifth International Symposium on Naturally Occurring Radioactive Material (NORM V)

This international symposium was organized by the University of Seville and held from 19 to 22 March 2007 in Seville, Spain. It followed, as a natural continuation, four previous symposia dealing with exposure to natural sources of radiation, held in Amsterdam, the Netherlands (1997), Krefeld, Germany (1998), Brussels, Belgium (2001) and Szczyrk, Poland (2004) respectively. Special attention was devoted to the following NORM topics:

- Thorium and its industrial applications;
- Processing and use of zircon and zirconia;
- Production of titanium dioxide;
- Monazite and the extraction of rare earths;
- Extraction, processing and use of phosphate minerals;
- Scrap recycling and waste management.

G.3. Workshop on the Agency's Integrated Regulatory Review Service

The French Nuclear Safety Authority (ASN), in cooperation with the Agency, hosted a workshop on the IRRS from 22 to 23 March 2007 in Paris, France, with the participation of governmental and regulatory authorities from Member States. In addition to informing governmental and regulatory authorities about the IRRS, participants reviewed lessons learned to date and identified ways in which the IRRS can be improved, including the establishment of a network of experts from nuclear regulatory authorities.

G.4. Special Symposium for Agency's 50th Anniversary: "Global Challenges for the Future of Nuclear Energy and the IAEA"

Hosted by the Japan Atomic Industrial Forum on the occasion of its 40th annual conference, this one-day Symposium held on 11 April 2007 was exclusively dedicated to the review of the Agency's 50 year history and activities and to assess the current status of the nuclear sector in the world. Topics addressed during the event included nuclear power generation and fuel cycle, nuclear safety and security, non-proliferation and future challenges for the Agency.

In addition to noting how the Agency has responded to challenges in the past, the symposium participants also looked at the challenges the Agency will face in the future and noted that safety must

remain the highest priority. It was also noted that new entrants must establish an infrastructure that provides the capability to build, operate and decommission NPPs safely and that the challenge of disposing of radioactive waste remains. Participants also noted that knowledge management will be ever more important in the years to come and that all of these challenges must be addressed in a transparent and open manner, with international cooperation at the forefront.

G.5. International Conference on Environmental Radioactivity: From Measurements and Assessment to Regulation

The Agency, in cooperation with UNSCEAR, organized this Conference, which was held in Vienna, Austria, from 23 to 27 April 2007. The Conference title 'From Measurements and Assessments to Regulation' reflects the broad scope of the subject area and the interests of some widely different disciplines, including regulation, assessment, monitoring, sampling and measurement. In the context of controlling the exposure of humans due to radioactivity in the environment, each of these disciplines is involved and interlinked. The conference sought to address all of these aspects and the inter-linkages between them.

G.6. International Conference on the Challenges Faced by Technical and Scientific Support Organizations in Enhancing Nuclear Safety

This Conference was hosted by the Government of France in Aix-en-Provence from 23 to 27 April 2007. Technical and Scientific Support Organizations (TSOs), whether part of a regulatory body or a separate organization, are gaining increased importance in providing the technical and scientific basis for decisions and activities regarding nuclear and radiation safety. International organizations such as the Agency and OECD/NEA also rely on the active contribution of TSOs. The Conference provided TSOs from different countries and other organizations and experts the opportunity to discuss and develop a common understanding of the TSO's responsibilities, needs, and opportunities.

The Conference concluded that TSOs are playing an important role in the safe and secure use of nuclear energy and associated technologies both at present and in the future and made a number of recommendations. These include, inter alia, that the Agency should facilitate the establishment of new or enhancement of existing networks on regional, international or topical bases between TSOs and other relevant bodies and that the Agency should consider developing peer review and self assessment approaches for the benefit of TSOs in enhancing nuclear safety.

G.7. International Conference on Knowledge Management in Nuclear Facilities

This Conference was held in Vienna, Austria from 18 to 21 June 2007, with a total of 212 participants and 20 observers from 42 Member States and ten international organizations attending. The objectives of the Conference were to take stock of the recent developments in nuclear knowledge management, to demonstrate and discuss the benefits of nuclear knowledge management in promoting excellence in operation and safety of nuclear facilities, to promote the use of nuclear knowledge management in the nuclear industry, and to provide insights and recommendations to the nuclear community. The Conference built upon the International Conference on Nuclear Knowledge Management — Strategies, Information Management and Human Resources Development held in 2004 in France.

Conference participants noted that nuclear knowledge management can, inter alia, contribute to maintaining the core knowledge that must be in place to operate existing facilities safely and help assure the smooth and effective transfer of knowledge from the current generation to the next. It was also noted that many key nuclear organizations, including regulatory authorities, utilities, research and

development organizations and vendors, have introduced and apply knowledge management as a corporate management approach with top-level commitment. At the strategic level, knowledge has emerged as a key resource and many organizations now have formal policies on knowledge management. These policies often include human resource management, information management and process management aspects.

The main recommendation of the conference is that nuclear knowledge management should become an integral part of all nuclear activities at the project, corporate and national level. The Conference also recommended that the Agency remain the global forum for advancing the use of nuclear knowledge management, continue to develop and provide guidance and assist in self assessments and programme development, and extend nuclear knowledge management activities to regulatory bodies and TSOs.

G.8. Open-ended Meeting of Technical and Legal Experts for Sharing of Information as to States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources

The Agency organized this meeting, which was held from 25 to 29 June 2007 in Vienna, Austria. The objective of the meeting was to promote a wide exchange of information on national implementation of the Code and the Guidance. In line with the non-legally binding nature of the Code and the Guidance, participation and presentation of papers was on a voluntary basis. The meeting was open to all Member and non-Member States, whether or not they had made a political commitment to the Code and/or to the Guidance. The meeting was attended by 122 experts from 70 Member States, two non-Member States, and observers from the European Commission, the Organization for Security and Co-operation in Europe (OSCE) and the Food and Agriculture Organization (FAO). Canada and the USA provided extrabudgetary funding to specifically support the participation of experts from States that otherwise could not have attended the meeting. Experts from 53 States presented papers on their experiences in implementing the Code and the Guidance. A number of conclusions were reached which are summarized in the Chair report[19]. The second such international meeting will be held from 26 to 28 May 2008.

G.9. Fourth Meeting of Competent Authorities Identified Under the Early Notification and Assistance Conventions

From 10 to 13 July 2007, the Competent Authorities met in Vienna for their 4th meeting, with 96 participants from 56 Member States and three international organizations in attendance. At the meeting, Competent Authorities recognized the quality and thoroughness of two work groups[20] findings and agreed that their recommendations represent a sound basis for enhancing international communications and assistance.

---

[19] http://www.iaea.org/About/Policy/GC/GC51Documents/English/gc51-3att1_en.pdf

[20] Work Group on International Communications and the Work Group on International Assistance of the International Action Plan for Strengthening International Preparedness and Response Systems for Nuclear and Radiological Emergencies

G.10. Regional Workshop on Denials and Delays of Shipment of Radioactive Material

From 12 to 13 July 2007, the Agency held a regional workshop on denials and delays of shipment of radioactive material in Montevideo, Uruguay. There was consensus from the 16 countries attending on the need for dissemination of accurate information on the transport of radioactive material. Communication among authorities, both at the national and regional level, needs to be improved. A number of reported instances of denials and delays could have been avoided if an efficient communication system in the region existed. Future actions include a tailored education and training programme for front line personnel (cargo handlers, customs, shipping agents, carriers) and the engagement of national regulatory bodies, other authorities and transport organizations.

G.11. International Workshop on Defence in Depth Aspects in Electrical Systems of Importance for Safety

This Workshop was hosted by the Swedish Nuclear Power Inspectorate (SKI) and was held from 5 to 7 September 2007 in Stockholm. The Workshop provided an opportunity for experts from industry and regulatory organisations to discuss events having occurred to electrical power supply systems, to exchange experience and to identify approaches to prevent or mitigate the consequences.

G.12. Geological Repositories: A Common Objective, a Variety of Paths

This Conference was organized by the International Association for Environmentally Safe Disposal of Radioactive Materials (EDRAM) and held from 15 to 17 October 2007 in Berne, Switzerland. There was consensus at an international level that disposal of high level radioactive waste in a deep geological repository offers the required long-term safety and security. A sound technical basis for implementing such repositories has already been established and effort needs to be invested now in discussing the way forward, as well as how the technical flexibility of the geological disposal concept can be used to help in meeting social and political requirements and expectations.

G.13. International Workshop on Harmonization of Approaches to Assuring Safety within National Radioactive Waste Management Policies and Strategies - A Common Framework for the Safety of Radioactive Waste Management and Disposal

The Agency organized this workshop, which was hosted by the Government of South Africa and held from 2 to 6 July 2007 in Cape Town, to assist in the establishment of comprehensive national radioactive waste management policies and implementing strategies that will ensure that all radioactive waste is appropriately managed and that a safe solution can be found for the disposal of all types of radioactive waste.

G.14. Technical Meeting on Remediation and Long Term Management of Radioactive Waste after Accidental Radioactive Releases to the Environment - the 20th Anniversary of the Goiânia Accident

The Agency, in cooperation with the Brazilian National Nuclear Energy Commission and the Spanish Nuclear Safety Council, held this technical meeting in Santos, Brazil from 3 to 5 October 2007. The long term consequences of different accidents were addressed, such as environmental impacts and management of radioactive waste arising from remediation actions. In the intervening two decades

since a series of accidents released radioactivity to the environment, much has been learned about management of the long term consequences of such accidents.

G.15. Technical Meeting on the Effective Management of Safety of Reactivity Control during Power Change and Shutdown in NPPs

This meeting, hosted the Nuclear and Industrial Safety Agency of Japan (NISA) and the Japan Nuclear Safety Organization (JNES), was held from 3 to 5 October in Tokyo. More than 80 participants, representing NPP operators, regulators and TSOs from 12 Member States and three international organizations, discussed reporting of events and incidents, technical issues, regulatory aspects and management of safety and leadership.

G.16. International Symposium on Extending the Operational Lifespan of Nuclear Plants

The Agency, in cooperation with the China Atomic Energy Authority and the China National Nuclear Corporation, organized this international symposium, held in Shanghai from 15 to 18 October 2007. With proper management, vigilance and safety enhancements, nuclear power plants can operate beyond their typical design lifespan of 30 to 40 years. Extending the operational life span of nuclear power plants is commonly referred to in the industry as plant life management or PLiM. This issue has gained increased attention over the past decade from regulators and operators alike.

The symposium focused on topical issues affecting PliM and provided a forum for information exchange on national and international policies, regulatory practices and safety culture; demonstrated effective strategies, including applications in an ageing management and PLiM programme; provided key elements and good practices related to the safety aspects of ageing, ageing management and long term operation; identified the progress made in ageing management and PLiM processes since the first international symposium; and assisted Member States further develop their PLiM programmes based on the latest technology available.

G.17. International Conference on Research Reactors: Safe Management and Effective Utilization

This conference was hosted by the Government of Australia and held from 5 to 9 November 2007 in Sydney. The conference focused on sharing of the latest scientific and technical information, including projects on design, construction and commissioning of new research reactor facilities. The conference fostered the exchange of information on current research reactors and provided a forum for reactor operators, designers, managers, users and regulators to share experience, exchange opinions and discuss options and priorities. A number of significant issues, primarily related to safety and security, operation and utilization, the fuel cycle, decommissioning and waste management, were also addressed.

G.18. Technical Meeting on the Risk Informed Decision Making Process

The Agency hosted this technical meeting in Vienna from 26 to 30 November 2007, with 21 delegates from 13 Member States plus the European Union attending. The meeting provided an opportunity for experts from industry and regulatory bodies to discuss the risk informed decision making process focusing on the key elements: defence-in-depth; safety margins; risk information; performance monitoring; and regulation.

H. Safety significant events in 2007

Through the various reporting mechanisms, the Agency was informed of 140 situations involving or suspected of involving ionizing radiation. In all cases, the Agency took actions, such as authenticating and verifying information, providing official information or assistance to the requesting party, or offering the Agency's good offices. Most of the situations were found to have no safety significance and/or no radiological impact to people or the environment.

The Nuclear Events Web Based System (NEWS) is a joint project of the Agency, OECD/NEA and WANO that provides fast, flexible and authoritative information on the occurrence of nuclear events that are of interest to the international community. NEWS covers all significant events at NPPs, research reactors, nuclear fuel cycle facilities, as well as occurrences involving radiation sources and the transport of radioactive material. The general public can access information submitted during the previous six months through the Agency's website[21].

The Incident Reporting System (IRS), operated jointly with the OECD/NEA, was set up in 1983 to exchange information on unusual events at NPPs and increase awareness of actual and potential safety problems. Since 2006, Web-based IRS has facilitated data input and report availability. As a consequence, the number of reports has increased and the dissemination delays have reduced. Activities within the IRS extend beyond the exchange of IRS reports. The Agency and the OECD/NEA have meetings and working groups of experts who meet regularly and discuss the safety relevance of events.

The 2007 joint Agency – OECD/NEA meeting of the IRS national coordinators discussed corrective actions and lessons learned from 22 recent events which occurred in NPPs. Two events were discussed in detail:

- *Dampierre 3, France (Pressurized Water Reactor)*: (2007-04-09) A relay failure led to the loss of the two 6.6kV emergency switchboards on train A. Protective and safeguard auxiliaries could only be power supplied from the 6.6kV switchboard on train B. During this incident, the initial situation was made worse by another fault, this time on a turbine trip breaker, causing the line breaker to open, disconnecting unit 3 from the 400 kV main offsite power line. In addition, the instrumentation and control device used to switch over to the auxiliary power supply had been cut, in accordance with the required operating procedures in the event of this type of incident. The loss of offsite power led to a reactor scram, reactor coolant pump shutdown and the automatic start up of the emergency diesel generator on train B.
  It has been established that the loss of the 6.6 kV emergency switchboard on train A was caused by a malfunction on an overcurrent relay. Although the conditions triggering the on-site emergency plan had not been reached, the plan was implemented as a preventive measure, thereby ensuring effective technical dialogue between the operator, the TSO and the nuclear safety authority. Offsite power was restored in the morning on 10 April, providing better conditions for bringing the reactor unit to a safe state. Investigations and studies are still underway to determine the exact cause of the failures observed during the incident. Incidents involving electrical switchboard failures have highlighted the complexity of the situations that may arise in connection with such incidents and the difficulties of managing these situations using current

[21] http://www-ns.iaea.org/news/default.asp

applicable procedures.
An INES rating has not been assigned to this event.

- *Kashiwazaki-Kariwa, Japan, (Boiling Water and Advanced Boiling Water Reactors)*: (2007-07-16) At 10:13 a.m. local time, a strong earthquake measuring 6.8 on the Richter scale struck Chuetsu area in Japan, with the epicentre approximately 9 kilometres from the NPP. Units 2, 3, 4 and 7 shut down automatically as designed. Unit 2 was under start up operation when the reactor was shut down. Unit 1, 5 and 6 were already shutdown for maintenance when the earthquake occurred. The maximum acceleration observed at the station was 680 gals. The designed acceleration at the observation point is 273 gals. At Unit 2, the maximum acceleration recorded was 3.6 times the value anticipated in the design stage (observation: 606 gal; design value: 167 gal).
  At 10:15, plant operators identified smoke coming from the station transformer at Unit 3. The Fire Department extinguished the fire at 12:10. Water in the Unit 6 spent fuel pool sloshed around and some leaked into non radiation controlled areas on the third floor and mezzanine. An estimated 1.2 cubic metres of water containing ~90 000 Bq radioactivity in total was discharged to the sea.
  Ducts connected to the main exhaust stacks in Units 1 to 5 were displaced, but this has not resulted in changes to releases from the plant.
  The entire 5th basement floor of the Reactor Combination Building at Unit 1 (controlled area) was flooded with water measuring 48 centimetres deep, with minute traces (~6 Bq/ml) of radioactive materials, caused by earthquake damage to the outdoor piping of the fire protection system. The basement floors of the Reactor Combination Building do not contain structures, systems or components important for reactor safety.
  From the perspective of ensuring public safety and security, the following measures are being implemented in all Japanese NPPs:
    - Enhance the in-house fire-fighting system;
    - Build a swift and strict accident reporting mechanism;
    - Confirm facilities' seismic safety with priority on public safety.

  An INES rating of 0 has been assigned to this event.

Other events of interest that were reported to the Agency include:

- *SGS Tecnos SA, Spain (radiography)*: (2007-10-22) an event resulting in the overexposure of one radiographer. The event occurred in an enclosure industrial radiography installation during the preparation of the radiography exposures. The event involved a gammagraphy device with a 2 TBq (55 Ci) Co-60 source. The interlock access control system to the room was broken so there were two fixed radiological survey instruments with visual alarm inside the room to check the radiation levels during operation. The worker carried a thermoluminescent personal dosimeter as well as a direct reading dosimeter with an acoustic alarm and a radiometer, but these monitoring systems had been failing occasionally. The operator did not realise the visual warning signals from the fixed instruments and remained inside the room for 10 -15 minutes while the source was exposed. The dose recorded by the thermoluminescent personal dosimeter was 718 mSv. On October 29 the worker was submitted to a medical review following the national standard guidance for accidentally exposed individuals as well as dosimetry by chromosome aberration analysis. An INES rating of level 3 has been assigned to this event.
- *OPAL Research Reactor, Australia*: (2007-07-24) During a routine core video inspection at the end of the operating programme, the team discovered three plates of three different fuel assemblies being displaced from their nominal positions by some 25mm, 250mm and 400mm respectively. No release of

fission products was detected. An INES rating of level 2 has been assigned to this event.

- *Georges François Leclerc Radiation Therapy Centre, France*: (2007-06-15) This event occurred during the treatment of a patient in radiation therapy. The irradiation of the patient was started while a radiation therapist was still in the treatment room. The irradiation was stopped after around ten seconds, resulting in an effective dose to the therapist of about 30 mSv, exceeding the annual regulatory dose limit of 20 mSv for a worker. No health effects are expected for the worker. The French regulatory authority conducted a reactive inspection and determined that the event was caused by human errors and a lack of procedures. The centre has taken immediate corrective organisational measures and committed itself to perform an in-depth risk identification analysis. This event has been assigned an INES rating of level 2.
- *University Hospital Ghent, Belgium*: (2005-12-29 to 2006-09-22) In March 2007, the Belgian Federal Agency for Nuclear Control (FANC) was informed of a problem in applied radiotherapy. Upon investigation, a misalignment of 13 mm between the reference point of the CT localization box and the reference point of the linear accelerator caused the dose to be administered incorrectly for 17 patients undergoing stereotactic radiosurgery. To date, none of the patients has shown clinical symptoms that are, or that even can probably be, attributed to the misalignment. Every identified patient has been followed up medically. An INES rating has not been assigned to this event.

I. Safety Networks

I.1. Asian Nuclear Safety Network (ANSN)

During 2007, the ANSN continued to develop with hubs in China, Japan and Republic of Korea and national centres in Indonesia, Malaysia, Philippines, Thailand and Vietnam. Australia, France, Germany, Japan, Republic of Korea and the USA provide in-kind and/or financial support in the frame of the Extrabudgetary Programme on the Safety of Nuclear Installations in South East Asia, Pacific and Far East Countries (EBP).

The ANSN Steering Committee, chaired by Australia, met twice in 2007 to coordinate ANSN development and work of the topical groups.

At the review meeting of the EBP, held in December 2007, results of 2007 activities were discussed and the work programme for 2008 was finalized. It was also decided to combine the review meeting and the meeting of the Steering Committee of the ANSN into one single annual meeting starting in 2008.

The ANSN has now reached maturity as a technical network for pooling and sharing nuclear safety knowledge. Considering the rapid expansion of nuclear power programmes, notably in China, and the interest of other countries in the region to embark on nuclear power programmes, the ANSN is expected to play an increasingly important role as a regional forum for senior decision makers to share strategies and experience to enhance nuclear safety. This role will be further explored in 2008.

The role of the topical groups is increasing, in particular for the management of regional activities, the creation of new knowledge to be shared in the ANSN, and the consolidation of existing knowledge. The new topical group on safety management of research reactors was activated in 2007.

The Agency's ANSN website developed considerably in 2007 with the upload of the material of past EBP activities.

During a Consultancy Meeting in March 2007 in Vienna, a new Integrated Safety Evaluation (ISE) process was approved. The scope of this self-evaluation process has been expanded to include new topics such as emergency preparedness and radioactive waste management. The first two steps of the process are available electronically on the Agency's ANSN website and was successfully used by the participating countries at the end of 2007.

To increase the ANSN outreach, the bi-weekly ANSN Newsletter is being widely distributed worldwide. In 2007, a promotional meeting (Caravan) was conducted in Vietnam to introduce the ANSN to those its scientific communities.

Increasing cooperation with the Forum of Nuclear Cooperation in Asia (FNCA) and Regional Cooperation Agreement (RCA) took place in 2007. It was also decided to inform the Association of Southeast Asian Nations (ASEAN) of ANSN activities and to look into the possibility of seeking participation in the nuclear safety related activities of that organisation.

I.2. Ibero-American Nuclear and Radiation Safety Network

In 2007, the Ibero-American Forum of Nuclear and Radiological Regulators agreed that the Ibero-American Nuclear and Radiation Safety Network would be hosted in Brazil. Installation of the server in Brazil has started and will be fully implemented in 2008.

The Network contains technical knowledge of regulatory interest in areas such as radiological protection of patients, safety of radioactive sources, national and Agency safety standards, national legislation and education and training. The Network is populated with resources provided by participating countries. Resources are classified and uploaded according to an agreed taxonomy that allows efficient interrogation and retrieval by registered users.

The Network also provides a working environment for implementing specific projects (see section C.4 of this Appendix). Project working group spaces provide participants with common access to drafts and results and meeting reports, as well as teleconferencing facilities.

J. The evolution of the uranium market and its consequences on Agency Programme L[22]

J.1. Current situation

The world energy demand is increasing and as a consequence the place of nuclear powered electricity generation has been reconsidered as a significant part of the solution to mitigate the effects of climate change while maintaining a sustainable economic development.

---

[22] More information on Agency activities concerning the front-end of the fuel cycle is available in relevant sections of the latest IAEA Annual Report (http://www.iaea.org/Publications/Reports/Anrep2006/) and at http://www.iaea.org/OurWork/ST/NE/NEFW/index.html.

The anticipated expansion of the nuclear power industry has sparked off a very rapid expansion of the market in uranium, the fuel source for the nuclear industry. One result is that interest in uranium mining world-wide is increasing at an astounding rate. The 2007 demand for uranium was 69 110 tonnes compared to 66 500 tonnes in 2006, but mine production in 2006 was only approximately 60% of this at 39 600 tonnes[23]. The immediate consequence has been a rapid increase in the price of uranium in the spot market. Figure 1 shows how spot prices of U_3O_8 have risen rapidly in the past two years after more than 20 years of depression. Outside short term variations related to market speculation, the trend of the contract price is still upwards steadily from $20-25 per pound of U_3O_8 for sales in 2007 to current contract prices of $60+ for future sales.

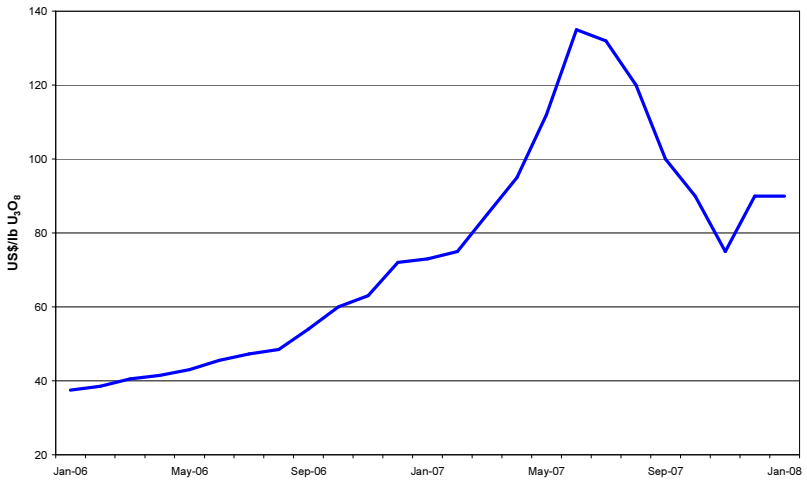


Figure 1: evolution of US$/lb U_3O_8 in 2006-2007[24]

The economic situation will remain buoyant as the demand for fuel for nuclear power plants seems likely to rise steadily as shown in the Figure 2 below. Even at the low end of the projections the demand for uranium will far exceed current production and will require new mining and processing facilities.

[23] These figures are based on the forthcoming OECD/NEA-IAEA 'Red Book' (OECD NUCLEAR ENERGY AGENCY-INTERNATIONAL ATOMIC ENERGY AGENCY, Uranium – 2007: Resources, Production and Demand, OECD, Paris (2007)

[24] http://www.uxc.com/review/uxc_Prices.aspx

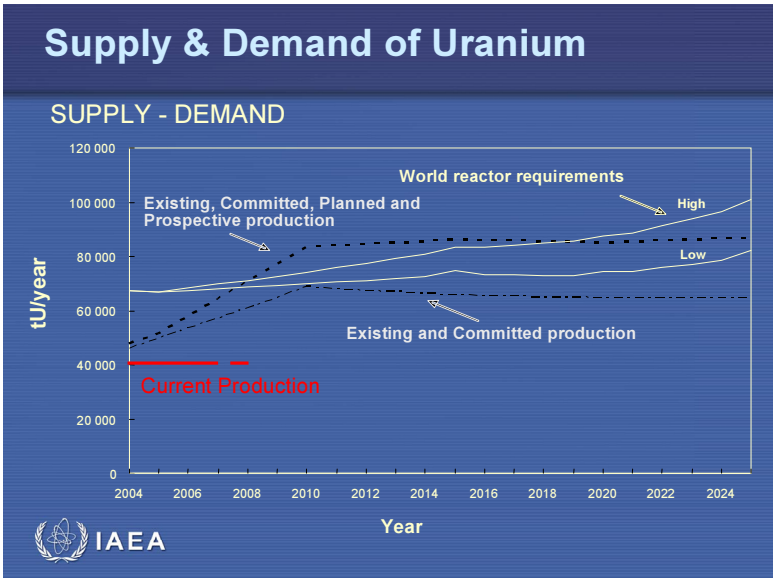


Figure 2: Projection of forward supply and demand for uranium

The time taken to find and develop new uranium resources has also been lengthening and is typically around 20 years. The rate of expenditure on uranium exploration has been low for many years. The first wholly new uranium mine since 1986 was opened only late in 2006 in Namibia. With the increasing uranium price, uranium exploration is increasing exponentially. New countries predominantly receive the attention of junior mining companies, whilst the major mining houses tend to look more closely at the assets and licence areas they already control. With such long lead times for major deposits, the development of many smaller deposits is likely to be where the industry will concentrate its efforts. Such deposits are often in Member States with little or no previous mining history, let alone uranium mining experience.

In this market atmosphere the number of smaller mining companies interested in uranium has grown rapidly. In both Australia and Canada, the two leading producer countries, the number of companies expressing an interest in uranium mining has gone from 20 or less in 2004 to over 240 in each country in 2007.

For the past 20 years, the expenditure of the uranium mining industry was low and there were many legacy sites from earlier days requiring remediation that were not given proper attention. For example, in the early 1990's, there was a sudden cessation of much of the uranium mining in the newly independent states of Central Asia. The Agency has been working for many years to help the affected Member States to restore their regulatory infrastructures and upgrade their skills and abilities to prepare for the remediation of these legacies once funding could be made available from multilateral donors. There have both been regional and national projects under the technical cooperation programme since 2004 addressing these issues in Central Asia. Other projects have been assessing remediation in Africa and looking at the potential for remediation activity in Asia, Europe, and South America.

J.2. Increasing demand for Agency assistance

Since 2005 there has been a rapid expansion in Member State requests for Agency assistance related to the growth of activity in the uranium mining industry. This has manifested itself in a sharp increase in requests for Agency assistance related to uranium mining and production and to regulatory issues and legal aspects. Also some existing projects, related initially to the remediation of legacy sites, may now have changed emphasis with the sites being actively investigated for possible re-opening and

redevelopment of remaining resources or re-working of old residues. All this activity needs to be undertaken with proper regulation and supervision to ensure that safety standards are enforced and maintained to protect people and the environment. This boom in uranium related activity is worldwide and covers two types of situation:

- Where a country already has one or more NPP but does not mine uranium or not enough for present demand: In order to assure themselves of future energy supplies, such Member States are seeking to expand uranium mining or even to begin exploration for uranium and develop the mining sector very quickly. These Member States also may not have regulatory systems sufficiently well developed to assure the safe development and exploitation of uranium resources.
- Where a previously known uranium deposit has become economic with the price increase: Most of these countries have no history of uranium mining, little history of any mineral exploitation activity, no appropriate regulatory framework for radiological protection and few qualified staff who could be expected to regulate such a new activity. Mining companies are increasingly interested in exploiting uranium assets. A regulatory authority to set the necessary standards and to regulate the mining activities is required.

As examples for 2007: Malawi has been seeking urgent assistance to develop the legal and regulatory infrastructure and system to be able to manage its responsibilities in relation to a new uranium mine. Mongolia has begun to look at remediation of former uranium mines that were legacy sites; in the meantime these same sites are being evaluated for re-opening as mines. Member States in South America are looking at how to regulate proposed new uranium exploration programmes submitted by mining companies and asking for Agency assistance. In Africa, there is a much increased level of interest in exploration for new deposits, development of unexploited resources previously identified, and possible re-opening of former production sites. A similar, but less pronounced, situation exists in Europe.

Member States need a secure supply of energy. This requires a legal and regulatory regime that will ensure that the public and the environment remain protected and safe from any possible impacts from the development and exploitation of uranium deposits.

The Agency has already undertaken a proactive development in which operators (through the World Nuclear Association) and regulators from the major uranium mining countries have been brought together to produce a Code of Practice in Radiation, Environmental and Occupational Safety. This is intended to provide new junior partners in the uranium resource development industry with a set of principles by which they can abide to ensure that appropriate standards are met.

A serious developing issue is the provision of properly trained staff in Member States to ensure the safe and secure development for all these operations. The uranium mining industry has been very quiet for about 20 years and so there has been little to attract new and young professionals into either the operation or regulation of the mines. Many of the current staff are close to retirement and there are barely enough experienced personnel available to manage the present production situation, much less any expansion. With the rapid expansion of activity, finding a sufficient number of suitable people for the industry will become more and more difficult. As the industry seeks to recruit, it will be more difficult for the regulatory systems in existing and new producer countries to attract personnel. This is inevitable since industry frequently offers higher rewards to staff than government entities. As such, one activity which will require support is the training of sufficient numbers of staff in Member States to ensure the safe and secure development of the expanding uranium mining industry. This is an area in which the Agency has an opportunity to assist — if it can supply sufficient trainers.

An additional issue will be the requirement for the Agency to undertake expert missions and fact-finding missions to ascertain exactly what Member State requirements are in the various activities that will need to be undertaken to support the safe expansion of uranium resource development.

In order to be able to support the anticipated expansion of activity in the whole of the uranium mining cycle, a major effort will be required on the part of the Agency. The availability of external experts of suitable knowledge and experience is decreasing rapidly due to a combination of the ageing of the working population in this specific area and the demand from industry, which is prepared to offer significantly higher incentives.

Links exist with multilateral agencies that are either already funding activities or have been asked for support by Member States. Examples include: a request for assistance from Kyrgyzstan directed to UNDP in dealing with legacy sites; the World Bank funding of some safety related work in relocation of uranium mill tailings at one legacy site in Kyrgyzstan; and Tajikistan's request for aid to develop an appropriate safety regime to support a programme of re-processing uranium mill tailings and the eventual remediation of the associated legacy site. The OSCE and NATO are partners in a programme in Central Asia to assist in the remediation planning for uranium mining legacy sites. The Agency has been working to maintain liaison with all these other organisations to try and ensure that the technical assistance effort going into the region is optimized.

Appendix 2

The Agency's Safety Standards: Activities during 2007

A. Introduction

Article III.A.6 of the IAEA Statute authorizes the Agency "to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangements, or, at the request of a State, to any of that State's activities in the field of atomic energy." The categories in the Safety Standards Series are Safety Fundamentals, Safety Requirements and Safety Guides.

The end of the four year term (2004–2007) of the Commission on Safety Standards (CSS) and of the three year term (2005–2007) of the four Safety Standards Committees was reached in 2007. Member States noted with appreciation the high quality and great relevance of the safety standards achieved with the help of the Committees and the CSS at the Board of Governors and at the 51st regular session of the General Conference in September 2007. Term reports are being prepared by the CSS and the Safety Standards Committees and will be available on the Agency's website when complete.

The main achievement during these CSS and Safety Standards Committees' terms was the completion and publication of the Safety Fundamentals publication on Fundamental Safety Principles, as a central element for the strengthening of the global safety regime and use of the Agency's Safety Standards worldwide. The successful completion of the action plan approved by the Board of Governors in March 2004 was another major achievement that has resulted in further enhancement of the global safety regime.

The Agency's new Integrated Regulatory Review Service (IRRS) has enjoyed considerable success owing to its firm foundations on the Fundamental Safety Principles and the Safety Requirements publication No. GS-R-1 on Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety. The revision of publication No. GS-R-1 will take into account the many valuable lessons learned from the IRRS missions.

Several other important Safety Requirements relating to the management system, research reactors, decommissioning of facilities and geological disposal were also published in 2007. The September 2007 meeting of the Board of Governors approved the Safety Requirements publication on the Safety of Fuel Cycle Facilities.

In 2007, the revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) was started. In December 2007, the CSS also approved the revising of Safety Requirements No. GS-R-1: *Legal and Governmental*

Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, No. NS-R-1: *Safety of Nuclear Power Plants: Design* and No. NS-R-2: *Safety of Nuclear Power Plants: Operation*, all first published in 2000.

Another important result of the 2004–2007 term is the progress achieved so far in the preparatory work being done by the CSS task force on the long term vision for the structure of the standards.

In terms of process, several significant improvements were observed, with, in particular, increased levels of openness, transparency and quality of the review process, with greater involvement of the users and interested parties, including collaborators in industry, and greater interaction between the Member States, the Committees and the CSS. This was facilitated by the use of modern information technologies and in particular the newly established interactive web site.

The IAEA Safety Glossary, which represents the international consensus on the terminology used in the safety standards, has been published in English, Arabic and Chinese. Editions in the other three official languages, French, Russian and Spanish, were being finalized. This work will assist in ensuring consistency in the six languages throughout all Safety Standards.

Since the establishment of the CSS and the Committees in 1995, 89 standards have been endorsed by the CSS for publication; of these, 79 (one Safety Fundamentals, 13 Safety Requirements and 65 Safety Guides) have been published; and 63 further standards (nine Safety Requirements publications and 54 Safety Guides) are being drafted or revised. A list of IAEA Safety Standards, indicating their status as of 31 December 2007, is attached as Annex I, and an up-to-date status report can be found on the Agency's website[25]. The full texts of published IAEA Safety Standards are also available on the website[26].

B. Commission on Safety Standards (CSS)

The CSS, chaired by Mr. André-Claude Lacoste, President of the Nuclear Safety Authority in France, met twice in 2007, in June and in November. A CSS task force on the long-term structure for the safety standards was also created in 2007 and met in September and November 2007.

In 2007, the CSS endorsed the submission of the draft Safety Requirements publication on the Safety of Fuel Cycle Facilities to the Board of Governors for approval. The CSS also endorsed in 2007 for publication draft Safety Guides on: Management Systems for Technical Services in Radiation Safety (DS315), Management Systems for the Safe Transport of Radioactive Material (DS326), The Management System for the Processing, Handling and Storage of Radioactive Waste (DS336), The Management System for the Disposal of Radioactive Waste (DS337), Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (DS346), Core Management and Fuel Handling for Research Reactors (DS350), Operational Limits and Conditions and Operating Procedures for Research Reactors (DS261), The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors (DS325), Management Systems for the

[25] http://www-ns.iaea.org/downloads/standards/status.pdf

[26] http://www-ns.iaea.org/standards/

Safe Transport of Radioactive Material (DS326), and Conduct of Operations at Nuclear Power Plants (DS347).

The CSS also approved in 2007 document preparation profiles (DPPs) for the revision of five existing Safety Guides and the preparation of eight additional new Safety Guides.

C. Nuclear Safety Standards Committee (NUSSC)

The Nuclear Safety Standards Committee (NUSSC), chaired by Mr. Lasse Reiman of the Radiation and Nuclear Safety Authority (STUK) of Finland, met twice in 2007.

In 2007, one Safety Guide was published: Maintenance, Periodic Testing and Inspection of Research Reactors: Safety Standards Series No. NS-G-4.2.

At its meetings in March and October 2007, NUSSC approved nine draft IAEA safety standards for submission to the CSS, namely three Safety Guides on Safety of Nuclear Fuel Cycle Facilities: Uranium Fuel Fabrication Facilities, Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities, and Conversion Facilities and Uranium Enrichment Facilities, and a Safety Requirements on Predisposal Management of Radioactive Waste, as well as five Safety Guides on the operation of nuclear power plants and research reactors.

In addition NUSSC reviewed and commented on various draft safety standards dealing with nuclear safety issues such as ageing, decommissioning, safety assessment and management systems. In 2007, NUSSC approved DPPs for eight new safety standards.

NUSSC also discussed a strategy for the future development and application of the IAEA Safety Standards, in particular the 'Roadmap on the Long Term Structure for Safety Standards' prepared by the CSS.

NUSSC had a joint meeting with RASSC and WASSC to enhance synergies and to avoid the duplication of work on the growing number of joint safety standards.

NUSSC was also involved in the revision of the BSS and commented on the different drafts prepared by the Secretariat.

As for the working tools, NUSSC introduced a new website where the members of the Committee could directly upload their comments on documents under review, as did all the other Committees.

A three year report[27] of the fourth term of NUSSC (2005–2007) has been drafted. The new term starts with the 25th NUSSC meeting in May 2008.

[27] http://www-ns.iaea.org/committees/files/draftcomments/547/FourththreeyearreportDraft3.1_301007_inclBelgcomments.pdf

D. Radiation Safety Standards Committee (RASSC)

The Radiation Safety Standards Committee (RASSC), chaired by Mr. Sigurdur Magnussson of the Icelandic Radiation Protection Institute, met in April and October 2007. The April meeting included a joint meeting with NUSSC and WASSC, and the October meeting included a joint meeting with WASSC, to discuss issues of common interest.

In 2007, RASSC approved a draft Safety Requirements publication on Predisposal Management of Radioactive Waste, and draft Safety Guides on: Advisory Material for the 2005 Edition of the IAEA Transport Regulations; Safety Assessment for the Decommissioning of Nuclear Facilities; Safety of Nuclear Fuel Cycle Facilities: Uranium Fuel Fabrication Facilities, Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities, and Conversion Facilities and Uranium Enrichment Facilities; and Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors.

RASSC received progress reports from the Secretariat on the revision of the International Basic Safety Standards (BSS). At both meetings, working groups were formed to discuss issues that had arisen during the revision of the BSS and to provide guidance to the Secretariat on resolving those issues.

In 2007, RASSC approved DPPs for the revision of three Safety Requirements publications and for the development of three new Safety Guides.

E. Transport Safety Standards Committee (TRANSSC)

The Transport Safety Standards Committee's (TRANSSC's) 14th and 15th meetings were chaired by Mr. Jarlath Duffy of the Radiological Protection Institute of Ireland. Meetings were convened in March and September 2007. On average there were 78 attendees, representing 35 Member States and six international organizations.

TRANSSC approved three draft safety standards relating to transport and three other standards for submission to CSS. The three standards relating to transport were on Management Systems; Compliance Assurance; and Schedules. In addition TRANSSC reviewed TS-R-1, 2005 Edition for harmonization with the UN Model Regulations on the Transport of Dangerous Goods. The other three were Safety Requirements on: Safety Assessment and Verification of Nuclear Facilities and Activities, and Predisposal Management of Radioactive Waste, and a Safety Guide on Radiation Safety in Industrial Radiography.

Four DPPs were approved on: Revision of NS-R-1: Safety of Nuclear Power Plants: Design; Revision of NS-R-2: Safety of Nuclear Power Plants: Operation; Revision of GS-R-1: Governmental and Regulatory Framework for Nuclear, Radiation, Radioactive Waste and Transport Safety; and the Licensing Process for Nuclear Installations.

In accordance with the new review and revision policy endorsed by the 49th regular session of the General Conference in 2005, a call for issues and any problems identified to be raised was initiated in June 2007 to address the possible publication of a new edition of TS-R-1 in 2011.

These proposals were discussed, more than 100 submissions were reviewed and the criteria developed by TRANSSC were applied. It was concluded that for none of the issues raised was there enough information available to be identified as significant in terms of safety, except with regard to the issue of harmonization with UN Model Regulations on the Transport of Dangerous Goods, which is already addressed in the draft 2009 Edition of TS-R-1.

F. Waste Safety Standards Committee (WASSC)

The Waste Safety Standards Committee (WASSC), chaired by Mr. Thiagan Pather of the National Nuclear Regulatory Body of South Africa, met in April and October 2007. The April meeting included a joint meeting with RASSC and NUSSC, and the October meeting included a joint meeting with RASSC, to discuss issues of common interest.

In 2007, WASSC approved three draft safety standards relating to waste management and four other draft standards for submission to the CSS. The waste management related drafts were: a draft Safety Requirements publication on Predisposal Management of Radioactive Waste; and draft Safety Guides on Safety Assessment for the Decommissioning of Nuclear Facilities and on Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors. Others drafts approved were for Safety Guides on Advisory Material for the 2005 Edition of the IAEA Transport Regulations; Safety of Nuclear Fuel Cycle Facilities: Uranium Fuel Fabrication Facilities, Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities, and Conversion Facilities and Uranium Enrichment Facilities.

At both meetings, WASSC received progress reports from the Secretariat on the revision of the BSS. In the April 2007 meeting, WASSC contributed to the RASSC working groups to discuss issues that had arisen during the revision of the BSS and to provide guidance to the Secretariat on resolving those issues.

In 2007, WASSC approved DPPs for the revision of three Safety Requirements publications and for the development of three new Safety Guides. The DPPs for the three Safety Requirements publications were for the revision of Safety of Nuclear Power Plants: Design (NS-R-1); Safety of Nuclear Power Plants: Operation (NS-R-2); and Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (GS-R-1). The DPPs for the three new Safety Guides were those on: Licensing of Nuclear Facilities; Protection of the Public against Exposure to Natural Sources of Radiation including NORM Residues from Industrial Processes; and Arrangements for Dealing with Orphan Radioactive Sources and Radioactively Contaminated Material in the Metal Recycling Industry.

The IAEA Safety Standards as of 31 December 2007

Safety Fundamentals

SF-1 Fundamental Safety Principles (2006) **Co-sponsorship:** EC, Euratom, FAO, ILO, IMO, OECD/NEA, PAHO, UNEP, WHO

Thematic Safety Standards

Legal and Governmental Infrastructure

GS-R-1 Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000) (under revision)
GS-G-1.1 Organization and Staffing of the Regulatory Body for Nuclear Facilities (2002)
GS-G-1.2 Review and Assessment of Nuclear Facilities by the Regulatory Body (2002)
GS-G-1.3 Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body (2002)
GS-G-1.4 Documentation for Use in Regulating Nuclear Facilities (2002)
GS-G-1.5 Regulatory Control of Radiation Sources (2004) **Co-sponsorship:** FAO, ILO, PAHO, WHO

One other Safety Guide on licensing process for nuclear installations is being developed.

Emergency Preparedness and Response

GS-R-2 Preparedness and Response for a Nuclear or Radiological Emergency (2002) **Co-sponsorship:** FAO, OCHA, OECD/NEA, ILO, PAHO, WHO
GS-G-2.1 Arrangements for Preparedness for a Nuclear or Radiological Emergency (2007) **Co-sponsorship:** FAO, OCHA, ILO, PAHO, WHO
109 Intervention Criteria in a Nuclear or Radiation Emergency (1994) (under revision)

One other Safety Guide on criteria for use in planning response to nuclear and radiological emergencies (replacing 109) is being developed.

Management System

GS-R-3 The Management System for Facilities and Activities (2006)
GS-G-3.1 Application of the Management System for Facilities and Activities (2006)

Safety Guides in the Safety Series 50-SG
Q8 Quality Assurance in Research and Development (under revision)
Q9 Quality Assurance in Siting (under revision)
Q10 Quality Assurance in Design (under revision)
Q11 Quality Assurance in Construction (under revision)
Q12 Quality Assurance in Commissioning (under revision)
Q13 Quality Assurance in Operation (under revision)

Q14 Quality Assurance in Decommissioning (under revision)

One Safety Guide is being developed on management system for nuclear installations to replace the above Q8 to Q14 guides and four other Safety Guides for: technical services in radiation safety; safe transport of radioactive material; waste treatment; and waste disposal are being developed.

Assessment and Verification

GS-G-4.1 Format and Content of the Safety Analysis report for Nuclear Power Plants (2004)

A Safety Requirement on safety assessment and verification and another Safety Guide on risk informed decision making are being developed. A Safety Guide on criticality safety is also being developed.

Site Evaluation

NS-R-3 Site Evaluation for Nuclear Installations (2003)
NS-G-3.1 External Human Induced Events in Site Evaluation for Nuclear Power Plants (2002)
NS-G-3.2 Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants (2002)
NS-G-3.3 Evaluation of Seismic Hazard for Nuclear Power Plants (2003)
NS-G-3.4 Meteorological Events in Site Evaluation for Nuclear Power Plants (2003) (under revision)
NS-G-3.5 Flood hazard for Nuclear Power Plants on Coastal and River Sites (2004) (under revision)
NS-G-3.6 Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants (2005)

Radiation Protection

115 International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996) **Co-sponsorship:** FAO, ILO, OECD/NEA, PAHO, WHO (under revision)
RS-G-1.1 Occupational Radiation Protection (1999) **Co-sponsorship:** ILO
RS-G-1.2 Assessment of Occupational Exposure Due to Intakes of Radionuclides (1999) **Co-sponsorship:** ILO
RS-G-1.3 Assessment of Occupational Exposure Due to External Sources of Radiation (1999) **Co-sponsorship:** ILO
RS-G-1.4 Building Competence in Radiation Protection and the Safe Use of Radiation Sources (2001) **Co-sponsorship:** ILO, PAHO, WHO
RS-G-1.5 Radiological Protection for Medical Exposure to Ionizing Radiation (2002) **Co-sponsorship:** PAHO, WHO
RS-G-1.7 Application of the Concepts of Exclusion, Exemption and Clearance (2004)
RS-G-1.8 Environmental and Source Monitoring for Purposes of Radiation Protection (2005)
RS-G-1.9 Categorization of Radioactive Sources (2005)
RS-G-1.10 Safety of Radiation Generators and Sealed Radioactive Sources (2006) **Co-sponsorship**: ILO, PAHO, WHO

Two other Safety Guides on protection of the public against exposure to natural sources of radiation and on justification of practices are being developed.

Radioactive Waste Management

WS-R-2 Predisposal Management of Radioactive Waste, including Decommissioning (2000) (under revision)

WS-G-1.2	Management of Radioactive Waste from the Mining and Milling of Ores (2002) (under revision)
WS-G-2.3	Regulatory Control of Radioactive Discharges to the Environment (2000)
WS-G-2.5	Predisposal Management of Low and Intermediate Level Radioactive Waste (2003)
WS-G-2.6	Predisposal Management of High Level Radioactive Waste (2003)
WS-G-2.7	Management of Waste from the Use of Radioactive Materials in Medicine, Industry, Agriculture, Research and Education (2005)
WS-G-6.1	Storage of Radioactive Waste (2006)
111-G-1.1	Classification of Radioactive Waste (1994) (under revision)

One other Safety Guide on safety assessment is being developed.

Decommissioning

WS-R-5	Decommissioning of Facilities Using Radioactive Material (2006)
WS-G-2.1	Decommissioning of Nuclear Power Plants and Research Reactors (1999) (under revision)
WS-G-2.2	Decommissioning of Medical, Industrial and Research Facilities (1999) (under revision)
WS-G-2.4	Decommissioning of Nuclear Fuel Cycle Facilities (2001) (under revision)
WS-G-5.1	Release of Sites from Regulatory Control on Termination of Practices (2006)

One other Safety Guide on safety assessment for decommissioning of facilities using radioactive material is being developed.

Remediation

WS-R-3	Remediation of Areas Contaminated by Past Activities and Accidents (2003)
WS-G-3.1	Remediation Process for Areas Affected by Past Activities and Accidents (2007)

Transport Safety

TS-R-1	Regulations for the Safe Transport of Radioactive Material 2005 Edition (2005) (under revision)
TS-G-1.1	Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2002) (under revision)
TS-G-1.2	Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material (2002)
TS-G-1.3	Radiation Protection Programmes for the Transport of Radioactive Material (2007)

Three other Safety Guides on management system for the safe transport of radioactive material (mentioned in section B.3), compliance assurance and schedule of provisions are being developed.

Facility Specific Safety Standards

Design of Nuclear Power Plants

NS-R-1	Safety of Nuclear Power Plants: Design (2000) (under revision)
NS-G-1.1	Software for Computer Based Systems Important to Safety in Nuclear Power Plants (2000)
NS-G-1.2	Safety Assessment and Verification for Nuclear Power Plants (2002)

NS-G-1.3	Instrumentation and Control Systems Important to Safety in Nuclear Power Plants (2002)
NS-G-1.4	Design of Fuel Handling and Storage Systems for Nuclear Power Plants (2003)
NS-G-1.5	External Events Excluding Earthquakes in the Design of Nuclear Power Plants (2004)
NS-G-1.6	Seismic Design and Qualification for Nuclear Power Plants (2003)
NS-G-1.7	Protection against Internal Fires and Explosions in the Design of Nuclear Power Plants (2004)
NS-G-1.8	Design of Emergency Power Systems for Nuclear Power Plants (2004)
NS-G-1.9	Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants (2004)
NS-G-1.10	Design of Reactor Containment Systems for Nuclear Power Plants (2004)
NS-G-1.11	Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants (2004)
NS-G-1.12	Design of the Reactor Core for Nuclear Power Plants (2005)
NS-G-1.13	Radiation Protection Aspects of Design for Nuclear Power Plants (2005)
79	Design of Radioactive Waste Management Systems at Nuclear Power Plants (1986)

Four other Safety Guides on safety classification of structures, systems and components, on development and application of level 1 and level 2 PSA and on deterministic safety analyses are being developed.

Operation of Nuclear Power Plants

NS-R-2	Safety of Nuclear Power Plants: Operation (2000) (under revision)
NS-G-2.1	Fire Safety in the Operation of Nuclear Power Plants (2000)
NS-G-2.2	Operational limits and Conditions and Operating Procedures for Nuclear Power Plants (2000)
NS-G-2.3	Modifications to Nuclear Power Plants (2001)
NS-G-2.4	The Operating Organization for Nuclear Power Plants (2002)
NS-G-2.5	Core Management and Fuel Handling for Nuclear Power Plants (2002)
NS-G-2.6	Maintenance, Surveillance and In-Service Inspection in Nuclear Power Plants (2002)
NS-G-2.7	Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (2002)
NS-G-2.8	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (2003)
NS-G-2.9	Commissioning for Nuclear Power Plants (2003)
NS-G-2.10	Periodic Safety Review of Nuclear Power Plants (2003)
NS-G-2.11	A System for the Feedback of Experience from Events in Nuclear Installations (2006)

Five other Safety Guides on conduct of operations, ageing management, seismic evaluation of existing nuclear facilities, on severe accident management and on chemistry are being developed.

Research Reactors

NS-R-4	Safety of Research Reactors (2005)
NS-G-4.1	Commissioning of Research Reactors (2006)
NS-G-4.2	Maintenance, Periodic Testing and Inspection of Research Reactors (2006)
35-G1	Safety Assessment of Research Reactors and Preparation of the Safety Analysis Report (1994) (under revision)
35-G2	Safety in the Utilization and Modification of Research Reactors (1994) (under revision)

Six other Safety Guides on operational limits and conditions; operating organization, recruitment, training and qualification; radiation protection and waste management; core management, use of graded approach and ageing management are being developed.

Fuel Cycle Facilities

116	Design of Spent Fuel Storage Facilities (1995) (under revision)
117	Operation of Spent Fuel Storage Facilities (1995) (under revision)

One Safety Requirements on safety of fuel cycle facilities, and six other Safety Guides on: safety of uranium fuel fabrication; MOX fuel fabrication; conversion facilities; reprocessing facilities; fuel cycle R&D and storage of spent fuel are being developed.

Radiation Related Facilities

107	Radiation Safety of Gamma and Electron Irradiation Facilities (1992) (under revision)
RS-G-1.6	Occupational Radiation Protection in the Mining and Processing of Raw Materials (2004)

Four other Safety Guides on medical uses, on industrial radiography, on national strategy for regaining control over orphan sources and on orphan radioactive sources in the metal recycling industry are being developed.

Waste Treatment and Disposal Facilities

WS-R-1	Near Surface Disposal of Radioactive Waste (1999) (under revision)
WS-R-4	Geological Disposal of Radioactive Waste (2006) (under revision)
WS-G-1.1	Safety Assessment for Near Surface Disposal of Radioactive Waste (1999) (under revision)
111-G-3.1	Siting of Near Surface Disposal Facilities (1994) (under revision)
111-G-4.1	Siting of Geological Disposal Facilities (1994) (under revision)

Two other Safety Guides on borehole disposal of radioactive waste and on monitoring and surveillance of disposal facilities are being developed.