2009 年核安全评论

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2009 年核安全评论

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国际原子能机构在奥地利印制
2010 年 7 月

前　言

《2009 年核安全评论》载有对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努力状况的分析性概述。分析性概述辅以两个附录：“2009 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：2009 年的活动”（附录二）。

《2009 年核安全评论（草案）》曾以 GOV/2010/4 号文件提交 2010 年 3 月理事会会议。《2009 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

全球核能界正在经历一个不断变革的时期。新核电厂在不断涌现，现有核计划在迅速扩大，辐射源和电离辐射得到更广泛的普遍应用，这一切都凸显出有必要继续加强国际合作，以应对相关的挑战。当今核业务和核活动的日益多国性也强调了这种必要性。在这方面尤其必须指出的是，适当安全基础结构和能力的建设工作不能滞后。

核工业的安全实绩水平依然很高。在过去的 20 年中，涉及非计划停堆、安全设备的可利用率、工作人员的辐射照射、放射性废物管理和放射性环境释放等各种安全实绩指标显示出一直在稳步改进，一些指标近年来一直处于平稳状态。但必须避免自满情绪，并不断改进和加强现有的全球核安全和核保安制度，这样才能以安全、可靠的方式引进核技术和扩大其应用范围，从而满足全球人类福祉和社会经济发展的需要。国际原子能机构继续支持和促进更多地参与全球核安全和核保安制度，并将其作为全球核活动实现高水平安全的一个框架。

经过对 2009 年观察到的全球趋势、问题和挑战进行深入思考，确定了全球核安全的四个关键主题：(1) 继续开展国际合作和协调，促进新的和扩大的核电计划；(2) 加强对放射性物质和核材料的长期管理；(3) 开展能力建设，促进可持续核安全；(4) 加强全球和地区网络建设活动。

越来越多的成员国正在首次考虑或表示有兴趣发展核电计划。若干国家还启动了扩大现有计划的宏伟规划。原子能机构对核电到 2030 年前景的最新预测高于前一年。

为新的和扩大的核电计划提供支持的最新国际合作努力侧重强调了一些关键问题。这些问题包括国家安全基础结构方面的差距、安全和保安的协同作用和统一以及核电计划各参与方的安全责任和能力。这种参与方包括营运者、监管者、政府、供应商、技术支持组织和相关国际组织。在某些情况下，制订核电发展计划的速度比建立必要安全基础结构和能力的速度更快，这反映出需要继续重点强调促进在新的和扩大的核电计划方面的合作。因此，拥有新的和扩大的核电计划的国家必须积极参加全球核安全和核保安制度。

由于当今核业务和核活动的日益多国性及其相应的技术经济效益，供应商、营运者、监管者和专家团体正在为实现设备、部件、方法和程序的标准化和统一做出重要努力。例如，欧洲联盟通过提及原子能机构“安全基本法则”和同行评审的核安全指令就是在实现全球统一的可持续核安全基础结构方案的道路上迈出的重要一步。同样，通过公约和行为准则包括相关的同行评审机制开展的国际合作也为安全方案的统一创造了条件。

建立和维护能有效独立地做出决策的监管机构继续十分重要。它们与负责促进和

实施核或辐射相关技术的组织或机构明确分离至关重要。在着手制订符合原子能机构安全标准的核计划时，有关国家应当通过法律框架确保核监管机构的独立性，并确保为其配备必要的人力和财政资源。核监管者必须拥有充分的监管决策能力，以便考虑与其他社会经济考虑因素之间的平衡达到最优化。

除了正在考虑在未来 10 年实施新核电计划的大量国家外，目前正在运行核动力堆的国家也对维护其在运的反应堆和延长这些反应堆的许可证表现出强烈的兴趣。这一挑战要求全世界的供应商、营运者和监管者进一步持续关注安全并提供可持续的人员资格和能力保证。

长期运行和老化管理是许多核电厂存在的重要问题。截至 2009 年底，在全世界正在运行的 437 座核电厂中，运行时间超过 30 年的有 127 座，超过 20 年的有 338 座。有资格延长运行寿期的核电厂的数量日益增多，因此，长期运行问题正变得十分重要，故应当在与安全有关的所有问题方面进行系统化处理和整合。

近年来，一些严重的自然事件如地震和海啸影响了世界各地。2009 年，影响日本浜冈原子力发电所的地震造成两个反应堆自动停堆，但未造成明显损害。分析从所有这些事件中汲取的经验教训的工作正在继续进行，以便更好地了解与对这种外部危害的评价以及核装置设计相关裕度有关的问题和关切。

全世界的研究堆在 2009 年继续安全运行，没有发生严重事件。仍有必要完成以下事项：改进老化管理计划；确保许多成员国的营运组织和监管机构可获得经过适当培训的合格工作人员；改进运行辐射安全和应急准备；以及制订许多研究堆的退役计划。全世界的许多设施仍处于“延期关闭”状态，尚无关于其今后利用或退役的明确计划。若干成员国正在考虑建设它们的第一座研究堆，并以此作为发展启动核电计划所需的国家技术和安全基础结构的工具。

世界各地大多数核装置的职业辐射防护管理良好。但从事医疗和无损分析工作的工作人员的受照比例一直高速增加。在所有受辐射照射的工作人员中，半数以上目前来自医疗领域，预计这一比率在未来几年还会增加。由于医学成像新技术的利用，在医务人员职业辐射防护方面出现了新的挑战。因此，适当且持续不断的培训对于辐射源和电离辐射在医学和工业领域的应用至关重要。

在全世界都可以发现辐射源和辐射相关技术的更复杂和更广泛的应用。全球年人均有效剂量正在迅速上升，而且几乎全都是由于不断增加的医疗照射引起的，在一些国家目前已经达到了相当于或超过天然本底照射量的程度。尽管这种增加在很大程度上反映了积极的事业发展，如增加了利用电离辐射的医疗程序的机会，但也有证据表明，许多诊断成像程序是不必要的，而且，许多程序又不够优化，包括放射治疗。这就突出强调了加强国际合作和确保相互学习的必要性。

放射源虽然在为数有限的应用中正在为其他技术如粒子加速器所取代，但在许多

情况下将继续在医学、工业和学术应用中得到利用。尽管所有成员国都认识到确保放射源受到监管控制的重要性，但对许多成员国来说，维持国家登记簿和确保源在其整个寿期内都得到监管控制仍是一个问题。许多成员国正在其国家立法中纳入《放射源安全和保安行为准则》的规定，但亟需进一步加强国际合作，以改进放射源“从摇篮到坟墓”的登记和监测。特别是搁用源往往处于无人看护状态。这是一个必须通过加强国家和国际努力紧急加以处理的重要问题。

放射性物质和核材料的长期安全继续成为国际核能界面临的一项挑战。新核电国家和现有核电国家尤其面临乏燃料和放射性废物管理问题，这些问题已成为公众主要关切的问题。由于核电计划的寿期可以达到 100 年以上，对乏燃料和放射性废物进行适当管理的必要性也大大超过 100 年，因此，这一点具有特别的重要意义。在过去的几十年中，若干国家一直在发展建立高放废物地质处置设施的项目。但只有少数国家既在技术发展也在公众认可方面取得了良好的进展，并达到了目前正在拟订许可证申请和将其提交国家监管当局的程度。

对世界上开展核退役活动的国家而言，全球民用核遗产退役和清理活动是一项巨大的管理、技术、安全和环境挑战。全世界数以百计的核电厂需要在未来 40 年至 60 年退役。除动力堆外，还要确定原型堆、试验堆和研究堆领域以及其他燃料循环设施如世界各地的燃料制造设施等其他领域的退役和清理需要。

国际核能界一直继续重点强调能力建设，以促进可持续核安全。获得和留住合格的工作人员及其素质的不断提高是形成组织能力、制度能力和国家能力的基础。它们对于发展适当且可持续的核安全和核保安基础结构至关重要。因此，对国际核能界而言，头等优先事项仍然是发展跨多种学科的人才如科学家、辐射和核技术专家、立法人员、监管人员、行政官员和应急响应人员的技能、知识和专门技术。能力建设不仅是首次利用核电国家的一个关键问题，而且是对所有核电国家的一项重大挑战。

成员国正越来越多地利用全球和地区知识网络，如“国际监管网”、“响应援助网”、“亚洲核安全网”、“伊比利亚-美洲放射性和核监管机构论坛”和最近设立的“非洲核监管机构论坛”。应当进一步促进通过更多的利用、更多的互动和更多的反馈不断改进这种网络，以维持高水平的安全和能力。原子能机构目前正在建立“全球核安全和核保安网”，并将其作为在全球范围内更有效地支持地区和主题网络以及成员国国家能力建设的一个全球性网络。

对核或放射性紧急情况作出适当响应的能力仍然是国际核安全的一项核心内容。成员国正在与秘书处一道致力于改进地方、国家、地区和国际各级应急响应的准备工作。但许多国家尚未达到应急准备和响应方面的国际安全要求。尽管需要在该领域的能力建设方面作出进一步的努力，但经验表明，参加由原子能机构事件和应急中心协调开展的响应活动的国家都持续改进了它们的应急响应能力。

总干事 2003 年设立的国际核责任问题专家组（核责任问题专家组）继续发挥作为

原子能机构处理核责任相关问题的主要论坛的作用，并旨在促进更好地理解和遵守国际核责任文书。原子能机构继续努力促进遵守在原子能机构主持下通过的各种相关国际法律文书，尤其是《核损害补充赔偿公约》。为此，总干事致函所有成员国，鼓励各国政府“适当考虑加入《核损害补充赔偿公约》，从而对加强全球核责任制度作出贡献”。

拒绝和拖延运输放射性物质的情况继续在世界各地发生。可用运输路线的减少似乎是拒绝和拖延运输的先兆，但由于商业敏感性，仍然难以对此进行监测和衡量。仍然显而易见的是，为了防止不正当的拒绝和拖延，必须与其主要活动不是处理放射性物质的运输人员进行有效交流。促进交流和培训是目前正在执行并接近完成的拒绝运输放射性物质问题国际指导委员会行动计划目前阶段的重点。另一项持续性挑战是加强与涉及危险货物运输的其他联合国机构的合作与协调。

目　录

分析性概述

A. 导言

1. 全球核能界正在经历一个充满活力的变革期。新核电厂的引进、现有核电计划的迅速扩大以及放射源和电离辐射的更广泛使用从总体上突出强调了持续并加强国际合作以应对相关挑战的必要性。当今的核业务和核活动越来越具有多国性，从而突显了这种必要性。在这方面，尤其必须指出的是，适当安全基础结构和能力的建设不能滞后。

2. 核工业的安全实绩仍然保持在高水平。在过去的 20 年中，涉及非计划停堆、安全设备可利用率、工作人员的辐射照射、放射性废物管理和放射性环境释放等各种安全实绩指标显示出一直在稳步改进，一些指标近年来则处于稳定状态。但需要避免自满情绪，并不断改进和加强现有的全球核安全和核保安制度，这样才能以安全的方式引进核技术或扩大其应用，从而满足全球人类福祉和社会经济发展的需求。原子能机构继续支持和促进更多地参与作为实现世界范围内核活动高水平安全框架的全球核安全和核保安制度。

3. 全球核安全和核保安制度（图 1）由制度框架、法律框架和技术框架构成，以加强国际协调和合作的方式确保世界范围内核设施和核活动的安全和保安。这一全球制度的基础是积极参与持续改进核安全和核保安之国际努力的各个国家强有力的国家基础结构。这一全球制度中协同合作的其他主要要素是支持和加强国家和地区现有基础结构的国际法律文书、安全标准、保安准则、同行评审、咨询服务和知识网络，从而有助于防止发生另一起严重的核事故或恐怖主义事件，或在这种事故和事件万一发生时更好地加以应对。

4. 《2009 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事件和应急准备方面的发展趋势、问题和挑战，并突出强调了 2009 年的发展情况。本概述辅以更详尽的“说明”[1]。为本文件的目的，“核安全”一词的涵义中包括核装置安全、辐射安全、运输安全以及乏燃料和放射性废物管理安全。该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。将于 2010 年 9 月以一份单独的报告完整地阐述核保安问题。

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[1] “2009 年世界范围内与安全有关的事件和活动的说明”（2010/Note 4 号文件）和“国际原子能机构的安全标准：2009 年的活动”（2010/Note 5 号文件）。

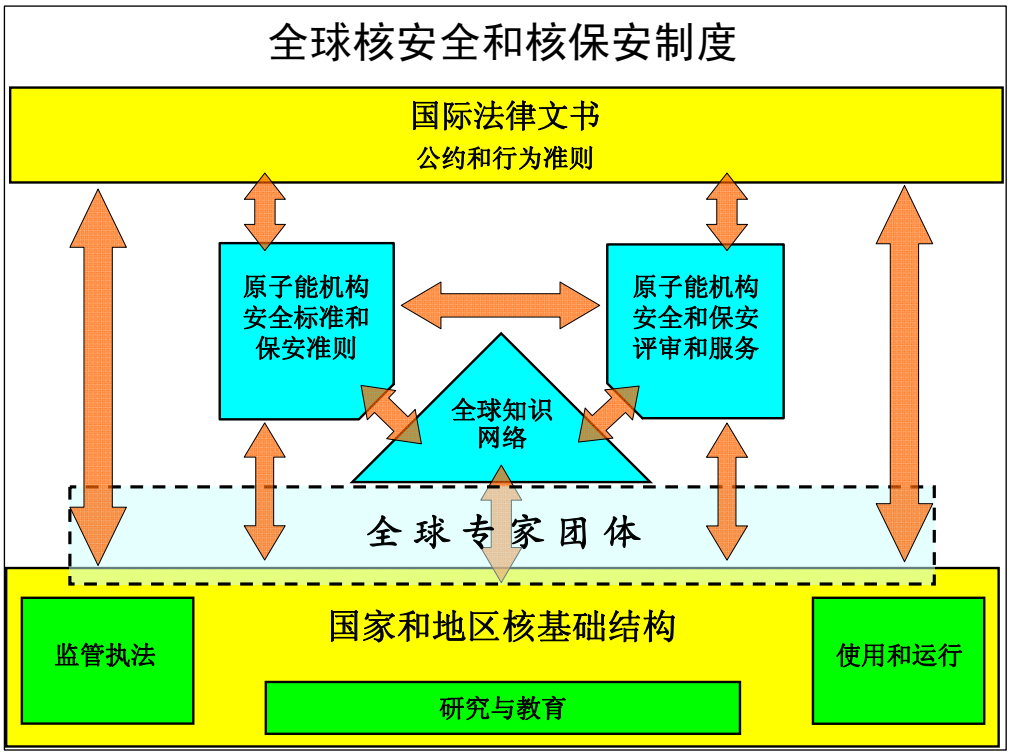

图 1. 全球核安全和核保安制度

B. 全球核安全的趋势、问题和挑战

5. 通过对 2009 年观察到的全球趋势、问题和挑战进行思考，确定了全球核安全的四个关键主题：(1) 继续开展国际合作和对新兴努力进行协调，以促进新的和扩大的核电计划；(2) 加强对放射性物质和核材料的长期管理；(3) 开展能力建设，促进可持续核安全；(4) 加强全球和地区网络建设活动。

B.1. 开展国际合作和对新兴努力进行协调，以促进新的和扩大的核电计划

B.1.1. 导言

6. 越来越多的成员国正在首次考虑或表示有兴趣发展核电计划。若干国家还启动了扩大现有计划的宏伟规划。原子能机构对核电到 2030 年的前景所做的最新预测高于去年的预测值。低值预测预期到 2030 年全球核电装机容量约为 511 吉瓦（电），较之当前装机容量约 370 吉瓦（电）增加 40%。高值预测预期达到约 807 吉瓦（电），是当前容量的两倍以上。这对世界核能界的确是一个重要的安全挑战。

7. 为新的和扩大的核电计划提供支持的新兴国际合作努力一直注重于许多关键问题。这些问题包括国家安全基础结构方面的差距、安全和保安的协同作用和整合以及核电计划各参与方的安全责任和能力，其中就包括营运者、监管者、政府、供应商、

技术支持组织和相关国际组织。但在一些情况下，有关核计划发展的规划比建立必要的安全基础结构和能力推进得更快。因此，拥有新的和扩大的核电计划的国家必须积极参加全球核安全和核保安制度。

B.1.2. 建立国家核安全基础结构

8. 随着探讨利用核电为今后供应能源的国家数量的增加，有必要确保落实有效的国家安全基础结构，以支持这种方案的发展。这种国家基础结构包括旨在为确保可持续高水平核安全提供基础而建立的制度、组织和技术的要素与条件。原子能机构已合并了其在该领域的安全标准和指导原则，并出版了一份安全导则草案（DS424）《建立国家核电计划的安全基础结构》，以起到在基础结构发展的最初三个阶段期间渐进地适用原子能机构的整套安全原则和安全要求的“路线图”的作用，这三个阶段与题为《国家核电基础结构发展中的里程碑》的原子能机构出版物中所阐述的阶段是一致的。

9. 原子能机构基于已制定的原子能机构安全标准和正在制订中的保安导则，已向成员国提供了一整套同行评审和咨询服务。原子能机构正在继续努力对“综合监管评审服务”和“综合核基础结构评审”[2] 等现有的同行评审和咨询服务进行调整和改进，以帮助新加入国家适用原子能机构的安全标准和保安导则。

B.1.3. 国际标准化和统一性方面的努力

10. 由于当今的核业务和核活动日益具有多国性和相应的技术经济效益，供应商、营运者、监管者和专家团体正在为实现设备、部件、方法和程序的标准化和统一作出重要努力。标准化主要指对核电厂适用同样的设计和实践。统一性的含义较为宽泛，系指不同国家如何能够采用更加一致和连贯的安全方案。例如，欧洲联盟有关提及原子能机构“安全基本法则”和同行评审的核安全指令的通过就是在世界范围内实现可持续核安全基础结构统一方案方面迈出的重要一步。同样，通过公约和行为准则包括相关的同行评审机制开展的国际合作也提供了安全统一方案。

11. 原子能机构建立了“通用反应堆设计安全评审”过程和服务，以期对照原子能机构的安全标准向成员国提供新反应堆的早期安全评价，并为建立安全评定能力提供支持。“通用反应堆设计安全评审”方法正在用于评审安全论证文件，以检查和评价供应商与原子能机构安全标准有关的安全要求的全面性和完整性。“通用反应堆设计安全评审”服务对安全论证文件提供早期的统一评价，以作为个案评价或许可证审批过程的潜在依据，而许可证审批过程仍是成员国的基本责任。来自许多成员国的专家顾问给这项服务带来了最新的知识、方法和方案。已利用从迄今所开展的六项评审中获得的经验制订了一项培训计划，该培训计划主要面向发展新核电计划安全基础结构的国家。

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[2] GOV/INF/2009/11 号文件。

12. 为了进一步支持新的和扩大的核电计划安全方案的统一，原子能机构参加了“多国设计评价计划”，目的是加强合作和增强承担新反应堆电厂设计评审任务的国家安全当局监管要求的趋同性。此外，目前正在“安全评定教育和培训计划”中酝酿实现基于原子能机构安全标准的教育和培训的标准化和统一问题。

13. 欧洲核能界对标准化和统一工作尤为积极。特别是，欧洲核安全监管者小组和西欧核监管者协会均已为更好地实现核安全活动的标准化和统一性采取了步骤。

B.1.4. 监管的有效性和独立性

14. 建立和维护能有效独立地做出决策的监管机构仍然十分重要。至关重要的是，监管机构应与负责促进或实施核或辐射相关技术的组织或机构明确分离。在着手制订符合原子能机构安全标准的核计划时，有关国家应当通过法律框架确保核监管机构的独立性，并确保为其配备必要的人力和财政资源。核监管者必须拥有使安全考虑与其他社会经济考虑之间的平衡达到最优化之充分的监管决策能力。

15. 自评定和同行评审在有关监管实践和政策的持续知识共享和相互学习中起着重要的作用。通过《核安全公约》和《乏燃料管理安全和放射性废物管理安全联合公约》提供了特别重要的机会，因为这两个公约均要求缔约国提交国家报告以进行同行评审。人们普遍认为，基于原子能机构标准和导则的自评定和同行评审活动是深化专门知识以及提高技术、管理和政策能力的有价值的工具。积极参加这些公约和“综合监管评审服务”等原子能机构的同行评审是世界各地的核监管机构通力合作以加强其有效性和独立性的一个主要机制。

B.1.5. 核电厂延寿和退役

16. 除了正在考虑在未来 10 年实施新核电计划的大量国家外，目前正在运行核动力堆的国家也对维护其在运的反应堆和延长这些反应堆的许可证表现出强烈的兴趣。这一挑战要求全世界的供应商、营运者和监管者进一步持续关注安全并提供可持续的人员资格和能力保证。

17. 务必对当前在运核电厂的安全状况给予持续关注和优先考虑。这些核电厂有许多已运行了数十年，正面临着材料降质和过时等老化现象。为此，原子能机构制订并于最近印发了一份题为《核电厂老化管理》的“安全导则”。原子能机构在该领域开展的安全评审服务的进一步结果表明，老化管理安排的发展状况因成员国而异。这些评审连同与有关专家进行的讨论均确认了在做出关于核电厂退役的最后决定之前制订一项核电厂老化管理计划和长期安全运行的国际统一方案的必要性和实用性。

18. 有关终止核设施运行阶段的决定需要得到良好的监管基础结构和实施退役的技术能力的支持。目前，在永久关闭的许多大型核装置中，只有一小部分已经或将在近期内得到完全拆除和实施退役。在一些国家似乎出现了一种立即拆除的趋势，但这似乎归因于适用性普遍有限的国家、场址或电厂的特定条件。由于国际努力的结果，这种

状况正在发生变化，包括筹资在内的规定和基础结构正在制订和建立，以应对在退役方面出现的挑战。

19. 但是，世界范围内的退役战略境况并未提供一个清晰的模式。整个核工业的状况过去几年来发生了相当大的变化，并将影响到在不久的将来进行的退役。经验表明，乏燃料的管理可能对退役战略的选择产生强有力的影响。特别是，贮存、处置或后处理乏燃料的设施可能不易获得，而这种燃料可能不得不保留在反应堆设施中。此外，缺少乏燃料转移路径可能迫使一些许可证持有者采用将乏燃料置放在经过安全关闭的设施中的战略。

B.2. 放射性物质和核材料的长期管理

B.2.1. 导言

20. 在全世界到处可目睹辐射源和辐射相关技术的更复杂和更广泛的应用。这种情况在医学和工业领域尤其如此：先进的辐射技术正在被更广泛地引入这两个领域。许多国家对改进危险放射源“从摇篮到坟墓”的登记和监测有着强烈的需求。特别是，搁用源往往处于无人看护状态。这是一个必须通过加强国家和国际努力紧急加以处理的重要问题。

21. 乏燃料和放射性废物管理问题是新核电国家和现有核电国家面临的特别具有挑战性的任务，这些问题也是公众的主要关切所在。由于核电计划的寿期可以达到 100 年更长的时间，以及对乏燃料和放射性废物进行适当管理的需求也远远超过 100 年，因此，这一点具有特别的重要意义。虽然预期的新核电计划受到很多关注，但现有计划的扩大在发展核电计划的总体规模上要可观的多。除了新的反应堆机组外，还有越来越多的反应堆机组被取代和（或）退役，因而进一步促进了将需要安全和可靠管理的乏燃料和放射性废物数量的增加。

B.2.2. 放射源的长期管理

22. 只有通过承诺在放射源寿期的每个阶段对其进行持续控制并实施这种控制，才能确保放射源的安全和保安。由于许多国家仍面临着寻找处置搁用密封放射源的解决方案问题，因此，从未系统地对完整的寿期管理问题进行过考虑。少数国家颁发了接收搁用密封放射源的处置设施许可证并正在运行这些设施。各国在其关于放射性废物管理的国家政策和战略中应涉及搁用密封放射源的长期管理特别是处置问题，并应鼓励实施搁用密封放射源处置以增强密封放射源使用的可持续性，这是很有必要的。

23. 原子能机构已印发了一些安全标准和出版物，其中强调了国家系统对于确保成员国放射源安全的必要性。这些已纳入国家法律和条例并由国际公约和详细的国家要求作为补充的安全标准为放射源的长期管理奠定了基础。此外，越来越多的国家还做出政治承诺，将《放射源安全和保安行为准则》作为它们制订和统一其政策、法律和条例的导则。但确有必要进一步加强以更广泛和更全面利用《放射源安全和保安行为准

则》为重点的国际合作。

B.2.3. 乏核燃料和放射性废物的管理

24. 人们长期以来就认识到乏燃料和放射性废物的安全管理对于保护人类与环境的重要性，并且已在这一领域取得了相当丰富的经验。虽然成员国在安全管理其放射性废物方面取得了显著进展，但一些国家仍然需要努力制订直到处置步骤的国家战略和相应地加强国家基础结构。

25. 全球所有废物类别加在一起的年平均处置率约为每年 280 万立方米，主要是低放废物和极低放废物。这些废物在各种贮存和处置设施中得到管理。低放废物的贮存和处置在世界范围内是一种成熟的实践。乏核燃料和高放废物的贮存也是一种成熟实践。乏核燃料和高放废物的处置虽然处在概念发展的成熟阶段，但仍有待实施。地质处置的许可证审批被认为是一种具有自身独特性挑战行为的新的风险性业务。当前推进地质处置设施许可证审批的国家和所拥有的计划先进程度不足的其他一些国家开始共同认识到拥有国际上统一的许可证审批过程方案对于促进公众接受的潜在好处。

26. 2009 年 5 月在维也纳举行的《乏燃料管理安全和放射性废物管理安全联合公约》第三次审议会上，与会的所有缔约方均认识到乏燃料和放射性废物管理安全是一个至关重要的难题，并认识到有相当多的领域有待改进。虽然各国情况千差万别，但与会的所有缔约方都对在建立和维护立法和监管框架以及在实际执行方面已取得进展的观点抱有同感。而且，由于认识到一些国家正在考虑启动国家核电计划，本次审议会的与会者强烈建议从考虑启动核电计划伊始就应虑及乏燃料和放射性废物管理的安全。时至今日仍是这种情况，即几乎所有的成员国都在使用放射性物质，但只有不到三分之一的成员国是“联合公约”的缔约方。国际核能界需要继续努力，促进更多的国家参加“联合公约”以及加强“联合公约”与安全标准和行为准则之间的联系，以便它们都能以战略和协同作用的方式得到实施。

B.3. 能力建设

B.3.1. 导言

27. 国际核能界一直继续重点强调能力建设，以促进可持续核安全。在此意义上的能力建设的范围比传统的教育和培训要广泛得多。它包括：人力资源开发，目的是使工作人员掌握有效完成任务所需的知识、技能和信息；组织发展，目的是不仅在组织内部而且在不同组织和部门之间执行有效的管理结构、过程和程序；制度性法律框架的发展，目的是建立能使各级和各部门的组织和机构保持和加强其能力的法律、监管和行政体系。

28. 获得和留住合格工作人员及其素质的不断提高是形成组织能力、制度能力和国家能力的基础。它们对于发展适当且可持续的核安全基础结构至关重要。因此，对国际核能界而言，头等优先事项仍然是发展跨多种学科的人才如科学家、辐射和核技术专

家、立法人员、监管人员、行政官员和应急响应人员的技能、知识和专门知识。在世界范围内加强人员能力、管理能力和技术能力将进一步促进可持续的制度能力和国家能力的发展。尽管对于首次利用核电的国家而言这是一个关键问题，但对于想要保持和不断改进自身能力的有经验的核电国家而言，这也依然是一项重大挑战。

29. 密切关注相关组织和国家基础结构的总体能力具有十分重要的意义。教育和培训对于促进组织能力和实绩的结果可以迥然不同。各组织需要铭记的是，即使是最好的人才也需要不断地学习和更新自己的专门知识，而且在竞争激烈的市场上，他们往往被外部实体以更好的条件收入麾下。

B.3.2. 教育和培训

30. 随着各国对核计划越来越感兴趣，需要作出国际努力才能帮助确保获得监管和运行核活动和辐射活动以及设施所需的合格专门人才。此外，核技术和辐射技术的进步及其更广泛的应用也导致有必要培训和保持适当的人员配备和能力水平，从而确保这种应用活动的安全和保安。

31. 需要制订出保留合格专家和进一步发展技能和能力的强有力的教育和培训计划，这样才能确保必要的经验水平与核计划的发展和扩大同步。为此，需要在国家、地区和国际各级做出努力。成员国制订和保持自主教育和培训计划而不是持续将这些活动外包出去尤其至关重要。尽管人力资源开发包括教育和培训是成员国的一项必不可少的主要职能，但在支持各成员国建立和保持促进安全、可靠和和平利用原子能所需的合格和可持续的人力资源方面，原子能机构一直发挥着重要作用。因此，必须通过利用双边、地区和国际活动特别是通过建立知识网络进一步加强在该领域的合作。

B.4. 加强全球和地区网络建设活动

B.4.1. 导言

32. 知识网络一旦适当建立并加以利用，便会成为十分有效的核安全和核保安知识分享、管理和创造机制。因此，知识网络和相关的全球专家团体是全球核安全和核保安制度的关键组成部分。成员国正越来越多地利用全球和地区知识网络，如“国际监管网”、“响应援助网”、“亚洲核安全网”、“伊比利亚-美洲放射性和核监管机构论坛”和最近设立的“非洲核监管机构论坛”。应当进一步促进通过更多的利用、更多的互动和更多的反馈不断改进这种网络，以维持高水平的安全和能力。原子能机构目前正在建立“全球核安全和核保安网”，并将其作为在全球范围内更有效地支持地区和主题网络以及成员国国家能力建设的一个全球性网络。

B.4.2. 全球和地区网络建设

33. 全球核安全和核保安网正在发展成为现有网络和信息来源的集合体，目的是确保已汲取的关于核安全和核保安的关键知识、经验和教训得到应有的广泛交流。该网络的设计基于原子能机构安全标准和保安导则的结构。

34. 国际监管网的原型已经建立。国际监管网将被视为国际核监管界的技术专家人才网。国际监管网还将为监管者之间的交流和合作提供灵活的手段。目前正在开发国际监管网的若干主题单元，包括综合监管评审服务活动、国家核监管概况和一般安全问题。

35. 2009 年，亚洲核安全网制订了该网络到 2020 年的设想。亚洲核安全网尤其旨在发展其地区能力建设体系的三个支柱，其中将包括一个虚拟地区教育和培训中心、一个合格专家库和一个提供新知识和创造性知识方面的技术咨询服务的虚拟技术支持组织。亚洲核安全网参加国一直积极致力于加强促进核安全的组织和制度性基础结构，以应对它们在能力建设包括人力资源开发方面遇到的挑战。亚洲核安全网核安全战略对话第三次年会将于 2010 年 4 月在印度尼西亚举行。

36. 伊比利亚-美洲放射性和核监管机构论坛的委员会会议和全体会议于 2009 年 6 月 22 日至 26 日召开。该论坛的全体会议同意与原子能机构举办分享政策、战略和所汲取经验教训的高级别研讨会，以提高伊比利亚-美洲地区的监管效率。全体会议还同意对该地区其他国家的能力建设活动提供专门知识和援助，并随时准备讨论与其他网络进行交流以实现在最大程度是实现互惠的途径。

37. 非洲大陆的核监管机构的领导人于 2009 年 3 月 23 日至 27 日在南非比勒陀尼亚举行会议，启动了“非洲核监管机构论坛”。会议由原子能机构和南非政府合作组织。“非洲核监管机构论坛”的宗旨是：为促进、加强和协调论坛成员国之间的辐射防护以及核安全和核保安监管基础结构和框架做好准备；并提供论坛用于在非洲核监管机构之间交流监管经验和实践的机制。

B.4.3. 欧洲联盟核安全框架指令

38. 在根据原子能机构有关核装置的主要安全标准以及《核安全公约》规定的义务建立共同的核安全法律框架方面，欧洲联盟（欧盟）开辟了一片新天地。欧盟是通过有约束力的核安全法律框架的第一个主要地区机构，这种开创性的行动被视为有助于加强全球合作安全努力的一个重要步骤。

39. 2009 年 6 月 25 日欧原联理事会关于建立共同体核装置安全框架的第 2009/71/Euratom 号指令赋予主要国际核安全标准即原子能机构制订的“基本安全原则”以及源于《核安全公约》包括定期同行评审过程的义务以有约束力的法律效力。该指令还强化了国家主管监管当局的独立性和资源。

40. 欧盟关于核装置适用原子能机构安全标准的指令规定，成员国应安排其国家框架和主管监管当局至少每 10 年定期自评定一次，并邀请对其国家框架和（或）国家当局的相关部分进行旨在不断改进核安全的国际同行评审。

C. 事件和紧急情况的准备与响应

C.1. 趋势、问题和挑战

41. 对核或放射性紧急情况作出适当响应的能力仍然是国际核安全的一项核心内容。成员国正在与秘书处一道致力于改进地方、国家、地区和国际各级应急响应的准备工作。但许多国家尚未达到应急准备和响应方面的国际安全要求。尽管需要在该领域的能力建设方面作出进一步的努力，但经验表明，参加由原子能机构事件和应急中心协调开展的响应活动的国家都持续改进了它们的应急响应能力。随后发生的事件得到了及时报告，并独立地成功开展了响应活动。如果事件需要国际援助，这些国家都很清楚如何启动国际响应程序。

42. 2009 年，许多成员国都为加强其应急体系的立法和监管基础开展了工作，并通过以一系列假想方案为基础的演习对其准备情况进行了检验。2009 年，10 个成员国向原子能机构通报，它们已经开展并（或）邀请原子能机构观摩了国家演习，这些演习的目的是确定其响应体系中的长处和需要改进的领域。

43. 通过不同的正式报告渠道和通过对新闻媒体的监测，原子能机构了解了全世界的核和辐射相关事件和紧急情况。2009 年，原子能机构收到或获悉 211 起涉及或怀疑涉及电离辐射事件的报告。大多数所发生的事件经确定都不需要原子能机构采取行动。原子能机构对 22 起事件采取了行动，如与国家主管当局一道鉴别和核实信息，交流正式信息或提供原子能机构服务。

C.2. 国际活动

44. 截至 2009 年底，16 个成员国在原子能机构“响应援助网”就一些援助能力进行了登记。尽管这是照比前一年出现的一项改进情况，但只有对成员国“响应援助网”作出更大的承诺，才能作为一种有效而且可靠的手段充分发挥作用。某些能力还有待登记（见图 2）。

45. ShipEx-1（2009）演习对当前国际安全、迅速运输需要进行生物剂量测定的样品的能力进行了检验。这次演习还是对“响应援助网”和国际援助合作所做的一次很好的检验。演习中得出的结论将有助于提高在国际援助任务中及时地适当运输生物样品的能力。

46. 作为对原子能机构大会关于审查事件和紧急情况报告机制的要求所作的响应，秘书处目前正在开发一个统一报告系统，该系统将替代原子能机构现行的“及早通报公约和紧急援助公约网站”和“网基核事件系统”。该系统的预览版已于 2009 年提供给国家当局的联络点试用。该系统预计将于 2010 年开始实施。

47. 根据《核事故及早通报公约》（及早通报公约）和《核事故或辐射紧急情况援助公约》（紧急援助公约）确定的主管当局于 2009 年 7 月 7 日至 10 日在维也纳举行了会议。

主管当局在会议期间为正在召开的主管当局正式会议制订了工作任务和工作方法。

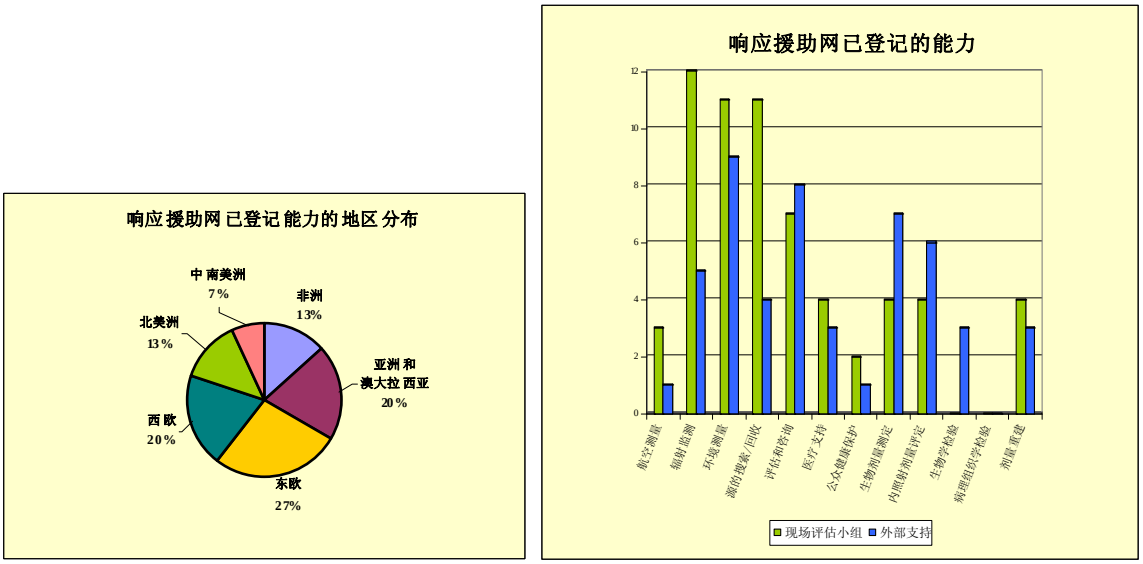

图 2. 响应援助网已登记能力的地区分布和响应援助网已登记的能力

48. 为了满足成员国的需要，原子能机构发起了研究堆紧急情况（二类威胁和三类威胁）通用响应程序的制订工作。通用程序分为两套：一套适用于低功率研究堆，即那些不会给研究堆场址以外的民众带来危险的研究堆；另一套是适用于较高功率水平研究堆的程序，这种研究堆可能对场址边界以外的民众带来影响。已经组织了一次参会者来自有低功率研究堆的九个成员国的讲习班，目的是获得关于计划于 2010 年印发的上述程序草案的反馈意见。

D. 核损害民事责任

D.1. 趋势、问题和挑战

49. 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对实际经济损失提供保险的重要性仍然是各国更加关注的主题，特别是在全世界对核电重燃兴趣的情况下尤其如此。

50. 总干事 2003 年设立的核责任问题专家组继续发挥作为原子能机构处理核责任相关问题主要论坛的作用，并旨在促进更好地理解和遵守国际核责任文书。

51. 原子能机构继续努力促进遵守在原子能机构主持下通过的各种相关国际法律文书，尤其是《核损害补充赔偿公约》。为此，总干事致函所有成员国，鼓励各国政府“适当考虑加入《核损害补充赔偿公约》，从而对加强全球核责任制度作出贡献”。

D.2. 国际活动

52. 核责任问题专家组于 2009 年 6 月 24 日至 26 日在维也纳原子能机构总部举行了第九次会议。讨论的主要专题包括国际核责任公约的批准状况、欧洲委员会关于《核能领域第三方责任公约》（巴黎公约）的影响评定、德国关于允许缔约方将正在退役的某些小型研究堆和核装置排除在《核损害民事责任维也纳公约》（或许还包括《核损害补充赔偿公约》）适用范围之外的建议以及核责任问题专家组今后的宣导活动。

53. 关于国际核责任公约的批准状况，核责任问题专家组成员重申了对促进建立全球核责任制度的支持，并就此对在国家一级为实现该目标所作的最新努力提出了一些深入见解。

54. 关于欧洲委员会的影响评定，核责任问题专家组注意到，欧洲委员会已对影响评定重新进行分类，将其划归为“法律研究”，预计将不会提出法律行动建议。核责任问题专家组忆及其在去年的会议期间对欧洲委员会审议的各种方案所表示的关切，特别是关切欧原联可能以有可能损害欧盟国家和非欧盟国家之间条约关系的方式行事。核责任问题专家组鼓励欧洲委员会继续审查现有的所有可能办法，包括将有助于加强全球核责任制度的那些手段，如《核损害补充赔偿公约》或《关于适用“维也纳公约”和“巴黎公约”的联合议定书》等。

55. 关于德国提出的建议，核责任问题专家组注意到，德国代表团于 2009 年 6 月 6 日为支持其建议向秘书处提交了进一步的解释性说明。该解释性说明详尽阐述了这一建议的技术背景，并同以往一样转交给了主管的原子能机构安全标准委员会（辐射安全标准委员会和废物安全标准委员会），以便在核责任问题专家组进行审议之前由这些委员会作出技术评定。

56. 关于核责任问题专家组的宣导活动，专家组注意到正在进行的为表示有兴趣启动核电计划的国家组织的第四次核损害赔偿问题讲习班的筹备工作，该讲习班于 2009 年 12 月 9 日至 11 日在阿拉伯联合酋长国阿布扎比举办。此外，核责任问题专家组还进一步讨论了宣导活动，并建议于 2010 年在俄罗斯联邦为东欧和中亚国家举办第五次讲习班。

E. 核电厂安全

E.1. 趋势、问题和挑战

57. 核电厂安全实绩仍然保持高水平。世界核电营运者联合会（核电营运者联合会）汇集的实绩指标资料表明，2008 年非计划自动紧急停堆次数为每 7000 临界小时 0.5 次（图 3）。从 1990 年的 1.8 次实质性降低之后，自 2000 年以来这一数值一直相当平稳。

其他可测量的指标也有着类似的趋势，这些指标包括机组容量因子、集体辐射照射量和安全系统性能。

每 7000 临界小时非计划自动紧急停堆次数

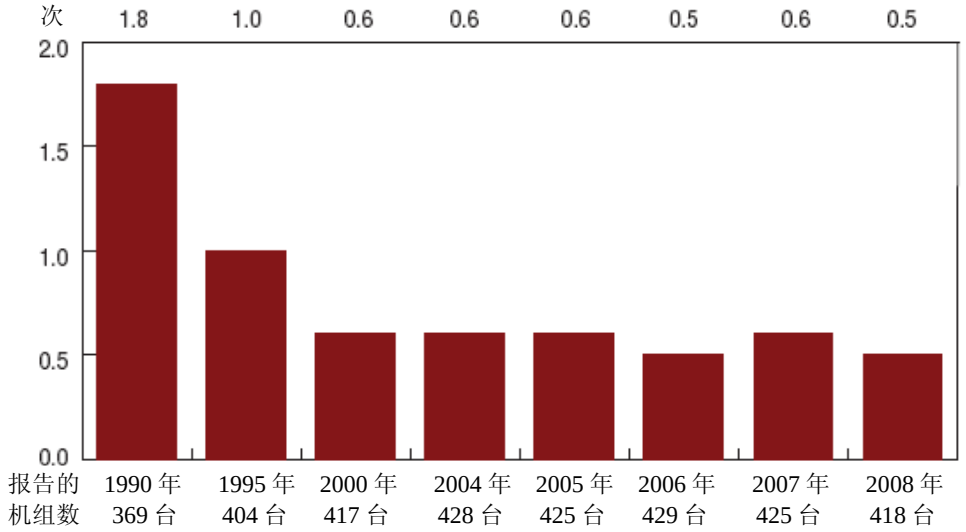

图 3. 每 7000 临界小时非计划自动紧急停堆次数
（来源：核电营运者联合会 2008 年实绩指标）

58. 许多国家已表示了考虑制订核电计划或恢复被搁置计划的意愿。这导致要求原子能机构为制订核电计划提供明确和实际的指导。国际社会还认识到，获得所需的能力和建立适当的安全文化来确保和维持安全的核电计划需要相当长的一段时间。为了进一步满足成员国的要求和需求，原子能机构拟订了一份“安全导则”草案（DS424）《建立国家核电计划的安全基础结构》，以期在落实对发展安全、可持续的核计划基础结构所需的安全要素方面提供指导。该导则包括所建议的来自现有成套安全标准的安全相关行动“路线图”，其中包括为实现制订以安全为重点的强力核计划的最大利益而应实施的行动发展阶段。

59. 随着对建造新核电厂的兴趣重新燃起，目前正在寻求缩短运行前周期的方式。监管者正在审查自身在此过程中的作用。例如，一些国家正在从事通用设计评定工作，以便在以后提出建造要求时，只需要解决场址特定的问题。监管机构面临的挑战将是精简这一过程，同时维持必要的监管严格性和安全判断能力。

60. 长期运行和老化管理是许多核电厂存在的重要问题。截至 2009 年底，在全世界正在运行的 437 台核电机组中，运行时间超过 30 年的有 127 台，超过 20 年的有 338 台。有资格延长运行寿期的核电厂的数量日益增多，因此，长期运行问题正变得十分重要，故应当在与安全有关的所有问题方面进行系统化处理和整合。

61. 定期系统地开展全面和综合性电厂特定安全评定是确保在整个长期运行期间实现所需安全功能的关键要素之一。现代安全评定工具的开发和实施对于开展这类评定至

关重要。在这方面，存在着与制订全面的老化管理计划有关的挑战，为了确保实现所有面临老化影响和包括过时等降质过程的系统和部件的安全功能，需要实施这种老化管理计划。此外，还需要就长期运行情况对初始设计计算中包括了时限设定的电厂特定安全分析进行重新验证。因此，重要的是应当就所建议的积极主动的电厂老化管理计划向核工业和监管当局提供指导。这类资料可作为一种源项用于制订一个统一的方案，通过实施公认的老化管理计划以及建立这一重要领域的综合国际知识来处理各种降质机理问题。

62. 2009 年开展的运行安全评审组工作访问发现，所访问的大多数电厂和电力公司都拥有表明其管理层对改进运行安全做出了坚定承诺的高质量计划。但是，在组织的最低一级，这些计划的实际执行和控制仍然有问题。即便每一级管理人员都被充分调动起来并接受了目标和宗旨沟通方面的培训，但一些管理人员并非总能为其工作人员所充分理解，从而导致在一些领域出现错误行为和绩效不合格情况。在许多电力公司因新核电厂建造计划和现有工作人员退休而面临工作人员大量更新的情况下，这个问题尤为关键。

63. 2009 年，核电厂营运者继续保持良好的核安全实绩，没有发生严重事故或对工作人员或公众的显著辐射照射。大多数电力公司实施了有效的运行经验计划，这些计划在一些情况下还包括对低级别事件和险发事件的分析以及从中汲取的经验教训。但在成员国之间共享运行经验信息和利用这些信息则较为有限。一些成员国共享和利用了事件报告系统中的事件资料。但许多成员国并没有在共享从有关重要事件的资料中汲取的经验教训，而且外部资料的利用也不充分。此外，成员国之间一般也不共享低级别事件和险发事件情况。

64. 正如原子能机构有关核反应堆设计和运行的各种安全标准中所反映的那样，存在着一般的国际共识，即确定性分析和概率分析均为核反应堆安全提供见解、观点、了解和平衡。对这些分析方案进行整合后的应用范围继续扩大。这些应用为设计、建造、安全评定、许可证审批、运行和监管监督提供支持。对利用结构框架进行最优决策的兴趣不断增加，这种决策考虑了确定性技术和概率技术及结果。目前正在开展国际协调努力，以期在确保核反应堆安全的综合决策过程中建立基于确定性方案、概率安全分析和其他因素之间平衡的良好实践。

65. 近年来，一些严重的自然事件如地震和海啸等影响了世界各地。分析从这些事件中汲取的经验教训的工作正在继续进行，以便更好地了解与对这类外部危害的评价以及核装置设计相关裕度有关的问题和关切。有关结果将包括在正在制订的关于地震、火山以及气象和水文危害评定的“安全导则”和报告中。此外，这些事件还强调了在运行中核电厂的场址上发生地震后需要开展的有关行动在程序上的重要性。

E.2. 国际活动

66. 2009 年 9 月 28 日举行了《核安全公约》缔约方第一次特别会议，以核准《核安全

公约》的“国家报告细则（修订案）”和核可秘书处为宣导目的编写的介绍《核安全公约》及《核安全公约》相关议事规则和细则的小册子。

67. 《核安全公约》缔约方第五次组织会议于 2009 年 9 月 29 日举行。会议的目的是筹备定于 2011 年 4 月 4 日至 14 日举行的第五次审议会。有 46 个缔约方参加了会议。《核安全公约》目前有 66 个缔约方和 13 个尚未将该公约付诸生效的签署国。四个国家即约旦、塞内加尔、阿拉伯联合酋长国和阿拉伯利比亚民众国于 2009 年成为《核安全公约》的正式缔约方。

68. 自国际地震安全中心 2008 年发起成立以来，许多成员国和研究机构开始参加该中心的活动，以解决与严重自然事件有关的各种问题。在原子能机构涵盖 21 个成员国的 45 个研究机构的地震安全预算外计划框架内，各工作组处理了地震危害评价、基准活动、震后行动和数据库开发等重要问题。在拉丁美洲和非洲组织了共享最近活动成果和结果的培训班。

F. 研究堆安全

F.1. 趋势、问题和挑战

69. 全世界的研究堆在 2009 年继续安全运行，没有发生严重事件。仍有必要完成以下事项：改进老化管理计划；确保许多成员国的营运组织和监管机构可获得经过适当培训的合格工作人员；改进运行辐射安全和应急准备；以及制订许多研究堆的退役计划。全世界的许多设施仍处于“延期关闭”状态，尚无关于其今后利用或退役的明确计划。这些设施安全的适当管理包括财政资源的缺乏仍是一个重要问题。若干成员国正在规划建造它们的第一座研究堆，以此作为发展启动核电计划所需的国家技术和安全基础结构的工具。原子能机构正在处理这一问题，并正在继续对成员国提出的相关请求作出响应。

70. 医用放射性同位素特别是钼-99 供应的当前短缺主要是由于大型放射性同位素生产研究堆数量有限（五座）和老化所致。对生产医用放射性同位素的迫切需求可能在满足反应堆安全要求和满足对公共卫生保健的社会需求之间造成两难的局面。这种关切突出强调了制订标准的必要性，以便能够在不损害安全的情况下均衡地考虑社会政治、经济和监管挑战。

71. 在地区基础上利用现有反应堆生产钼-99 是有助于顺利地管理大型生产堆的任何意外停堆问题的中期解决方案。这就要求对开发必要的人力资源包括技术和安全能力以及协调监管要求和许可证审批过程给予特别的关注。在 2009 年 9 月大会第五十三届常会期间原子能机构组织的一次小组简况介绍会和讨论会上涉及了所有这些问题，来自 34 个成员国的 76 名代表参加了会议。

F.2. 国际活动

72. 2009 年 6 月 2 日至 5 日，原子能机构举行了一次关于根据“项目和供应协定”提供的研究堆的安全的会议，来自 17 个成员国的代表参加了会议。会议建议，拥有根据“项目和供应协定”提供的研究堆的成员国应当加入原子能机构针对这些研究堆的跟踪系统，特别是继续使用安全实绩指标，适用《研究堆安全行为准则》，适用原子能机构的安全标准和按照 INFCIRC/18/Rev.1 号文件“原子能机构的安全标准和措施”利用原子能机构的安全评审服务。

73. 2009 年 10 月 5 日至 9 日，原子能机构举办了一次关于研究堆老化管理、现代化和整修的技术会议，来自 33 个成员国的 56 个运行组织、监管机构和研究堆供应商的代表参加了会议。会议确定了与研究堆老化、现代化和整修有关的当前问题和挑战，并提出了根据原子能机构的安全标准处理这些问题的建议。

74. 2009 年 11 月 16 日至 20 日，原子能机构在荷兰佩滕举行了一次关于研究堆事件报告系统的技术会议，35 个成员国的国家协调员和当地协调员参加了会议。会议促进共享了运行经验反馈，确保适当分析了向研究堆事件报告系统报告的事件，并向研究堆营运者和监管者传播了从这些事件中汲取的经验教训。对研究堆事件报告系统进行了调整并于 2009 年 11 月将其纳入了事件报告系统和燃料事件通报和分析系统的共用平台。

75. 关于与医用放射性同位素生产有关的安全问题，原子能机构向荷兰的高通量反应堆派遣了国际安全评审工作组，并就所观察到的一次冷却剂系统的降质问题提供同行评审。向埃及 ETRR-2 号反应堆派遣了另一个安全评审工作组，对已规划的钼-99 生产计划的安全问题进行了评审。

G. 燃料循环设施的安全

G.1. 趋势、问题和挑战

76. 燃料循环设施涵盖广泛多样的装置，包括转化、浓缩、燃料制造、乏燃料贮存（包括长期贮存）、后处理和相关的废物管理设施。这些设施存在不同程度的危害，在实施安全要求时应当采取分级方案。一些燃料循环设施带来了独特的核安全挑战，例如临界控制、化学危害以及易发生火灾和爆炸。此外，许多燃料循环设施还高度依赖运行人员的干预和行政控制来确保核安全。向“燃料事件通报和分析系统”报告的事件表明，发生这些事件的主要根源与组织因素和人为因素有关。

77. 通过传播运行经验和良好实践包括报告安全相关事件及其原因和所汲取的教训来改进运行安全继续成为一项挑战。成员国对原子能机构同行评审服务、“运行期间燃料循环设施的安全评价”和“燃料事件通报和分析系统”的利用仍然有限，原子能机构

将继续宣传这些服务的好处。为了对这些服务提供支持，需要编写完成涵盖所有类型燃料循环设施的整套“安全导则”。

G.2. 国际活动

78. 原子能机构和经合组织核能机构于 2009 年 10 月 7 日至 9 日举行了“燃料事件通报和分析系统”国家协调员联席会议，来自 12 个国家的 24 名与会者出席了会议。会议交流了关于燃料循环设施发生的安全相关事件的资料，并审查了这些事件的原因和从中汲取的经验教训。会议确定安全文化贫乏和依靠手动操作是促成大多数事件发生的重要因素。国家协调员们确认了“燃料事件通报和分析系统”作为惟一的国际燃料循环设施报告系统的重要性，并承诺加大使用该系统的力度。

79. 原子能机构于 2009 年 10 月 19 日至 23 日举行了关于研究堆乏燃料贮存问题的会议，来自 19 个国家的研究堆运行人员和管理者参加了会议。与会者审查了他们管理研究堆乏燃料的实践和计划。会上交换的资料将用于编写供研究堆界使用的原子能机构出版物，以作为临时贮存研究堆乏燃料良好实践的指南。

H. 职业辐射照射

H.1. 趋势、问题和挑战

80. 根据联合国原子辐射效应科学委员会（联合国辐射科学委）的报告，职业辐射照射所致年集体总剂量在仍继续增加。

81. 目前，最严重的辐射照射涉及处理无损分析用放射性同位素的工作人员。这种过度照射经常发生在辐射安全监管有限、安全培训不足和辐射防护计划和程序不完善的孤立场所。虽然大多数核装置都建立了报告运行经验以及事件和事故并从中汲取经验教训的某种程序，但工业射线照相工作人员并不拥有这种反馈资源。

82. 在所有受辐射照射的工作人员中，半数以上目前来自医疗领域，预计这一比率在未来几年还会增加。由于医学成像新技术的利用，在医务人员职业辐射防护方面出现了新的挑战。这种电离辐射的新应用能改进患者保健，但同时也产生了必须规划和实施新辐射防护技术的新情况。将继续对医学专业人员进行适当培训，并继续使用辐射防护工具和技术，以确保医务人员的职业辐射安全。

83. 但世界各地大多数核装置的职业辐射防护管理良好。此外，2009 年，这些装置中只有极低比例的工作人员接受了超过相关监管当局所定限值的有效剂量。图 4 显示了核电厂工作人员接受的年集体总剂量的发展趋势。

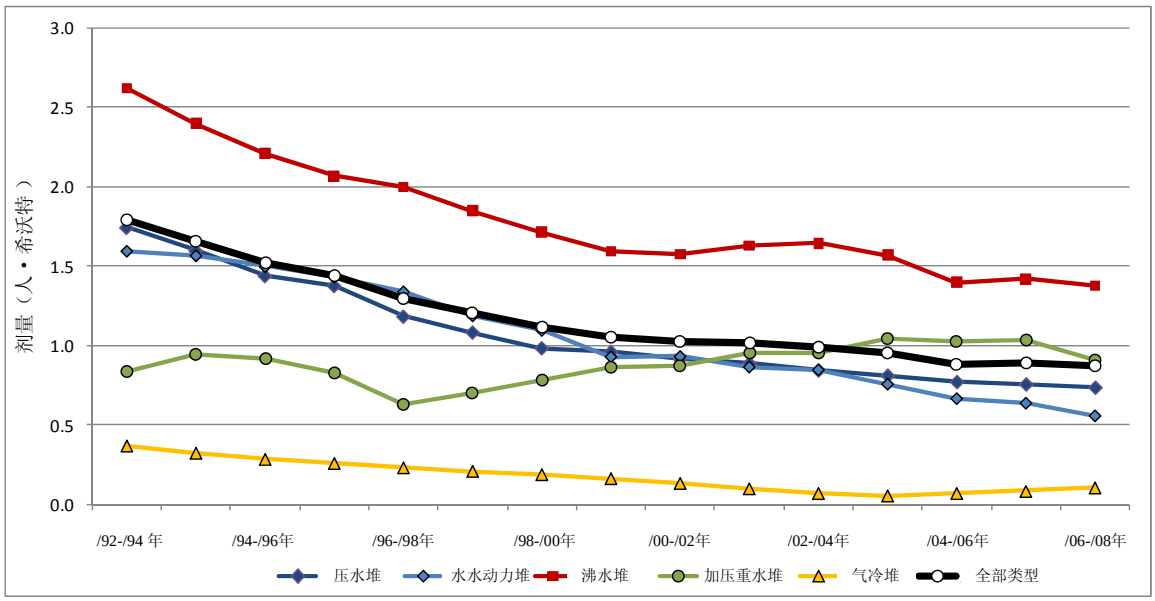

图 4. 1992－2008 年“职业照射信息系统”按所有在运反应堆堆型列出的三年滚动平均集体剂量（人·希沃特）[压水堆、沸水堆、水冷和水慢化动力堆（水水动力堆）、加压重水堆、气冷堆、轻水冷却石墨慢化堆（石墨轻水堆）] 参考文献：“职业照射信息系统”2009 年职业照射数据库（由经合组织核能机构和原子能机构共同主持）

H.2. 国际活动

84. 10 月在维也纳举行了 2009 年度职业照射信息系统“合理可行尽量低原则”国际专题讨论会。该专题讨论会召集了来自 27 个国家的总共 110 名与会者，目的是讨论核电厂职业辐射防护的优化问题。会议还讨论了确保正在首次考虑核电厂计划的成员国可以受益于全世界反应堆营运者多年积累的职业辐射防护经验和良好实践所需的程序。

85. 为了加强原子能机构安全标准的统一实施，正在与国际组织保持现有合作，如与国际劳工组织（劳工组织）在“职业辐射防护行动计划”方面或与经合组织核能机构在“职业照射信息系统”联合秘书处方面保持合作。

I. 医疗辐射照射

I.1. 趋势、问题和挑战

86. 全球年人均有效剂量正在迅速上升，而且几乎全都是由于不断增加的医疗照射引起的，在一些国家目前已经达到了相当于或超过天然本底照射量的程度（见图 5）。与过去 10 年一直保持不变或减少的其他电离辐射照射如核装置的职业照射相反的是，医疗照射一直在高速增加。尽管这种增加在很大程度上反映出一些积极意义，如增加了利用电离辐射的医疗程序的机会，但也有证据表明，许多诊断成像程序是不必要的，而且许多程序不够优化。

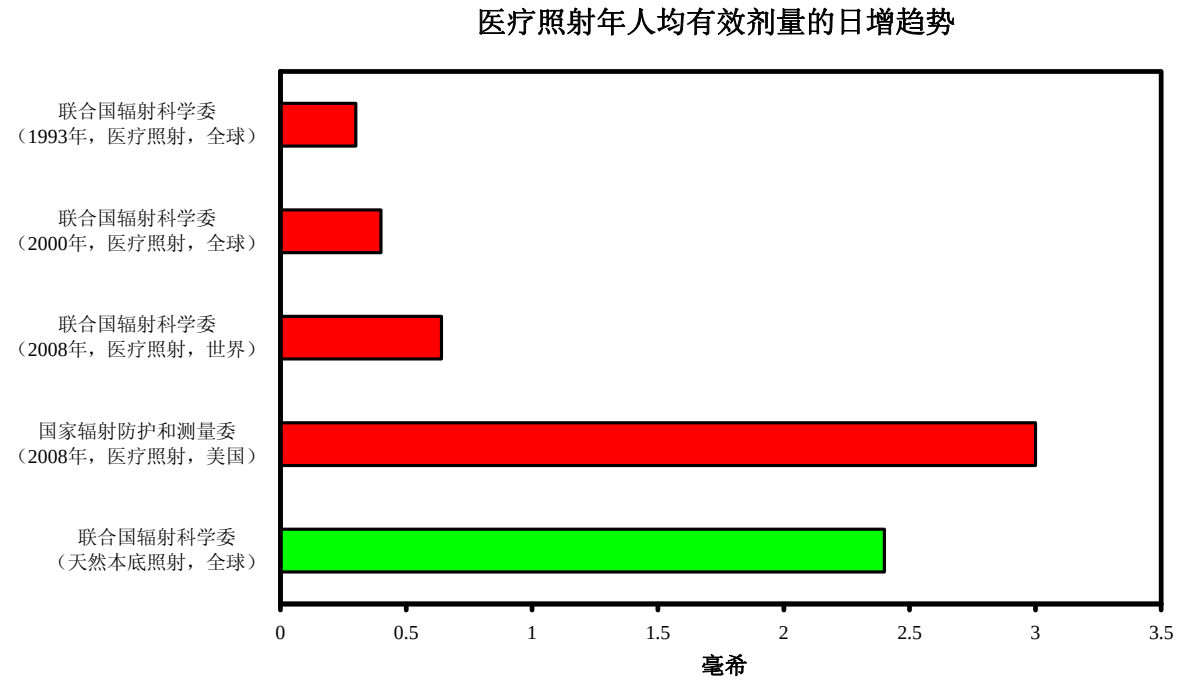

图 5. 不同年份报告的由医疗照射引起的全球年人均有效剂量、与美国的比较以及来自天然本底的全球年人均有效剂量。

87. 调查表明，出现了大量系统性的不适当放射学检查实践，导致许多患者接受了不必要的照射（在当地调查和多中心调查中占 20%－50%不等），这就突出强调绝对有必要在个人医疗照射的合理性方面作出改进。

88. 利用电离辐射的医疗技术正在不断迅猛发展，导致新技术迅速得到采用。这种技术现在还越来越多地影响到基础设施欠发达的发展中国家。自 1998 年以来，全球计算机断层照相（CT）扫描仪的年销售量翻了一倍以上，而且预计还会以同样的速度继续增加。CT 扫描仪现在占患者辐射剂量的很大部分。最近在大型医疗中心开展的调查发现，CT 检查现在经常占所有检查的 25%，患者所受剂量的 60%到 70%都来自诊断放射治疗。CT 装置的数量、CT 检查的频度和类型以及每次检查的剂量在全世界都在增加。此外，患者调查也显示同样检查的患者剂量范围很大，这凸现出继续有必要在医疗照射的优化方面作出改进。

89. 利用 X 光导引体内干预的方法所开展程序的数量越来越多，而且许多程序是为替代外科干预而实施的。一些程序可能引起大量的患者照射，并有可能带来确定性伤害，最近的调查表明实施这种程序的工作人员受确定性伤害的危险已经升高。因此，进一步优化患者和工作人员在这种模式下的辐射防护的紧迫性愈来愈大。

I.2. 国际活动

90. 2009 年 9 月 2 日至 4 日，在比利时布鲁塞尔举行了欧洲委员会与原子能机构合作主办的诊断成像中医疗照射的合理性国际讲习班。有效通报风险、最新转诊指南以及

合理性临床审核情况被视为有可能促进和加强合理性的手段。

91. 2009 年 10 月 8 日至 9 日在爱尔兰都柏林举行了非医学成像照射国际专题讨论会。该专题讨论会由欧洲委员会在原子能机构的参与下主办，会议旨在审查非医学目的人体成像当前的状况，其重点是这种实践中所遇到的伦理、法律、社会和技术问题，目的是为导则和建议的编写提供一个出发点。全球在处理这一新专题方面存在的差异表明必须密切开展国际合作。

92. 2009 年 12 月，法国核安全管理局与原子能机构、世卫组织、欧洲委员会和另外 18 个国际和国家组织合作，在凡尔赛组织了“现代放射治疗：患者辐射防护方面的挑战和进步国际会议”。会议的结论之一指出，从传统放射治疗事故汲取的经验教训对较新的放射治疗技术仍然有效，应当将这种经验教训纳入国家培训计划，并在制订放射治疗部门的程序时加以考虑。但新技术存在着应当加以考虑的新危险。为了事先制订主动的事故预防方案，应当在放射治疗中采用主动的安全评定方法，并对安全规定提供风险知情的合理选择。

J. 公众和环境的辐射防护

J.1. 天然放射性

J.1.1. 趋势、问题和挑战

93. 人们日益认识到天然放射性作为全球集体剂量贡献因素的重要性。联合国辐射科学委所作的最新估计表明，天然辐射源为年人均 3.0 毫希总剂量贡献了 2.4 毫希。其中，约有 1.2 毫希（占总量的 40%）系由氡照射所致。氡不仅是许多国家集体剂量的主要贡献因素，而且还是易于控制的几种照射源之一。尽管数十年来一直在对矿井等地下工作场所的氡照射进行监管，但在住宅和地上工作场所如办公室和商店控制氡照射的必要性现在正受到成员国越来越多的关注。

94. 最近的两种事态发展尤其提高了公众对于氡既作为辐射防护问题也作为公众健康问题的认识。前一问题是流行病学研究中表明住宅照射后肺癌危险增加的直接证据。尽管调查结果大体符合来自职业受照矿工和其他人的现有数据，但关注的重点一直侧重于这样的事实，即存在着低至约 150 贝可/立方米的浓度时危险增加的证据，而该浓度低于许多国家采用的参考水平。后一问题是氡照射与吸烟之间的密切协同关系。

J.1.2. 国际活动

95. 2009 年 12 月，原子能机构在维也纳原子能机构总部举行了一次国际研讨会，对与氡长期照射有关的健康危险方面的最新科学资料进行了审议。来自世界各地的 80 多名技术专家和决策者聚集一堂，听取了联合国辐射科学委、国际放射防护委员会（国际

放射防护委）和世界卫生组织（世卫组织）所作的介绍。会议的结果将在修订原子能机构第 115 号“安全丛书”《国际电离辐射防护和辐射源安全的基本安全标准》（辐射防护基本安全标准）时加以考虑。

96. 原子能机构明年将制订一项向希望制订减少国内氡照射国家计划的成员国进行通报和对其提供援助的计划。这将是对职业照射和公众照射方面现有工作所作的补充。作为这一主动行动的一部分，原子能机构将谋求与具有该领域专门知识和负责该领域工作的国际组织合作的最大化。

J.2. 放射性物质释放所产生的照射

J.2.1. 趋势、问题和挑战

97. 在优化由于活动和设施的正常运行所产生的放射性排放，以及在监管机构确定环境排放核定限值方面，成员国所积累的实际经验与原子能机构安全标准所提供的导则有所不同。有鉴于此，秘书处编写了题为“确定放射性排放核定限值：有待考虑的实际问题，讨论报告”的原子能机构《技术文件》。作为 1996 年印发的“辐射防护基本安全标准”当前修订过程以及随后进行的相关“安全导则”修订前的一个预备性步骤，该出版物将用于在成员国之间进行磋商。

98. 2009 年印发的国际放射防护委出版物《环境保护：参考动物和植物的概念和使用》提出了关于环境保护相关问题的新建议。该出版物详细叙述了估计参考动物和植物受照量以及确定照射与照射效应之间联系的参考方案。该出版物还提供了关于放射性环境影响评定的初步导则。至于是否及如何在符合合理化、最优化和实行限制等防护原则的辐射防护框架内开展放射性环境影响评定，需要进一步讨论才能就此达成共识。

J.2.2. 国际活动

99. 原子能机构“辐射安全环境仿真模型”计划（EMRAS II）于 2009 年 1 月在维也纳原子能机构总部举行的第一次技术会议上发起实施。“辐射安全环境仿真模型”计划继续开展以往国际活动的一些工作，并侧重于：改进环境迁移模型，以减少相关的不确定性；制订新方案，以加强对环境中放射性核素产生的放射性对人以及植物群和动物群影响的评价。该计划将持续执行三年，直到 2011 年为止。

100. 2009 年 4 月发起实施了国际切尔诺贝利研究和信息网项目。该项目是在第六十二届联合国大会期间制订的“联合国到 2016 年的切尔诺贝利行动计划”框架下由原子能机构、开发计划署、儿童基金会和世卫组织协调的有关活动的一部分。在莫斯科和基辅组织了国际原子能机构/国际切尔诺贝利研究和信息网关于传播切尔诺贝利相关信息的两个联合地区讲习班。此外，还与开发计划署、儿童基金会和世卫组织在基辅合作举办了一次讲习班，目的是启动并加强科学家与记者的对话，从而确保向公众提供公正客观的信息。

101. 2009 年 10 月在伦敦举行了《防止倾倒废物及其他物质污染海洋公约》（伦敦公约）缔约方第 31 次咨询会议。在这次会议上，原子能机构提出的报告介绍了国际上在更全面的环境（包括人和其他物种）保护系统上取得的进展，这一系统遵循了这一领域的国际趋势，而且符合原子能机构的“环境辐射防护活动计划”。原子能机构还提出了关于基于当前科学知识水平的放射性评定程序的建议，该程序对人类和非人类物种一视同仁地做了考虑。

J.3. 豁免和解控

J.3.1. 趋势、问题和挑战

102. 材料再循环和复用是一种可持续实践，并得到了核安全基本原则的认可。在这一领域，金属回收已成为所有成员国一项重要的工业活动。但来自核工业的材料需要先解除监管控制才能为传统工业所复用。此外，放射性物质可能因疏忽与废金属混在一起，从而可能造成健康、经济和公众接受问题。“豁免”和“解控”这两个术语的使用也在不断出现问题，二者经常被混用。“特别解控”、“有条件解控”和“无条件解控”以及“经批准的解控”等术语也在使用。虽然其中一些问题是历史造成的，但也有一些系使用不够严格所致。这一问题在被期望成为这方面范例的国际文件中亦不鲜见。

103. 但对于应当多么严格地执行监管，观点不一。特别是，如果金属工业对最终产品能否被公众接受认可为不具放射性的关切得不到解决，尤其是鉴于最近发生的金属进口方面的问题，金属解控就不会获得大规模成功。这些问题需要国际解决方案，部分的办法将是利用一般解控水平作为国际贸易的默认值。目前正在普遍实行解控，并且大量的建筑碎石已经解控和在常规处置设施中处置。在若干成员国，核工业正在利用清洁解控概念来确定哪些材料可以被解除监管控制以进行再循环。迄今，大多数解控金属已用于受控应用，或者被返回供在核工业内复用。但没有证据表明这些材料普遍进入废金属市场，它们只是经特别安排进入市场。

J.3.2. 国际活动

104. 西班牙核安全委员会与原子能机构合作组织了 2009 年 2 月 23 日至 27 日在西班牙塔拉戈纳举行的“废金属中意外放射性物质的控制和管理国际会议”。与会者一致认识到在各国政府间签署某种形式有约束力的国际协定以统一与含有放射性物质的废金属有关的跨境问题的应对方案具有潜在的好处。一些现有国际文书，如《放射性物质安全运输条例》，可处理某些跨境问题。会议与会者在这方面提出的许多议题已在联合国欧洲经济委员会提出的建议中涉及，因此，可将那些建议作为审议的起点。会议还认为，《关于金属材料辐射监测协作的西班牙议定书》为制订关于在发现废金属中含有源或发现受污染材料情况下的责任分工的国家安排提供了范本。

105. 2009 年 9 月 21 日至 23 日在德国威斯巴登举行了“第六次解除放射性物质监管要求 — 豁免和解控规定国际专题讨论会”。该专题讨论会是德国 TÜV NORD SysTec 公司在原子能机构、欧洲委员会、经合组织核能机构和德国-瑞士辐射防护协会的支持下

组织的。自第一次举行这一系列的专题讨论会以来的 10 年中，已在豁免和解控政策和标准的国际统一和有关概念的应用方面取得了显著进展。虽然如此，与会者的发言表明各国在执行豁免和解控方面仍有自己的做法。专题讨论会讨论了最近几年在解控水平的国际统一方面的发展。与会者建议，在修订“辐防基本安全标准”时，应考虑根据原子能机构第 RS-G-1.7 号“安全导则”编制一个单一的数值表，而不是将豁免和解控分开的两个表。专题讨论会还涉及了低放废物的处置问题。讨论会注意到在有关地表处置库放射学标准中的关闭终点和受长寿命放射性核素污染场址的解控方面尚无明确的导则。

K. 退役

K.1. 趋势、问题和挑战

106. 对世界上开展核退役活动的国家而言，全球民用核遗产退役和清理活动是一项巨大的管理、技术、安全和环境挑战。全世界 440 多座核电厂需要在未来 40 年至 60 年退役。除动力堆外，还要确定原型堆、试验堆和研究堆领域以及其他燃料循环设施如世界各地的燃料制造设施等其他领域的退役和清理需要。

107. 负责新电厂规格和设计的专家、从事该领域工作的监管人员和退役与废物管理专家普遍认识到，退役应被视为电厂寿期的一个组成阶段，并应自设计活动的早期阶段就加以考虑。这样做有望减少废物的积累和最终拆除所需的时间。一般情况下，这还能导致为维护工作提供更好的条件。一些国家因为没有处置设施甚至因为没有任何明确的处置政策而推迟了退役，在评定新建核电厂的全面影响时，可从中汲取特定的经验教训。

K.2. 国际活动

108. 许多国家的政府和国家的支持组织目前都在向伊拉克工作人员提供技术专门知识，允许其参观它们的核场址和核设施以及为其提供培训机会，以便帮助建立伊拉克退役计划的退役和监管能力。2009 年，完成了 LAMA 设施退役的第一阶段和第二阶段，并启动了 GeoPilot 设施的退役工作。5 月和 11 月在原子能机构的协调下举行的两次审查和规划会议审查了计划状况，讨论了下一时期的计划并确定了对进一步培训和支助的需求。

109. 2009 年 10 月，欧洲委员会通过了一项关于延长对保加利亚的财政支助以供其进行 Kozloduy 核电厂 1 号机组至 4 号机组的退役和减轻由此带来的经济后果的新建议，并将此作为欧洲理事会的条例。如果不作出这一新的延长决定，对保加利亚核电厂退役的财政支助就会在 2009 年 12 月结束。就立陶宛和斯洛伐克而言，其伊格纳林纳核电厂和博胡尼斯核电厂的退役有着类似情况，对这两座核电厂退役的财政支助已确保至 2013 年底。

110. 国际退役网络协助成员国共享实用退役知识。2009 年开展了若干项活动，包括举办了面向项目管理人员和规划人员的退役基本原则讲习班和培训班；研究堆和其他小型设施退役的规划和实施讲习班和培训班；表征、废物管理、拆除和解控技术讲习班和培训班；以及多设施场址退役的组织和实施讲习班和培训班。2009 年 11 月在维也纳举行了国际退役网络年度会议。这次会议为审查各国的状况、各国对来自其他国际退役网络成员的支助需求以及主办退役培训和讲习班的要求提供了机会。会议结束后举办了为期两天的关于利益相关者参与退役问题的专题培训会议。

111. “安全评定在规划和实施使用放射性物质的设施退役中的应用国际项目”目前正在帮助成员国根据世界范围内的良好实践和国际安全标准制订、审查和实施安全评定与退役计划。该项目 2009 年的活动是在三个工作组和四个辅助性试验案例的范围内组织的，2009 年 12 月在德国波恩举行的主要会议对活动进行了审查和整合。

L. 受污染场址的恢复

L.1. 趋势、问题和挑战

112. 20 世纪 80 年代末，恢复核武器试验、核事故、不良实践和遗弃设施产生的遗留场址的必要性变得明显起来。国际社会对可持续的铀生产实践和以往铀生产产生的遗留场址的恢复也有着浓厚的兴趣。目前的重点是恢复铀矿采冶遗留的场址，特别是中亚国家的遗留场址，因为许多老旧铀矿的开发没有对遗留残留物或对环境造成的损害给予关注。

L.2. 国际活动

113. 原子能机构于 2009 年 5 月 18 日至 22 日在哈萨克斯坦阿斯塔纳组织举行了受放射性物质残留物染污土地的恢复问题国际会议。会议支持制订一项战略，通过适当的寿期规划和良好运行实践及通过促进矿业公司形成环境保护文化来避免今后产生遗留场址。会议还认识到，开展采矿作业的那些国家通过制订适当的条例和设立强有力的监管机构，是可以取得很大成果的。

114. 为提高国际上对中亚铀矿开采遗留问题的认识，联合国开发计划署（开发计划署）2009 年 6 月在瑞士日内瓦组织了一个论坛。作为对这次活动的后续行动，原子能机构目前正在协调编写关于中亚铀遗留场址的基准文件。该文件将以风险大小为序提供一个项目组合，捐助者今后可对项目组合提供支助。举行了由在该地区积极开展活动的一些组织如欧洲银行、欧洲委员会、欧安组织、开发计划署、环境规划署和世界银行参加的技术会议，以审查上述基准文件。

115. 由于通过适当的规划和协助更有可能实施补救行动，由原子能机构推动的拥有丰富经验的国家和缺少经验的国家之间的相互交流可能导致改善项目的实施条件。2009

年大会期间宣布的原子能机构“环境管理和恢复网络”即是为了促进这些相互交流。“环境管理和恢复网络”的目的是协调国际支持计划；提供以地区或主题领域为重点的培训和示范活动；促进拥有先进环境管理和恢复计划的组织之间的知识共享和交流；以及创建可提供专家咨询和技术指导的论坛。

M. 放射性废物管理和处置的安全

M.1. 趋势、问题和挑战

116. 在过去的几十年中，一些国家已经实施了发展高放废物地质处置设施的项目。迄今，活动的侧重点一直是调查不同主岩地质和概念设计对处置设施的适宜性和为这类设施寻找所在地社区。在这些技术和社会政治层面上已经取得进展并且获得了许多经验教训，例如，需要开展有充分依据的科学调查，并结合开展所有相关方之间的公开和透明对话。一些国家既在技术发展也在公众接受方面取得了良好进展，并达到了目前正在拟订许可证申请和将其提交国家监管当局的程度。瑞典、芬兰和法国分别计划在 2010 年、2012 年和 2014 年提出许可证申请。

117. 若干年来，国际上还开展了关于地质处置和安全性验证之安全标准的辩论，并在很大程度上达成了共识。但随着编写地质处置设施的安全论证文件和许可证申请的细致进程取得进展及监管当局筹备和启动其审查，仍有许多细节问题需要解决。鉴于全世界对这一专题的兴趣日益增加，遂设立了各种国际论坛，以便开展经验交流，特别是在 2009 年原子能机构大会第五十三届常会期间，瑞典辐射安全管理局在原子能机构“放射性废物管理计划”下组织了一个圆桌论坛。此后，2009 年 12 月在南非开普敦举办了一个国际讲习班。虽然已在核设施的许可证审批方面积累了可观的经验，但迄今，这些设施都是寿期有限和处于运行控制下的设施。必须建立对地质处置设施安全的置信度，而这需要很长时间，这因此构成了一项新的挑战。

M.2. 国际活动

118. 作为乌克兰、欧洲委员会和原子能机构三边协定的一部分，2008 年和 2009 年对所有在运核电厂的安全开展了一次审查。在国家核计划中特别将废物管理和退役活动置于全面的同行评审之下，尚属首次，这也是首次将关于放射性废物预处置的新安全要求作为这种评审的依据。考虑到为统一放射性废物处置的安全以及对安全和相关监管控制的验证所作的努力，这被认为是一个重要发展。该活动获得了若干经验教训，特别是需要采取认识到从废物产生到废物处置的放射性废物管理各步骤之间的相互依赖性的整体方案。全面的废物表征对确保废物与处置方案相一致的重要性显而易见，而对解除材料的监管控制加以综合考虑的必要性也是如此。还强调需要在足够早的阶段制订综合退役计划和确认资金的充足性。最后，认识到了综合安全论证文件涉及废物管理和退役方面的所有安全论据的重要性。

119. 2009 年 11 月，欧盟对芬兰辐射和核安全管理局监管放射性废物管理活动的过程开展了同行评审。首个联合欧洲评审组确定了一些良好实践，并提出建议，希望进行修改，以便实现持续改进和为其他欧盟国家提供指导。评审组已经非常熟悉芬兰辐射和核安全管理局基于原子能机构安全标准的自评定。评审的主要侧重点是波西瓦的乏核燃料最终处置项目；拟议中的奥尔基卢奥托乏燃料处置库；以及相关岩石表征设施昂卡罗的建造，该设施计划作为奥尔基卢奥托处置库的一个组成部分。评审组得出结论认为，除其他外，芬兰辐射和核安全管理局特别需要审查其目前针对核电厂的导则和条例，确保它们足够清晰，以便能够用于废物管理监管目的和确保提高有关要求对利益相关者的透明度。

120. 2009 年 9 月，得克萨斯环境质量委员会向废物管制专业公司颁发了在得克萨斯州安德鲁斯县的场址建造和运行一个新的低放废物处置设施的许可证。该设施预计于 2010 年开始运行，它将接受来自得克萨斯州和佛蒙特州以及来自美国联邦政府的 A 类、B 类和 C 类低放废物。美国目前有三个接收商业低放废物的处置设施，其中两个在南卡罗来纳州的巴恩韦尔和华盛顿州的里奇兰，被许可接收 A 类、B 类和 C 类废物；另一个在犹他州的克莱夫，被许可接受 A 类废物。

N. 放射源的安全和保安

N.1. 趋势、问题和挑战

121. 高活度放射源在世界各地广泛使用。目前还没有关于正在使用的放射源数量的可靠资料。不过，美国核管理委员会 2007 年的一份报告估计，仅在美国使用中的一类源和二类源就有 53 700 个，这对世界范围内的源数量具有指示性意义。放射源虽然在为数有限的应用中正在为其他技术如粒子加速器所取代，但在许多情况下将继续在医学、工业和学术应用中得到利用。尽管所有成员国都认识到确保放射源受到监管控制的重要性，但对许多成员国来说，维持国家登记系统和确保源在其整个寿期内都得到监管控制仍是一个问题。

122. 越来越多的国家认识到《放射源安全和保安行为准则》的重要性，许多成员国已做出政治承诺，将该行为准则作为制订和统一其政策、法律和条例的导则。大多数成员国都使用该行为准则建议的分级方案来管理放射源，而且越来越多的成员国正在利用它的补充导则《放射源的进口和出口导则》。

123. 每年在世界各地的入境港和金属回收设施都会发现无监管控制的放射源（无看管源）。一旦发现无看管源，往往应当考虑安全关切和保安威胁，并应将这类发现报告给有关当局。许多成员国不具备充足的专门知识或资源来表征所发现的放射性物质和对无看管源重新实施监管控制。

124. 由于持续的国际努力的结果，对放射源有了良好的控制。但是，放射源在达到其使用寿期终点时就更容易受到破坏。虽然《放射源安全和保安行为准则》和《乏燃料管理安全和放射性废物管理安全联合公约》都制定了安全管理废放射源的原则和目标，并鼓励采取所有可能的选案（再循环、复用、返还原产国、贮存和处置），但许多国家仍未确定对其当前和今后的搁置放射源进行管理的适当战略（图 6）。这个问题对于拥有少量放射性废物和没有核计划的国家尤为重要。

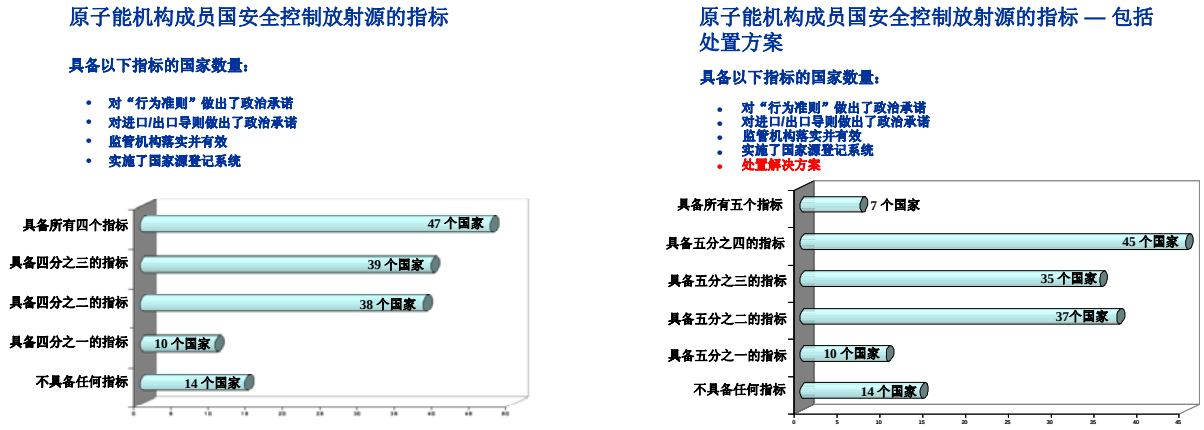

图 6. 成员国安全控制放射源的指标

N.2. 国际活动

125. 2009 年 6 月，原子能机构在维也纳举行了一次不限人数的技术和法律专家会议，以共享有关《放射源安全和保安行为准则》在密封源长期管理战略方面执行问题的信息。会议讨论了所有可能的战略，特别是那些鼓励各国促进搁用源返还供应商或为不能返还供应商的搁用源或无看管源建立中央贮存设施或处置设施的战略。会议还讨论了执行该行为准则的成员国与“联合公约”缔约方之间共享信息的问题。

126. 在 2009 年的高级监管官员会议期间，组织了一次关于搁用放射源长期管理战略的小组会议。对核管理问题进行了深入的讨论，这些问题如对放射源进行境内和跨境电子跟踪、维持东道国对放射源整个寿期的安全和保安的长期承诺、规划并提供充足的资金以资助废物处置以及为核废物和废源制定适当的贮存空间。

127. 为了支持成员国不断改进其对放射源的监管控制和盘存，原子能机构一直定期更新“监管部门信息系统”，同时考虑了成员国的反馈和建议。2009 年推出的“监管部门信息系统”网络门户处于改进的下一阶段。它为“监管部门信息系统”3.0 版提供了一个网络界面，并使现场视察员、监管机构地区办公室和设施的受权代表等能够接触设施数据。

128. 在发展中国家，高活度搁用源的操作和整备一直是一个问题，因为它们没有必要的基础设施使得能够对远距离治疗仪或辐照器中使用的高活度钴-60 源和铯-137 源进行操作。原子能机构与南非的一家承包商（南非核能公司）一道开发了一种移动热室，

最近已在两个非洲国家成功地部署了这种热室。这种移动热室从南非运至苏丹，并在那里进行了组装部署。远距离治疗仪此后被装入该热室中（一次装入一个），将源取出，并对其进行表征、整备和放入一个长期贮存屏蔽容器中。该长期贮存屏蔽容器随后被放入该国一个安全和可靠的贮存设施中。然后将移动热室拆解并运至第二个国家坦桑尼亚联合共和国，在那里重复执行同样的程序。今后使用这种技术的作业问题目前正处在规划阶段。这是一种能够为一国提供安全和保安利益的独特技术。长期贮存屏蔽容器使得能够对源进行进一步处置，而无论是将它们从当事国移出或是在地下处置库中进行处置。一旦完成对这些源的整备，在有关国家当局选择贮存方案的情况下，还能够将这些源安全和可靠地长期贮存在长期贮存屏蔽容器中。

O. 放射性物质的运输安全

O.1. 趋势、问题和挑战

129. 拒绝和拖延运输放射性物质的情况在世界各地继续发生。可用运输路线的减少似乎是拒绝和拖延运输的先兆，但由于商业敏感性，仍然难以对此进行监测和衡量。仍然显而易见的是，为了防止不正当的拒绝和拖延，必须与主要活动不是处理放射性物质的运输人员进行有效交流。促进交流和培训是目前正在执行并接近完成的拒绝运输放射性物质问题国际指导委员会行动计划目前阶段的重点。

130. 另一项持续性挑战是加强与涉及危险货物运输的联合国其他机构的合作与协调。交叉问题越来越多，如船舶退役和可移动核装置等。目前正在研究这些新概念的运输安全影响，以了解新的重要民用核技术的潜在复杂性和确定相关安全条例的必要更新问题。

131. 对大型源和核燃料空运更加严格的要求所产生的影响将鼓励采用陆上运输，并将使得有必要评定安全要求中的这些空运限制与保安需求的平衡问题。对原子能机构运输要求的审查将必然调查是否包含确保能够达到适当平衡所需的充分灵活性。

132. 除了是国际空运和海运公约的缔约方外，拥有核工业的许多国家还签署了运输危险货物的地区陆路运输协定，从而为货物运输提供了便利。虽然空运和海运公约在性质上是全球有效的，但随着工业基地的扩大，没有国际陆路运输协定可能成为一个问题。

O.2. 国际活动

133. 拒绝运输放射性物质问题国际指导委员会继续指导开展国际活动。2009 年，这项工作包括举办地区讲习班，以建立地区网络来实施讲习班期间制定的地区行动计划，其中包括制订和实施旨在提高决策者和其他各方认识的宣传战略。目前已经从基于秘书处领导开展工作的发展阶段推进到由地区协调员和国家协调中心领导开展的实施阶

段。国际上的侧重点将是促进国家解决方案、推动地区解决方案和协调国际解决方案。指导委员会监督了拒运情况数据库的建立，截至 2009 年底，该数据库登记了 200 多份拒运报告。

134. 2009 年，运输安全标准委员会作出决定认为，由于存在足够多的安全相关问题而需要对《放射性物质安全运输条例》进行更新。这主要是为了响应大会所要求的制订放射性物质运输适用的不属于易裂变材料的新要求。这次修订预期将在 2012－2013 年左右完成，并在此时间之前暂停对“运输条例”的进一步审查。

135. 2009 年 9 月，一些沿岸国和承运国在原子能机构的参与下在维也纳举行了第五轮非正式讨论，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。

136. 继法国和英国的主管当局成功地实施了谅解备忘录之后，于 2008 年提出了设立欧洲放射性物质运输主管当局联合会的倡议，此举经证明非常有效。经过初期发展阶段之后，该联合会已成为欧洲主管当局讨论共同感兴趣的问题、交流信息和最佳实践、交换导则材料以及对那些采取共同立场将是有益的专题合作制订共同导则文件的有效网络。

Appendix 1
safety related events and activities worldwide during 2009

A. Introduction

137. This report identifies those safety related events or issues during 2009 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 2009.

B. International instruments

B.1. Conventions

B.1.1. Convention on Nuclear Safety (CNS)

138. The 1st Extraordinary Meeting of the Contracting Parties to the CNS took place on 28 September 2009 to approve the revision of the Guidelines regarding national reports, and endorse a brochure on the CNS and its associated rules of procedure and guidelines prepared by the Secretariat for training purposes.

139. The 5th Organizational Meeting of the Contracting Parties to the CNS took place on 29 September 2009. The purpose of the meeting was to prepare for the 5th Review Meeting to be held 4-14 April 2011. A total of 46 out of 66 Contracting Parties participated in the meeting.

140. The Convention has now 66 Contracting Parties and 13 Signatory States that have not yet ratified the Convention. In 2009, four countries, namely Jordan, Libyan Arab Republic, Senegal, and the United Arab Emirates became Contracting Parties to the Convention.

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)

141. In 2009, the Libyan Arab Jamahiriya, Mozambique and Oman acceded to the Convention on Early Notification of a Nuclear Accident.. There are now 106 Contracting Parties to this Convention.

142. Mozambique and Oman acceded to the Convention for Assistance in Case of a Nuclear Accident or Radiological Emergency in 2009, bringing the total to 104 Contracting Parties to this Convention.

143. Senegal acceded to both conventions in December 2008 but the respective accessions entered into force only in January 2009

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

144. The third Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management took place in May 2009. Forty-five Contracting Parties participated in the Third Review Meeting, including five new Contracting Parties, i.e., China, Nigeria, Tajikistan, Senegal and South Africa. Throughout the Review Meeting it was observed that the review process is maturing well and more constructive exchanges and more knowledge sharing took place than at previous Review Meetings. Within Country Group sessions, many Contracting Parties reported on their use of the IAEA Safety Standards and on their experiences with the Integrated Regulatory Review Service (IRRS) of the IAEA; other Contracting Parties plan to undergo or to request IRRS missions in the future. Contracting Parties that have not received these missions were encouraged to invite such missions.

145. The Review Meeting emphasized Policy and technical highlights in the Summary Report on: legislative and regulatory framework; disposal of waste, decommissioning, disused sealed sources, past practices, knowledge management, stakeholder involvement and international cooperation. In addition, improvements for future Review Meetings were identified through the deliberations of the Open-Ended Working Group and were approved at the Plenary Session of the Review Meeting.

146. In helping reaching this aim, the Review Meeting agreed that during the period between review meetings, the General Committee of the Joint Convention can encourage the Agency to organize meetings open to all Member States to address specific topics identified at the Review Meeting. Taking into account discussions during the country sessions of the Review Meeting, the following specific topics can be of mutual interest: definition and implementation of a comprehensive national plan for the management of spent fuel and of radioactive waste; management of very low level waste and implementation of clearance thresholds; establishment of national agencies in charge of the management of spent fuel and radioactive waste; and management of graphite waste.

B.2. Codes of Conduct

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

147. The Code of Conduct on the Safety of Research Reactors is now widely known and accepted as a principal source for guidance for management of research reactor safety. Continuous commitment of Member States is central to achieving effective implementation of the Code. The provisions and guidance in the Code have been integrated into appropriate Agency safety review services, technical cooperation projects and extra budgetary programmes. Application of the Code is being accomplished through enhancement and implementation of national safety regulations. The Agency continued to encourage Member States 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. To support this effort the Agency published in 2009 a Safety Guide on radiation protection and radioactive waste management in the design and operation of research reactors, and made a significant progress in the development of three other Safety Guides on the use of a graded approach in the application of the safety requirements, safety assessment and preparation of safety analysis report, and safety in utilization and modification of research reactors.

148. Following the recommendations of the 2008 International Meeting on the Application of the Code of Conduct on the Safety of Research Reactors, the Agency continued to implement regional activities to examine progress, to promote sharing knowledge and building technical and safety capacities, and to address specific needs of Member States as defined in their self-assessments

presented during the International Meeting. In 2009, these activities focused on promoting performance of periodic safety reviews for research reactors, and improving the capabilities for preparation, review and assessment of research reactor safety documents, as well as on the need to enhance operational radiation protection programmes and emergency planning and preparedness for research reactors.

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

149. By the end of 2009, 95 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 53 States had expressed support for the Supplementary Guidance on the Import and Export of Radioactive Sources.

150. The provisions and guidance in the Code of Conduct have been integrated into appropriate Agency safety review services, such as the Integrated Regulatory Review Service (IRRS), advisory missions on control of sources, technical cooperation projects and extra budgetary programmes. Application of the Code of Conduct is being accomplished through implementation of national regulations. According to the formalized process established in 2006 for sharing information on implementation of the Code, the next open ended meeting will be held in 2010.

C. Cooperation between national regulatory bodies

151. 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 technology 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)

152. INRA comprises the head regulators from Canada, France, Germany, Japan (representatives of both NSC and NISA), Republic of Korea, Spain, Sweden, the UK and the US. There were two INRA meetings in 2009, both hosted by the Republic of Korea. The first was in April, and the second in October. The group has continued to focus on the regulatory challenges relating to the fragility of the supply of medical isotopes, organizational and human resources for current and future nuclear power programs, materials ageing and exchanges about operational experience. The next round of meetings in 2010 will be held in the UK, although the specific dates have not been set.

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

153. Under the presidency of Italy, the G8-NSSG met three times in 2009. The Agency, the European Commission (EC), the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD/NEA) and the European Bank for Reconstruction and Development (EBRD) also attended the three meetings as observers. The G8-NSSG meetings focused on, inter-alia, the safety upgrading programme of the Armenian Nuclear Power Plant; the Chernobyl Shelter Fund and Nuclear Safety Account managed by the EBRD; the implementation of the EC-Agency-Ukraine Joint Project; the Global Nuclear Safety and Security Network (GNSSN);

strengthening of nuclear safety and security activities; the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary guidance on imports and exports; the Global Initiative to combat nuclear terrorism; the international initiative on 3S-based (Safety, Security, Safeguards); and the human resources development in the field of nuclear safety and security. In this connection, and as the first concrete step of the Italian presidency towards capacity building including education and training in nuclear safety and security, the International Workshop on Nuclear Safety and Security Education and Training in Countries Embarking on or Expanding Nuclear Programmes was organized by the Italian National Agency for new Technologies, Energy and the Environment (ENEA) in cooperation with the IAEA and the EC. Approximately one hundred participants from twenty eight countries and six international organizations (i.e. Arab Atomic Energy Agency (AAEA), EBRD, EC, IAEA, OECD/NEA and WINS) attended this event.

154. At the last meeting in October 2009, the main themes to be considered by NSSG under the Canadian G8 presidency were introduced. The Canadian delegation reported that the G8 Leader's Summit was scheduled to take place from 25 - 27 June 2010 in Huntsville.

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

155. In 2009, WENRA celebrated its 10th Anniversary. It was founded with three main objectives: to develop a common approach to selected nuclear safety and radiation protection issues and regulation, in particular within the EU; to provide the EU with an independent capability to examine nuclear safety and regulation in its candidate/applicant countries and to serve as a network of chief nuclear safety regulators exchanging experience and discussing significant safety issues. In order to achieve the harmonized safety approaches and to continuously improve nuclear safety in the following areas WENRA has established two working groups - the Reactor Harmonization Working Group (RHWG) and the Working Group on Waste and Decommissioning (WGWD).

156. The RHWG has already fulfilled its original mandate (harmonization of requirements for existing reactors which are based mainly on the Agency’s safety standards and best regulatory practice/experience from WENRA countries) and as its follow-up it will regularly revise the safety reference levels according to the latest development in the field of international standards. Within its new task, the RHWG is working on a report on safety objectives for new power reactors which will be published in early 2010.

157. The WGWD is continuing to develop safety reference levels for radioactive waste and spent fuel storage and decommissioning under its original mandate and in addition is formulating safety reference levels for geological disposal facilities.

158. In its ten years history, WENRA has become a credible and well recognized organization. It has enlarged to the current 17 members, heads of nuclear regulatory authorities of European countries having at least one nuclear power plant, and most recently also to eight observers – five from European Economic Area countries without nuclear power programme (Austria, Ireland, Luxembourg, Norway and Poland) and three from non-EU European countries with operating nuclear power plants (Armenia, the Russian Federation and Ukraine). Besides this new cooperation launched in 2009, WENRA is considering also possible new tasks and challenges.

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

159. The Ibero American FORO started sharing its experiences and the results of technical projects with other countries in form of seminars with the occasion of IRPA 12 Congress in 2008. In 2009, the FORO, in cooperation with the Agency, provided assistance and expertise on risk analysis in radiotherapy. A similar approach is planned in the areas of continuous improvement of the regulatory

control of medical exposure. At the IAEA General Conference in 2009, the FORO made a presentation at a round table discussion on the activities of the Asian Nuclear Safety Network in order to share its experiences and policies with other regions.

C.5. Cooperation Forum of State Nuclear Safety Authorities of Countries which operate WWER[1] Reactors

160. The 16th Annual Meeting of the State Nuclear Safety Authorities of the Countries Operating WWER-type Reactors (WWER Regulators Forum) was hosted by the Bulgaria Nuclear Regulatory Agency (BNRA). The meeting was attended by the heads of the regulatory authorities or their representatives of all countries operating or constructing WWER type reactors, namely Armenia, Bulgaria, China, Czech Republic, Finland, Hungary, India, Iran, Russian Federation, Slovak Republic and Ukraine. Observers from the IAEA and the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) also attended the meeting.

161. Reports were presented on the most important recent national issues and developments in the field of nuclear regulation and safety, followed by discussions among the participants. Several working groups have been established and reported on their activities including the regulatory aspects of organizational, management and safety culture related issues of NPPs (work completed); operating experience feedback for improving safety of NPPs; and the regulatory use of Probabilistic Safety Analysis. The working groups will continue their activities into 2010. The next meeting of the WWER Regulators Forum is to be held in Hungary in 2010.

C.6. Forum of Nuclear Regulatory Bodies in Africa (FNRBA)

162. The newly established "Forum of Nuclear Regulatory Bodies in Africa" (FNRBA) had a meeting in Pretoria, South Africa in March 2009, to finalize its charter as a key document governing its operation. FNRBA also identified the main programme areas for the Forum's cooperative activities.

163. The charter was signed on 26 March 2009 by representatives of 24 participating regulatory authorities and following its entry into force, a new Steering Committee was elected for a two years term of office.

164. The Forum benefited from presentations made by partner institutions (US NRC, resource persons from the European Radiation Protection Authorities Network and the Asian Nuclear Safety Network), as well as from the IAEA, on experiences and lessons learned by other regional networks of regulators. This includes the Global Nuclear Safety and Security Network (GNSSN) platform, which is currently being established, as well as the International Regulatory Network (RegNet), which will be linked through the GNSSN.

C.7. Network of Regulators of Countries with Small Nuclear Programmes (NERS)[2]

165. NERS is an international network of nuclear regulators and inspectors who are dedicated to the free exchange of nuclear regulatory information and its dissemination. Country members are Argentina, Belgium, Czech Republic, Finland, Hungary, Netherlands, Pakistan, Slovak Republic, Slovenia, South Africa and Switzerland.

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[1] water cooled, water moderated power reactor

[2] www.ners.info

166. NERS provides a means of communication between regulators of countries with small nuclear programmes. It complements any bilateral engagement or agreements a regulatory body may have. One of its roles is to support the activities of other international organizations such as the IAEA and committees of the OECD-NEA, Committee on Nuclear Regulatory Activities (CNRA) and Committee on the Safety of Nuclear Installations (CSNI). The IAEA supports the formation of such networks as part of its knowledge sharing activities.

167. The 12th meeting of NERS was held in Brussels, from 4 – 5 June 2009. General items discussed included information on regulatory organisation in member countries; rules, regulations and licensing process and operational experience feedback. Specific items were also discussed relating to the licensing and construction of new nuclear power plants, safety assessment of cranes, experiences with licensing of final disposal facilities and methods of calculation of third party nuclear liability insurance. The 13th NERS meeting will be hosted by South Africa with a provisional date of October 2010.

C.8. The senior regulators from countries which operate CANDU-type nuclear power plants

168. The Annual Meeting of Senior Regulators of Countries Operating CANDU-type Reactors took place in Buenos Aires, Argentina, from 26 - 30 October 2009 and was hosted by the Nuclear Regulatory Authority of Argentina. In addition to the seven participating countries (Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania), the representatives of the CANDU Owners Group (COG) were invited to attend, in order to enhance the exchange of information among regulators and COG and identify future areas of cooperation.

169. In addition to the regular topics, which cover presentations of country annual reports, recent developments and exchange of operational feedback, the meeting addressed technical and policy regulatory issues, which includes assessment and licensing of new design, refurbishment and ageing management, risk-informed and its specific application for CANDU safety issues and for regulatory compliance activities. The participants visited Embalse NPP and exchanged information with the Argentinean counterparts on the organization, status of implementation and technical aspects of the Embalse Plant Life Extension Project.

170. The next meeting will be held in Shanghai, China, in the fourth quarter of 2010.

C.9. The International Nuclear and Radiological Event Scale (INES)

171. The International Nuclear and Radiological Event Scale (INES) User's Manual was issued by the IAEA in June 2009. The new manual puts forward a new revised INES, which applies to any event associated with the transport, storage and use of radioactive material and radiation sources, whether or not the event occurs at a facility. The revision is aimed at better addressing areas and activities such as the transport of radioactive material, or human exposure to sources of radiation. It also ensures more consistent terminology and adds more examples of INES rating to the manual.

172. It is anticipated that INES will be widely used by the Members States and become the worldwide scale for putting into the proper perspective the safety significance of nuclear and radiation safety events. Member States demand for the new INES User's Manual was high and the 2000 copies of the INES User's Manual printed in June 2009 were out in less than five months. A second release of additional 1000 copies was issued in October 2009.

173. With a view of promoting the consistent and wide use of INES by all interested Member States, and recalling the IAEA General Conference resolution GC(52)/RES/9 which welcomed the new INES

User's Manual, urged Member States "to designate INES national officers and utilize the scale" and "recognised the efforts of the Secretariat and Member States in implementing the International Nuclear and Radiological Event Scale (INES) and resolution GC(53)/RES/10), the IAEA organized for the first time, a train-the-trainers workshop on INES from 22 to 25 September 2009.

174. The train-the-trainers workshop on INES aimed to present the updated INES rating methodology to INES national officers and, at same time, to encourage Governments to join the system. The train-the-trainers workshop on INES was successfully attended by over 50 participants from 35 countries. The lecturers of the workshop were cost free experts and members of the INES Advisory Committee and the IAEA Secretariat. Participants attended the workshop without financial support of the IAEA confirming the interest of the Member States in the scale. Besides, as a result of this initiative, additional four Member States have recently joined the INES system: Kenya, Latvia, Malaysia and the Philippines. Currently sixty-five countries are members of the INES information system.

D. Activities of international bodies

175. 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)

176. The United Nations General Assembly established the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) in 1955 to assess and report levels and effects of exposure to ionizing radiation. The Assembly has designated 21 United Nations Member States to be members of the Committee. The Committee's secretariat, which is provided through the United Nations Environment Programme and based in Vienna, engages specialists to analyse information, study relevant scientific literature and produce scientific reviews for scrutiny at the Committee's annual sessions. Every few years, the United Nations publishes substantive reports, which are recognized as authoritative scientific reviews. These provide the scientific foundation for national and international programmes on radiation risk assessment and management, including for example the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS).

177. During 2009, the United Nations published the second volume of the Committee's 2006 report to the Assembly with scientific annexes, presenting reviews of: non-targeted and delayed effects of exposure to ionizing radiation, effects of ionizing radiation on the immune system, and sources-to-effects assessment for radon in homes and workplaces. A clearer understanding of the risks from radon inhalation has prompted the World Health Organization, the International Commission on Radiological Protection and the International Atomic Energy Agency to take up the matter with respect to protection advice.

178. The fifty-seventh session of UNSCEAR is scheduled to be held from 19 - 23 April 2010 and is expected to discuss the following topics: an assessment of levels of radiation from energy production

and the effects on human health and the environment; uncertainty in radiation risk estimation; attributability of health effects due to radiation exposure; updating the Committee's methodology for estimating exposures due to discharges from nuclear installations; a summary of radiation effects and improving data collection, analysis and dissemination. With regard to the latter, the UNSCEAR secretariat has been liaising with other relevant organizations, such as the World Health Organization, the International Atomic Energy Agency, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development and the European Union, with a view to streamlining the collection of data on radiation exposures of the public, workers and patients and avoiding duplication of efforts.

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

179. ICRP is an independent group of experts that issues recommendations and guidance on the principles of radiation protection. ICRP recommendations have provided the basis for national and international standards on radiation protection in particular the BSS. Appointments to the ICRP and its Committees are made for five years; the current cycle started on 1 July 2009. With the new leadership the ICRP is conducting a review of its mission, mandate and working practices to be prepared for new challenges in radiation safety.

180. The ICRP published the following recommendations in 2009:

- Radiation Dose to Patients from Radiopharmaceuticals (P106)
- Nuclear Decay Data for Dosimetric Calculations (P107)
- Environmental Protection: the Concept and Use of Reference Animals and Plants (P108)
- Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations (P109)

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

181. The ICRU, a sister organization of ICRP, develops and promulgates internationally accepted recommendations on radiation related quantities and units, terminology, measurement procedures, and reference data for the safe and efficient application of ionizing radiation to medical diagnosis and therapy, radiation science and technology, and radiation protection of individuals and populations.

182. The ICRU held its annual meeting from 11 – 16 September 2009 in Dresden, Germany, where topics for potential work for the future were discussed, including functional imaging; harmonization on prescribing, recording and reporting radiotherapy planning; measuring and reporting radon exposure; and operational quantities and units.

183. The ICRU published the following reports in 2009:

- Vol. 9, No. 1, 2009: Report 81, Quantitative Aspects of Bone Densitometry
- Vol. 9, No. 2, 2009: Report 82, Assessment of Image Quality in Mammography

184. In radiation protection, the ICRU has introduced operational quantities and recommendations for their experimental determination. In basic science, the measurement of physical parameters concerning ionizing radiation is improving constantly, and the results must be continuously re-evaluated in order to provide recommendations on reducing the risk of radiation exposure by both the public and radiation workers.

185. In diagnostic radiology and nuclear medicine, developments have been rapid, and the ICRU has expanded its programme related to medical imaging, ranging from fundamental concepts to practical applications involving all types of imaging techniques, and also encompassing specific dosimetric procedures regarding protection.

D.4. International Nuclear Safety Group (INSAG)

186. The International Nuclear Safety Group (INSAG), convened under the auspices of the IAEA, is a group of experts with high professional competence in the field of safety working in regulatory organizations, research and academic institutions and the nuclear industry. INSAG's objective is to provide authoritative advice and guidance on nuclear safety approaches, policies and principles. In particular, INSAG provides recommendations and opinions on current and emerging nuclear safety issues to the IAEA, the nuclear community and the public.

187. Presently INSAG is in the final stage of preparation of two documents that are expected to be issued at the beginning of 2010. The first one deals with the relationship between safety and security and highlights the importance of a coordinated approach to nuclear safety and security. The second one proposes a framework for an integrated risk informed decision making process taking into account deterministic and probabilistic techniques.

188. As in previous years, the INSAG Forum was held in the margins of the 53rd Regular Session of the General Conference. During the Forum, which was dedicated to *Responsibility for Safety in a Globalized Nuclear Environment*, speakers identified challenges which deserve further consideration. These include: states embarking for the first time on a nuclear power programme - the so-called nuclear newcomers; an anticipated flurry in construction occurring simultaneously around the globe and an increasingly globalised nuclear industry; an emerging need for the security regime to match the existing safety regime because of the growing terrorist threat to nuclear material and installations; and a generation of ageing nuclear power plants which could have their life spans extended well beyond 60 years.

E. Activities of other international organizations

E.1. Institutions of the European Union

189. On 25 June 2009 *Council Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations*[3], was adopted by the EU Member States. The Directive creates a solid and flexible legal framework that defines basic obligations and principles governing nuclear safety throughout the EU. By enshrining in its legislation the nuclear safety requirements of the Convention on Nuclear Safety and of the Safety Fundamentals established by the International Atomic Energy Agency (IAEA), the EU has become the first major regional nuclear actor to give binding legal force to these leading international nuclear safety instruments. The underlying principles on which the Directive is built are: national responsibility for nuclear safety and continuous improvement of nuclear safety. In line with these basic principles, the Directive requires Member States to establish and maintain a national legislative, regulatory and organisational framework governing the safety of nuclear installations. It also aims to reinforce the role and the independence of

[3] OJ L 172, 2.7.2009

the competent national regulatory authorities by building on their competencies and acknowledging the fundamental prerequisite that only independent and strong regulators can guarantee the safe operation of nuclear installations in the EU. The prime responsibility of licence holders for nuclear safety is explicitly recognised.

190. In the framework of the continuing positive cooperation with Ukraine on energy and nuclear safety matters, a joint European Commission-IAEA-Ukraine project on the evaluation of the nuclear safety of the Ukrainian Nuclear Power Plants is under way since 2007. First interim reports have been presented by the IAEA in November 2009.

191. In 2009, the European Nuclear Safety Regulators Group (ENSREG)[4], an independent expert body composed of senior officials from the national regulatory or nuclear safety authorities of all the 27 EU Member States, held four meetings. The objective of ENSREG is to further a common approach to the safety of nuclear installations, the safety of the management of spent fuel and radioactive waste and the financing of the decommissioning of nuclear installations. As a main concrete result, the ENSREG work has provided a valuable contribution to the preparation of the Council Directive on nuclear safety. In addition, ENSREG submitted to the Commission its first Activity Report, presenting the Group's discussions and recommendations covering nuclear safety, waste management and transparency aspects[5]. According to the procedure established in the Decision, the Commission has further transmitted this Report to the European Parliament and to the Council.

192. The European Nuclear Energy Forum (ENEF) provides a platform for a broad and transparent stakeholder discussion on the opportunities and risks of nuclear energy, as well as transparency issues. The fourth plenary meeting was held in May 2009 in Prague and gathered more than 250 high-ranking participants from all relevant stakeholders in the nuclear energy field – Governments of all 27 EU Member States, European Institutions, nuclear industry, electricity consumers and the civil society. The ENEF working groups (opportunities, risks and transparency) supported possible initiatives in the area of nuclear safety and waste policies, training, education and transparency. High level interventions from political leaders and from industry have noted that nuclear power is perceived by them as a major contributor to the future low carbon economy, together with renewables. The next plenary ENEF meeting will be held in Bratislava in May 2010.

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

193. The Nuclear Energy Agency (NEA) is a specialized agency 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.

194. The NEA Committee on Nuclear Regulatory Activities (CNRA) established a working group on the Regulation of New Reactors inter alia to develop a database on construction experience (ConEx). The objectives of the ConEx database are to identify the major deficiencies that occurred during the design and construction of nuclear power plants, to assess the adequacy of and supplement if necessary, the current regulatory activities to detect and correct such events and prevent them from remaining undetected until the plant becomes operational and finally to disseminate information to

[4] Set up by the Commission Decision 2007/530/Euratom of 7 July 2007 on establishing the European High Level Group on Nuclear Safety and Waste Management (O.J. L 195/44, 27.7.2007)

[5] The full Report is available at http://ec.europa.eu/energy/nuclear/ensreg/doc/2009_ensreg_report.pdf

ensure appropriate regulatory attention is given to the lessons learned from past events. A CNRA working group on operating experience is discussing safety issues having potential generic importance about control rods (wear, corrosion, manufacturing defects, cracks) recognising an international trend on issues of human factors, quality assurance, vendor oversight and sharing of vendor information internationally, explosive risk for hydrogen carrying pipes and follow-up of the 2006 Forsmark-1 event.

195. Under the auspices of the Committee on the Safety of Nuclear Installations (CSNI) an activity is ongoing to identify the key safety issues and the data needs for specific advanced reactor design concepts, the infrastructure needs for producing the required data, and the role of the regulator, industry and R&D institutions in the development of such infrastructure. The reports related to experimental research need for Gas Cooled Reactors were completed in 2009 and work is under completion for Sodium Fast reactors.

196. The Multinational Design Evaluation Programme (MDEP) is a multinational initiative to increase cooperation and enhance convergence of regulatory requirements of national safety authorities who will be tasked with the review of new reactor power plant designs. The MDEP compared inspection practices and scope, and observed and participated in vendor inspections conducted by other regulators. In the relation to the standards and codes, pressure boundary codes are compared for pressure vessels in coordination with the standard development organizations, who have been encouraged to meet and discuss differences. On instrumentation and control (I&C), an MDEP working group engaged the I&C standards organizations to develop a comparison table, interfacing with equipment designers and manufacturers to draft common positions. In addition, specific working groups address design aspects of EPR and AP1000. To share their results with stakeholders, the MDEP organised a conference with participation of non-MDEP regulators and industry. The main conclusions reached after two days of debates confirmed MDEP's important role as an initiative pooling an effective and efficient expert network from different countries, and requested that the initiative should improve the dissemination of information to a wide group of stakeholders (regulators, new entrants, industry and public).

197. The NEA provides for a number of joint international research projects that cover technical safety areas such as fuel safety, thermal-hydraulics and severe accidents. Two such projects on thermal-hydraulic issues and on fuel cladding reliability (ROSA and SCIP) had been extended, and important data have been achieved from the FIRE and OPDE database projects, respectively on fire incidents and on pipe failure data. A new project on fuel overheating of spent fuel assemblies in storage ponds, subsequent to water loss, has started.

198. The Committee on Radiological Protection and Public Health (CRPPH) provides for an active dialogue between regulators and the scientific community on how scientific developments and their uncertainties are integrated into regulatory processes in radiological protection. Based on case studies, a recent workshop discussed these issues in the context of radon exposure, increasing medical exposures, and of the possibility of radiation-induced cardio-vascular diseases. The Committee's Working Party on Nuclear Emergency Matters (WPNEM) developed a new International Nuclear Emergency Exercise (INEX 4) which will address issues in post-crisis consequence management and the transition to recovery following a malicious act in the urban environment.

199. In the area of waste regulation, the Radioactive Waste Management Committee (RWMC) has taken stock of its initiative on long-term safety criteria in a workshop on Regulating the Long-term Safety of Geological Disposal, providing important insights into current practice in terms of regulating long-term safety, on obligations to future generations, and the need for harmonised safety objectives across countries. The RWMC also launched a project in the field of reversibility and retrievability concerning the final disposal of radioactive waste developing inter alia, a "retrievability scale" as a

tool for informing and dialoguing with the public. The Committee's Forum on Stakeholder Confidence (FSC) continued its work in providing a neutral ground for national stakeholder dialogues by organising a stakeholder workshop in France, at the target region for siting a high-level waste repository.

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

200. Every organization in the world that operates a nuclear power plant is a member of WANO. It is an association 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. WANO has no interests other than nuclear safety.

201. WANO conducted peer reviews at 36 NPPs during 2009, altogether 420 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 would include OSART missions, WANO follow-up peer reviews, and national organizational reviews such as those conducted by the Institute of Nuclear Power Operations (INPO) and the Japan Nuclear Technology Institute (JANTI).

202. WANO continues to emphasize technical support missions, which focus on providing assistance in selected areas, with more than 150 technical support missions undertaken during 2009. Many of these technical support missions included experts from other WANO regions sharing their experiences to support improvements in operational safety.

203. 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 Operating Experience Reports, Significant Event 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.

F. Safety significant conferences in 2009[6]

F.1. International Conference on Control and Management of Inadvertent Radioactive Material in Scrap Metal

204. Metal recycling has become an important industrial activity in all countries. Radioactive material may become associated with scrap metal inadvertently and if it is melted can cause health, economic and public acceptance problems for the metal industry. In Tarragona, Spain, from 23 - 27

[6] For the 4th Review Meeting of Contracting Parties to the Convention on Nuclear Safety see section B.1.1.; for the open-ended meeting of technical and legal experts for sharing information on lessons learned from States' implementation of the Guidance on the Import and Export of Radioactive Sources see section B.2.2.; for the international meeting on the application of the Code of Conduct on the Safety of Research Reactors see section B.2.1.

February 2009, the IAEA co-organized a conference on the subject together with the Spanish Nuclear Safety Council. The aim of this conference was to share experiences and, if possible, to contribute towards the resolution of the problems caused by the inadvertent presence of radioactive material in scrap metal.

205. Reducing the magnitude of the problem by prevention, detection and subsequent reaction requires the cooperative efforts of all concerned parties, that is, the scrap metal carriers, the scrap metal industry, the steel industry, the national regulators and the radioactive waste management organisations. From the presentations and discussions it is clear that many countries feel that the main problems come from imports from outside their frontiers The participants of the conference were unanimous in recognising the potential benefit that would result from establishing some form of binding international agreement between governments to unify the approach to trans-border issues concerning metal scrap containing radioactive material. This should now be a subject for the international agencies to consider and to determine the most effective mechanism for the purpose.

206. The conference also addressed the issues surrounding the recycling of metals from the nuclear industry. The nuclear industry in several countries is using the clearance concept to determine which materials can be released from regulatory control for recycle. Most of the released metals have so far been used in controlled applications or returned for reuse within the nuclear industry. Generally, the release of cleared metals from the nuclear industry for unrestricted use has not yet gained acceptance. This is a key issue for the future and the determination of an agreement on appropriate acceptance criteria for radionuclides in metal scrap and processed metal would be one step towards its resolution. It is also clear that countries have different acceptance criteria for radionuclides in metal scrap leading to possible acceptance problems at borders.

F.2. 4th International Conference on Education and Training in Radiological Protection

207. This conference, held from 8 - 12 November 2009 in Lisbon, Portugal, and organized in coordination with IAEA, was attended by 124 participants from 27 countries. It addressed a range of people having an interest in education and training in radiation protection, such as policy makers, radiation safety professionals, regulators and representatives from industry, medicine, and research facilities. The conference aimed to reinforce the contacts between various organisations, individuals and networks dealing with education and training in radiological protection.

F.3. International Conference on Remediation of Lands Contaminated by Radioactive Material Residues

208. The need for the remediation of legacy sites resulting from nuclear weapons testing, nuclear accidents, poorly operated practices and abandoned facilities became evident in the late 1980s. Since then, the full extent of the global remediation problem has become clear. In response, the Agency organized several radiological assessments of major affected sites around the world and held a number of international conferences, the last one from 18 - 22 May 2009 in Astana, Kazakhstan. The emphasis was on the remediation of uranium mining and milling legacy sites, in particular in the countries of Central Asia, where many old uranium mines were developed with no attention given to the residues left behind or the damage inflicted on the environment.

209. The involvement in the conference of many international organizations is a reflection of the importance of this issue. The European Bank for Reconstruction and Development, European Commission, North Atlantic Treaty Organization, Organization for Security and Cooperation in

Europe, United Nations Development Fund, World Bank, World Health Organization, and the Agency were all represented and made presentations. The aims of most of these organizations are similar in that they wish to provide assistance in the remediation of uranium mining and milling legacy sites in the countries of Central Asia. All support a regional approach and see the need for a well defined road map before proceeding with any project. The conference showed that there is a need for increased coordination between them. The Agency has formal international responsibilities and specialized knowledge in the areas of radiation protection and radioactive waste management and therefore would be the appropriate organization to coordinate this regional approach.

210. The Conference in Astana recommended that the Agency explore the possibility of negotiating 'memoranda of common understanding(s)' among Member States or another equivalent legal framework, with the aim of ensuring that common and coherent radiation protection criteria be used for the remediation of land with radioactive residues. In the context of regulations, the Conference proposed an International Working Forum for Regulatory Supervision of Legacy Sites, coordinated by the Agency, where regulatory bodies could exchange experiences and knowledge in procedures and regulatory supervision. Draft terms of reference for the Forum were presented at the Conference. The Conference also supported the strategy of avoiding the creation of future legacy sites by proper planning and good operating practices and by promoting an environmental protection culture among mining companies. The Conference also gave strong support to ENVIRONET, a new Agency initiative that has the aim of promoting mutual interests and the sharing of information in the area of environmental remediation.

F.4. International Conference on Modern Radiotherapy: Advances and Challenges in Radiation Protection of Patient

211. This conference was organized by the French Nuclear Safety Authority ASN, in cooperation with the IAEA, WHO, EC and 18 other international and national organizations. It was held in Versailles, France from 2 – 4 December 2009. The event attracted more than 300 participants from many countries.

212. The major objective of the conference was to provide a forum for participants to exchange experience, and to review the actions implemented to improve the radiation safety in radiotherapy at both national and international level. An extensive technical programme was featured, including separate sections on lessons of radiotherapy accidents; safety reporting; individual radiosensitivity; stochastic risks; treatment of complications; quality audits; education and training; and new risks from new technology.

213. Papers were presented and discussions were held, not only from the health professionals' and regulatory authorities' viewpoints, but also from the manufacturers' and patients' perspectives.

214. Among the conclusions of the conference, it was noted that the lessons learned from accidents in conventional radiotherapy are still valid for newer radiotherapy technologies and that they should be incorporated into national training programmes, and taken into account for procedures in radiotherapy departments. There are, however, also new risks with new technologies that should be considered. In order to have a proactive approach to preventing accidents before they occur, proactive methods of safety assessment should be used in radiotherapy, providing a risk-informed and rational choice of safety provisions. The necessity of an international conference with broader scope was supported by the participants.

F.5. International Conference on Nuclear Power Newcomers and international cooperation.

215. More than 120 participants from 49 Member States and some international organizations came to Vienna from 3 - 5 November 2009 to discuss the issues that newcomers are currently facing in introducing their nuclear power programmes in safe and sustainable ways. This conference allowed participants to better understand newcomers' expectations regarding what experienced countries could be doing to support the infrastructure development efforts in countries embarking on nuclear power.

216. Current newcomers' issues, needs and expectations along with the perspectives from vendor countries were presented. Lastly, the roles and responsibilities of both newcomers when developing their nuclear infrastructure; and vendor countries, including government, vendors, manufacturers, suppliers, the regulatory body, TSOs, etc., in providing support to newcomers' organizations to ensure long-term safe and efficient operation, were discussed.

217. It was concluded that newcomers might be expecting too much from the IAEA, EU, vendor countries or other organizations. Strong national commitments and efforts following a robust political decision to introduce nuclear power within the country are essential to succeed in embarking on nuclear power. Newcomers need to be intelligent customers; they need to understand the technology, the process to embark on nuclear power and to be able to coordinate all assistance programmes provided from foreign countries, EU or international organizations to build up their nuclear and safety infrastructure. Such coordination should be enhanced for most newcomers. The main difficulties affecting safety infrastructure building in newcomer countries include:

- Developing human resource and keeping qualified and trained staff (avoiding brain drain). This includes all necessary industrial skills to be used on a large scale industrial project including those of welders, constructers, mechanics, electricians, heavy load transporters, logisticians, technicians and so on. Such a "localization" issue should be anticipated and carefully planned by newcomers in their national strategy when importing nuclear power technology.

- Establishing or consolidating the national newcomers legal and regulatory framework, which may take more time than expected.

- Transparency, openness and involvement of the public and stakeholders in the development of a nuclear power programme. This should be started before the decision to introduce nuclear power is taken and should be carried on with continuity throughout all the NPP lifetime including when dealing with spent fuel and radioactive waste management

218. The IAEA should perhaps facilitate newcomers' efforts to coordinate all assistance programmes and information sharing coming from foreign countries, EU and international organizations. Likewise, vendor countries should also consider coordinating their own nuclear stakeholders for better assistance towards newcomers.

F.6. International Conference on Effective Nuclear Regulatory Systems

219. In 2006, the first International Conference on Effective Nuclear Regulatory Systems was held in Moscow, with a focus on Facing Safety and Security Challenges. This conference brought together senior nuclear safety, radiation safety and security regulators from around the world to discuss how to improve regulatory effectiveness to assure protection of the public and the environment. During the Moscow conference, senior regulators decided that a forum dedicated to discussing regulatory effectiveness was needed every three years. Consequently, a second International Conference on

Effective Nuclear Regulatory Systems was held in Cape Town, South Africa from 14 to 18 December 2009 with a focus on further enhancing the global nuclear safety and security regime.

220. The objectives of this second International Conference on Effective Nuclear Regulatory Systems were to review and assess the effectiveness of the global nuclear safety and security regime, and to propose future actions to further enhance it. A regulatory body is effective when it ensures that an acceptable level of safety and security is being maintained by licensees/operators; when it takes appropriate actions to prevent the degradation of safety and security; when it takes actions to promote safety and security improvements; when it performs its regulatory functions in a timely and cost effective way; and when it strives for the continuous improvement of itself and the industry.

221. The action items resulting from the conference related to strengthening international safety and security cooperation with those countries embarking on new nuclear power programmes, focussing on capacity building; developing the international cooperative agreement to strengthen the safety and security of radioactive sources; enhancing the Global Nuclear Safety and Security Regime (GNSSR) through the promotion of the use of international legal instruments, safety standards, security guidance, peer reviews and knowledge networks; and increasing active participation in the GNSSR by Member States, especially supporting and facilitating the participation of those embarking on new nuclear power programmes.

F.7. International Ministerial Conference on Nuclear Energy in the 21st Century

222. Following the Ministerial Conference held in Paris in March 2005, the International Atomic Energy Agency held the International Ministerial Conference on Nuclear Energy in the 21st Century in Beijing, China, from 20 to 22 April 2009. This conference was designed to allow participants to discuss developments and emerging issues relevant to the role of nuclear power in providing clear and sustainable energy for national and regional development. The Conference was organized by the IAEA in cooperation with the OECD and OECD/NEA and was hosted by the Chinese Government.

223. The objectives of the conference were, inter alia, to recognize the positive momentum towards nuclear power and to further raise the profile of nuclear energy, to provide a forum for discussions between high level participants from a large number of countries about the role of nuclear power in meeting energy demands in a sustainable manner and to discuss the different aspects of, and conditions for, the development of nuclear power in developing and developed countries.

224. The participation of 808 experts from 61 IAEA Member States and seven international organizations, the national presentation on the future of nuclear power by 16 Ministers in person and 13 presentations made on behalf of Ministers demonstrate the timeliness and importance of this Conference. The participation of about 150 press and media people and broad media coverage are further indication of the increasing interest in nuclear energy.

225. The conference provided a platform for discussion of the future role of nuclear power. Many interested Governments and other parties presented and discussed their vision on the future of nuclear energy. It was observed that the interest was more specific during this Conference than during the first Ministerial Conference on nuclear energy in Paris in 2005, although there were no tangible actions such as orders from new countries, or breakthroughs in design or organisation which would make a radical change to future expectations.

G. Safety significant events in 2009

226. Through the various reporting mechanisms, the Agency was informed of 211 safety-related events involving or suspected of involving ionizing radiation. Most of these events were found to have no safety significance and/or no radiological impact to people or the environment. In 22 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.

227. 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.[7]

228. Events of interest that were reported to the Agency in 2009 include:

- **Ecuador**, April 2009 – a construction worker picked up a loose Class III 16 Ci (600 GBq) radiography source and kept it on his person for an extended period of time. His overexposure endangered his left leg. The IEC sent a team of international experts (Brazil and France) to investigate. IEC arranged with France for the injured worker to be transported and treated in that country. In September of 2009 the injured worker was released from successful treatment and now lives a normal life.

- **Belgium** experienced two events in 2009. In May, a technician performing measurements in a Co-60 irradiator cell (3,600 TBq) became aware that the irradiation start-up sequence had been initiated without first checking that no human beings were present in the cell. The technician immediately triggered one of the emergency stop systems inside the cell. This emergency stop interrupted the start-up sequence and shut down the installation. During June, a radiopharmaceuticals plant released "less than" 3TBq of radioactive Xenon. Production at the facility has been stopped. No protective actions were taken for the population. The alert was given by the Telerad automatic monitoring network. Measurements and model estimations indicated the order of magnitude of 1 microSv for the dose to the critical individual.

- The **Republic of Georgia** also experienced two events in 2009. In February a container of Cs-137 (radiation levels of 25R/hr) was discovered at the Kopitnari airport outside Kutaisi. Georgian authorities regained control of the sources suspected as being calibration sources left over from the Russian Army. July 2009 also proved eventful for the Georgians as elevated radiation was detected at a scrap metal site, and sources (Sr-90 and Cs-137) were identified as the reason for this. There was some contamination from Cs-137 but the removal of a thin layer was a sufficient measure to remove the contamination. The sources were put into transport containers and were placed in safe storage.

- **Burkina Faso** encountered problems with an aging irradiator used to control the spread of disease by sterilized tsetse flies. While no numbers are available the irradiation source (Cs-137) is still formidable, and interlock safety mechanisms are known to be failing, or circumvented, in order to continue operations. An IAEA internal coordination meeting was held, a message to

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

the operator was written to stop the operation until safe operation is guaranteed. Also steps were taken to contact the project counterparts. The stopping of the irradiator had negative impact on the project outcome (control of the flies that are the disease vectors).

- **France** experienced a "Lack of Respect for Safety Criticality at a Nuclear Fuel Facility, INES level 2 (Degradation of Defense-in-depth)" during March 2009. An exceptional operational criticality related event occurred in the laboratory of AREVA Melox facility (MOX plant) in March. The analysis revealed the inadequacy of the introduction procedure that applies to fuel samples coming from other facilities and a failure of the software for fissile material counting dedicated to the mass management of criticality-concerned workstations.

229. 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. Over more than twenty five years the IRS has proved its usefulness as a comprehensive source of information for worldwide operating experience and lessons learned from that experience.

230. The IRS is an essential element of the mechanism for providing feedback of international operating experience for NPPs. It ensures proper reporting and feedback of safety significant events for the international community, so that the causes, the lessons learned and the corrective actions can be disseminated widely. In this way, the IRS plays an important role in contributing to the prevention of occurrence or recurrence of incidents. The information provided through the IRS is also useful for making improvements in design, operational procedures, organizational aspects and human factors in NPPs. Activities within the IRS extend beyond the exchange of IRS reports. The Agency and the OECD/NEA have assigned meetings and working groups of experts who meet regularly and discuss the safety relevance of events, thus contributing to the dissemination of lessons learned to the international community and to the safe operation of NPPs.

231. The 2009 joint Agency – OECD/NEA meeting of the IRS national coordinators which was held this year at the International Energy Agency in Paris, France, discussed corrective actions and lessons learned from 25 recent events which occurred in nuclear power plants. These events were in a wide range of scope and complexity. A second part of the meeting was reserved for the response to two events reported to IRS considered by the IAEA Event Review Group as significant and which were brought to the attention of the IRS community when posted on the WB IRS: one from the US dealing with gas accumulations in different safety and safety related systems (IRS 7950), the other one from France dealing with water-soluble paper used during inert-gas welding (IRS 8014). This was the first time that this kind of response was asked for at an IRS Meeting.

H. Safety Networks

H.1. Asian Nuclear Safety Network (ANSN)

232. In April 2009, the second annual meeting of the Nuclear Safety Strategy Dialogue took place in Seoul, Korea. About 30 participants from the ANSN participating countries discussed broader strategy and policy issues to promote regional cooperation in capacity building in Asia, particularly the vision

for the ANSN by 2020. The participants confirmed the willingness to help to fulfil this vision by enhancing bilateral, regional and international cooperation for capacity building, knowledge and lessons learned sharing, peer review, advisory services and education and training. By the year 2020, the ANSN is expected to provide regional capacity building for all topics of nuclear safety infrastructure.

233. The 9th ANSN Steering Committee meeting was held in May 2009 in Yogyakarta, Indonesia, to review the ANSN activities since October 2008 and to decide on a work plan for the next 6 months based on recommendations made during the second Strategy Dialogue meeting. About 60 follow-up actions related to the vision for the ANSN by the year 2020 were listed and approved with a responsible body and target date for each action. Approval for the concept of a Virtual Technical Support Organisation, creation of a Sitting Topical Group and development of public awareness activities were some important decisions taken during this meeting.

234. A round-table discussion on enhancements of the ANSN took place in September in Vienna during the 53rd IAEA General Conference. Along with participants from ANSN participating countries, there were also participants from Africa and other networks. Discussions on how to improve the ANSN and how to harmonize and optimize its activities with other mechanisms including the Association of South-East Asian Nations (ASEAN) and the Forum for Nuclear Cooperation in Asia (FNCA) took place. Participants shared a view that cooperation among global and regional nuclear safety networks would be mutually beneficial and that ANSN could be a good model for the new networks. Further enhancement of cooperation and coordination among the regional networks (e.g. ANSN, FORO and the Forum of Nuclear Regulatory Bodies in Africa - FNRBA) for information exchange was encouraged by the ANSN member countries.

235. The 10th ANSN Steering Committee (SC) meeting was held in October 2009 in Singapore. Each topical group reported to the SC on the development of their mid-term planning and proposed work plan for 2010 based on the vision for the ANSN by the year 2020. The SC approved the proposal to establish a Capacity Building Coordination Group for coordinating and monitoring the topical group activities, particularly for developing the Regional Capacity Building System in Asia. It was agreed that the Capacity Building Coordination Group would explore appropriate performance indicators for assessing ANSN activities so that these activities will be evaluated based on outcomes rather than on outputs. A decision for the necessary coordination mechanism and management support functions to facilitate steady progress was also taken.

236. The IAEA's ANSN website was further improved in 2009 with the process of Integrated Safety Evaluation made available online. Also the topical group coordinators and ANSN member states can now submit regional as well as national activity requests online. Activity requests were successfully filed in the ANSN website and evaluated during the ANSN Steering Committee meeting.

H.2. Ibero-American Nuclear and Radiation Safety Network (FORO)

237. The 2009 FORO´s annual plenary meeting took place in June, in Argentina, where the presidency was transferred from Argentina to Brazil until June 2010. The plenary reviewed ongoing projects, as well as proposals for new projects.

238. The programme of work for 2009-2011 on integrated information management through the network, and a new project on strategy for the prevention, detection and response to inadvertent radioactive material in metal recycling and associated processes, were approved by the FORO´s plenary at its meeting in June 2009.

239. A project on Nuclear Safety was started in January 2009. The objective is to share experience ageing management and life extension of nuclear power plants in the region and elaborate technical advice to improve regulatory practices on the issue, including safety assessment and licensing.

240. The plenary also discussed the Agency's proposal to enhance FORO´s role in raising the level of safety in the region The FORO´s plenary agreed to increase cooperation with the Agency in organizing high level seminars to share policies, strategies and lessons learned from experience in order to improve the regulatory efficiency in the region. It also agreed to support with expertise and assistance capacity building in the region and is ready to explore interaction with other networks to obtain the maximal benefit worldwide.

241. The FORO´s technical activities are implemented within the Agency's Extrabudgetary Programme on Nuclear and Radiation Safety and Security. After about six years working on the implementation of the programme, it has become apparent that there is a need to consolidate the experience in implementing and administering the programme. To that effect, a written set of procedures are currently being drafted.

242. In 2009, the FORO provided assistance and expertise to the Agency's initiatives to disseminate and apply the knowledge gained with the FORO´s projects on risk analysis in radiotherapy: As many as 18 countries of the region participated. After dissemination, technical cooperation activities were launched to apply this knowledge in practice and to prepare a report in 2010 on the achievements.

243. Since the approval of the two-year programme of activities in June 2009, the FORO has developed a number of guides and procedures to select, optimize the content of the network and upload documents to be shared on the network, as well as a procedure for evaluating the network according to a set of performance indicators, based on the objectives of the network. The objectives are to effectively share information of regulatory interest. It also has carried out the first systematic evaluation of the efficiency of the network against performance indicators and derived a number of recommendations.

H.3. International Decommissioning Network (IDN)

244. In 2007, the IAEA launched a network to provide a continuing forum for the sharing of practical decommissioning experience in response to the needs expressed at the Athens Conference in December 2006 on "Lessons Learned from the Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities". This network is intended to bring together existing decommissioning initiatives both inside and outside the IAEA to enhance cooperation and coordination. The network aims at facilitating direct exchange of information between practitioners, i.e., between and among those with extensive decommissioning experience and those seeking to learn from this experience and to promote application of best practices in decommissioning technology, planning, project management, and the management of nuclear wastes.

245. A number of activities were conducted in 2009, including workshops and training courses on fundamentals of decommissioning for project managers and planners, on planning and implementation of decommissioning for research reactors and other small facilities, technologies for characterization, waste management, dismantling and clearance, organization and implementation of decommissioning on multi-facility sites. The Annual IDN meeting was held in November 2009 in Vienna. The meeting was a possibility for a review of national situations, needs for support from other IDN members and offers for hosting decommissioning trainings and workshops. The meeting was followed by a two days topical training on a decommissioning stakeholder involvement.

H.4. Disposal of low level radioactive waste (DISPONET)

246. Following the growing demand from Member States for assistance in disposal of low level radioactive waste, a network was established in 2009 to increase efficiency in sharing international experience in this area. DISPONET is intended to bring together those planners, developers and operators of disposal facilities who wish to steadily improve international practices and approaches in managing low level waste. The network aims at coordinating support to organizations or Member States with less advanced programmes for disposal of low-level waste, by making available the relevant skills, knowledge, managerial approaches and expertise from Member States with operating disposal facilities and to organize an expanded range of training and demonstration activities with a regional or thematic focus providing hands-on, user-oriented experience and disseminating proven technologies. Topics considered cover the full scope of disposal issues and respect different national approaches, in particular low level and very low level waste, including disused sealed radioactive sources, facilities for surface and subsurface disposal: planning, siting, design, construction, assessment of safety, operation, closure, monitoring and institutional control.

H.5. Global Nuclear Safety and Security Network (GNSSN)

247. The Secretariat has established a prototype of the global nuclear safety and security network (GNSSN), based on the structure of the Agency's safety standards and security guidance. The hardware and software have been selected and the configuration and content management are in process. The GNSSN was presented at the International Conference on Effective Nuclear Regulatory Systems in South Africa in December 2009.

248. The GNSSN is the set of existing networks, such as the Asian Nuclear Safety Network and the Ibero-American Nuclear and Radiation Safety Network, and other internationally accessible information and data sources. The aim of the GNSSN is to ensure that critical knowledge, experience, and lessons learned about nuclear safety and security are exchanged as broadly as they need to be. The GNSSN constitutes the framework for knowledge networks in the global nuclear safety and security regime, related to the sharing of information and knowledge among the global expert community.

249. One section of the GNSSN will be the International Regulatory Network (RegNet). RegNet will serve the specific needs of regulators and relevant international organizations by strengthening and enhancing existing networks. RegNet will include areas for the Integrated Regulatory Review Service, generic safety issues, the Radiation Safety Regulators Network (RaSaReN), and country nuclear regulatory profiles.

H.6. International Regulatory Knowledge Network (RegNet)

250. RegNet was originally initiated at the International Conference on Effective Nuclear Regulatory Systems in 2006 in Moscow. There was strong support by Member States and other international organizations and it was recognized that establishment of regulatory network to share and exchange regulatory information covering the nuclear, radiation, waste and transport safety in a efficient and effective manner is quite urgent and necessary among the regulators. In 2008, IAEA established the RegNet project in the regular budget.

251. In 2009, several meetings were held to further develop the framework and detailed technical aspects for all the designed components of RegNet with the help of German Federal Government (BMU) and its Technical Support Organization (GRS). Prototype platforms for RegNet on the German side have been established, including the IRRS platform, Country Nuclear Regulatory Profiles (CNRP) and Generic Safety Issues (GSI). It is expected that other components of RegNet would be developed by the middle of next year.

252. In session 4 of the conference related to International Safety and Security Cooperation, a specific presentation was made on Global, Regional or Thematic Networks for Regulators. In the presentation itself and during the ensuing discussions, the statement was made that the GNSSN is currently under development and would be made available to Member States during 2010.

Appendix 2
The Agency's Safety Standards: Activities during 2009

A. Introduction

253. 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.

254. One of the main achievements during the year was the completion of the work of the Commission on Safety Standards (CSS) on the definition of the long term structure of safety standards initiated by the roadmap approved in 2008. This provides for an improved structure and format for the Safety Requirements and a reference set for the collection of Safety Guides.

255. Another main achievement results from the organization in April 2009 of a joint AdSec (Advisory Group on Nuclear Security) and CSS session to exchange on issues relating to safety and security synergies and interfaces, and on the feasibility of working towards the establishment of Nuclear Safety and Security Standards that would cover both nuclear safety and nuclear security.

256. It was agreed to establish a joint task force, to be co-chaired by the Chairman of AdSec and the Chairman of the CSS, with equal participation of members from both groups and with support from the Secretariat. At its first meeting in October 2009, the Task Force finalized its proposed terms of reference, including short and long term objectives. For the short term, the task force will follow the implementation of the measures to strengthen, and ensure the transparency of the process for the review and approval of Nuclear Security Series publications and will propose steps to establish in a progressive manner the necessary interface of nuclear safety and nuclear security related draft publications, including their cross-verification, to ensure their completeness and consistency. For the long term, the task force will study the feasibility of the establishment of a *Nuclear Safety and Security Standards Series* that would cover both nuclear safety and nuclear security.

257. The first two General Safety Requirements of the new structure of safety requirements on Safety Assessment for Facilities and Activities and on Predisposal Management of Radioactive Waste were adopted as Agency standards by the Board of Governors in 2009 and published respectively as GSR Part 4 and GSR Part 5.

258. The draft revision of the Safety Requirements NS-R-2: *Safety of Nuclear Power Plants: Commissioning Operation* was approved by the Safety Standards Committees in 2009 for submission to the Commission on Safety Standards early in 2010. The revision of the Safety Requirements No.

NS-R-1: *Safety of Nuclear Power Plants: Design* was submitted to Member States for comment in 2009.

259. In 2009, the revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) continued and draft 2.5 was reviewed by the Safety Standards Committees at their meeting in October and November 2009 and approved for submission to Member States for comments.

260. Regarding the processes associated with the safety standards programme, several significant improvements were observed. In particular, these improvements led to increased levels of openness, transparency and quality of the safety standard review process; greater involvement of the users and interested parties, including collaborators in industry; and greater interaction between the Member States, the Committees and the Commission on Safety Standards. In 2009, this was further complemented by the preparation of a strategy paper on stakeholder involvement in the planning, preparation, review and approval of safety standards. Its approval expected in March 2010 will allow its implementation for the fifth term of the Committees starting in 2011. These improvements were facilitated by the use of information technologies and, in particular, the newly established interactive website[8].

261. Since the establishment of the Commission on Safety Standards and the Committees in 1995, 107 standards have been established; of these, 97 (one Safety Fundamentals, 15 Safety Requirements and 81 Safety Guides) have been published; and 51 further standards (five Safety Requirements publications and 46 Safety Guides) are being drafted or revised. A list of published IAEA Safety Standards, indicating their status as of 31 December 2009, is attached as Annex I, and an up-to-date status report can be found on the Agency's website[9]. The full texts of published IAEA Safety Standards are also available on the website through this status report.

B. Commission on Safety Standards (CSS)

262. The CSS met twice in 2009, in April and in October and endorsed the submission to the Board of Governors for approval of two Safety Requirements on Governmental, Legal and Regulatory Framework for Safety, Safety Requirement (DS415) and on Disposal of Radioactive Waste, Safety Requirement (DS354). The CSS also endorsed nine Safety Guides on Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (DS387), Chemistry Programme for Water Cooled Nuclear Power Plants, Safety Guide (DS388), Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (DS393), Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (DS394), Deterministic Safety Analyses and their Application for Nuclear Power Plants (DS395), Radiation Safety in Industrial Radiography, Safety Guide (DS408), Radiation Safety of Gamma, Electron and X Ray Irradiation Facilities, Safety Guide (DS409), Ageing Management for Research Reactors (DS412), Licensing Process for Nuclear Installations (DS416) and Seismic Hazards in Site Evaluation for Nuclear Installations (DS422).

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

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

263. CSS also approved in 2009 five Document Preparation Profiles (DPPs) for Safety Guides on Radiological Environmental Impact Analysis for the verification of Radiological Protection (DS427), External Expert Support on Safety Issues (DS429), Design of Electric Power Systems for NPPs (DS430), Design of I&C Systems for NPPs (DS431) and on Volcanic Hazards in Site Evaluation for Nuclear Installations (DS405).

C. Nuclear Safety Standards Committee (NUSSC)

264. NUSSC, chaired by Mr. Geoff Vaughan of the Nuclear Installations Inspectorate of the United Kingdom, met twice during 2009.

265. At its meetings in June and October 2009, NUSSC approved 9 draft IAEA safety standards for submission to the CSS, namely. Storage of Spent Fuel (DS371); Chemistry Programme for Water Cooled Nuclear Power Plants (DS388); Ageing Management for Research Reactors (DS412); Governmental, Legal and Regulatory Framework for Safety (revision of GS-R-1, DS415); Licensing Process for Nuclear Installations (DS416); Evaluation of Seismic Hazard for Nuclear Installations (DS422), Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Storage of Spent Fuel (DS371), and Safety of Nuclear Power Plants: Commissioning and Operation (revision of NS-R-2, DS413).

266. In addition NUSSC reviewed and commented on 7 draft safety standards namely Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report (DS396); Volcanic Hazards in Site Evaluation for Nuclear Installations (DS405); Safety of Nuclear Power Plants: Design (revision of NS-R-1, DS414); Establishing a Safety Infrastructure for a National Nuclear Power Programme (DS424), International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (Revision of the BSS, DS379), Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations (DS417), Use of a graded approach in the application of safety requirements for Research Reactors (DS351), and Periodic Safety Review of Nuclear Power Plants (DS426). In 2009, NUSSC also approved DPPs for 8 new, or revision of safety standards.

267. NUSSC reviewed twice the document *"Strategies and Processes for the Establishment of IAEA Safety Standards (SPESS)"*, which describes the strategies, the processes and associated responsibilities for the planning, development, review and revision, approval and establishment of the IAEA safety standards. NUSSC also discussed finally the strategy for the future development and application of the IAEA Safety Standards, in particular the "*Reference Set of Safety Guides for the Long-Term*".

268. The document on *"Stakeholder Involvement in the Establishment of IAEA Safety Standards"* was reviewed and discussed twice. It establishes a clear set of criteria to determine which organizations may be invited at the various stages of development of the IAEA safety standards (e.g. drafting consultancies and NUSSC meetings). It also specifies the expected contribution from these invited stakeholders in the review and approval process, including contributions in terms of feedback from the application of the IAEA safety standards.

D. Radiation Safety Standards Committee (RASSC)

269. RASSC, chaired by Mr. Sigurður Magnusson of the Icelandic Radiation Protection Institute, met in June-July and November in 2009. Both meetings included a joint session with WASSC to discuss issues of common interest, and the June-July meeting included a joint meeting with WASSC and TRANSSC.

270. RASSC reviewed at its meeting in June-July draft 2.0 of the revised International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). More than 500 written comments were provided, some of which were suggestions to improve the text, while others were of a substantive nature.

271. At its meeting in November, RASSC reviewed and approved for submission to the Member States the draft 2.5 of the revised BSS.

272. In 2009, RASSC also approved for submission to the CSS the draft Safety Requirements Safety of Nuclear Power Plants: Commissioning and Operation (revision of NS-R-2, DS413), Governmental, Legal and Regulatory Framework for Safety (revision of GS-R-1, DS415) and Disposal of Radioactive Waste (revision and combination of WS-R-1 and WS-R-4, DS354) as well as the following Safety Guides, Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Geological Disposal of Radioactive Waste (DS334), Storage of Spent Fuel (DS371), Chemistry Programme for Water Cooled Nuclear Power Plants (DS388), Radiation Safety in Industrial Radiography (DS408), Radiation Safety of Gamma, Electron and X-Ray Irradiation Facilities (DS409) and Licensing Process for Nuclear Installations (DS416).

273. RASSC also approved for submission to the Member States for comments the draft Safety Requirements Safety of Nuclear Power Plants: Design (revision of NS-R-1, DS414) and the following draft Safety Guides, Near Surface Disposal of Radioactive Waste (DS356), National Strategy for Regaining Control over Orphan Sources and Improving Control over Vulnerable Sources (DS410), Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (DS411), Establishing a Safety Structure for a National Nuclear Power Programme (DS424) and Periodic Safety Review of Nuclear Power Plantss (DS426).

274. In a number of instances the need for amendment was identified and the approval of RASSC was subject to the document being satisfactorily revised and to approval being received from other Safety Standards Committees and/or their Chairpersons.

E. Transport Safety Standards Committee (TRANSSC)

275. TRANSSC met twice in 2009, in June/July and October. At the June/July meeting there was a joint RASSC/WASSC/TRANSSC session and a WASSC/TRANSSC session.

276. TRANSSC approved for submission to the CSS two draft Safety Requirements publications, Safety of Nuclear Power Plants: Commissioning and Operation (revision of NS-R-2, DS413),

Governmental, Legal and Regulatory Framework for Safety (revision of GS-R-1, DS415) and four draft Safety Guides, Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Radiation Safety in Industrial Radiography (DS408), Radiation Safety of Gamma, Electron and X Ray Irradiation Facilities (DS409) and Licensing Process for Nuclear Installations (DS416).

277. TRANSSC also approved for submission to Member States for comments two draft Safety Requirement, Safety of Nuclear Power Plants: Design (Revision of NS-R-1, DS414) and the draft 2.5 of the revised BSS. TRANSSC also approved for submission to Member States for comments on two Safety Guides on Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (DS411) and on Establishing a Safety Structure for a National Nuclear Power Programme (DS424).

278. TRANSSC also approved four DPPs for one Safety Requirement and three Safety Guides. A draft DPP for Safety of Small/Medium, Transportable and Floating Nuclear Power Plants was also reviewed.

279. In 2009 TRANSSC carried out a review of the IAEA transport Regulations and concluded that there were sufficient safety related reasons to initiate a revision of the document. This was mainly based on the need to improve the regulations defining and controlling excepted quantities of fissile material.

F. Waste Safety Standards Committee (WASSC)

280. WASSC, chaired by Mr. Thiagan Pather of the National Nuclear Regulator of South Africa, met twice in 2009, in June/July and November. Both meetings included joint sessions with RASSC to discuss issues of common interest. At the June/July meeting there was a joint RASSC-WASSC-TRANSSC session and a WASSC/TRANSSC session dedicated to discuss the outcome of the WASSC-TRANSC WG meeting, held in March 2009.

281. In 2009, WASSC approved for submission to the CSS three draft Safety Requirements publications Governmental, Legal and Regulatory Framework for Safety (Revision of GS-R-1, DS415), Disposal of Radioactive Waste (Revision of WS-R-1 and WS-R-4, DS354) and Safety of Nuclear Power Plants: Commissioning and Operation (Revision of NS-R-2, DS413). WASSC also approved for submission to the CSS seven draft Safety Guides on: Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency (DS44), Storage of Spent Fuel (DS371), Chemistry Programme for Water Cooled Nuclear Power Plants (DS388), Licensing Process for Nuclear Installations (DS416), Evaluation of Seismic Hazards for Nuclear Facilities (DS22), Periodic Safety Review of Nuclear Power Plants (DS426) and Geological Disposal of Radioactive Waste (DS334).

282. In addition, WASSC approved for submission to Member States for comments a draft Safety Requirement on: Safety of Nuclear Power Plants: Design (Revision of NS-R-1, DS414) and the draft 2.5 of the revised BSS. WASSC approved as well for submission to Member States for comments eight draft Safety Guides on: National Strategy for Regaining Control over Orphan Sources and Improving Control over Vulnerable Sources (DS410), Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries (DS411), Licensing Process for Nuclear Installations (DS416), Establishing a Safety Structure for a National Nuclear Power Programme (DS424),

International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (revision of the BSS, DS379), Near Surface Disposal of Radioactive Waste (DS356), Volcanic Hazards in Site Evaluation for Nuclear Installations (DS405) and Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations (DS417).

283. WASSC also approved one DPP for the Revision of the Regulations for the Safe Transport of Radioactive Material; and four DPPs for Safety Guides on: External expert support on safety issues, Radiation Protection of the Public and the Environment, Site Survey and Site Selection for Nuclear Installations and Radiation Safety of Radioisotope Production Facilities.

284. During 2009 WASSC members provided additionally feedback on the draft Safety Guide on Monitoring and Surveillance of Radioactive Waste Disposal Facilities, and on the Revision of the Safety Guides on Decommissioning.

Annex I
The published IAEA Safety Standards as of 31 December 2009

A. Safety Fundamentals

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

B. Thematic Safety Standards

B.1. 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

Two other Safety Guides on licensing process for nuclear installations and on establishing a national nuclear installations safety infrastructure are being developed.

B.2. 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 Safety Guide on criteria for use in planning response to nuclear and radiological emergencies (replacing 109) is being developed.

B.3. 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)
GS-G-3.2	The Management System for Technical Services in Radiation Safety (2008)
GS-G-3.3	The Management System for the Processing, Handling and Storage of Radioactive Waste (2008)
GS-G-3.4	The Management System for the Disposal of Radioactive Waste (2008)

GS-G-3.5 The Management System for Nuclear Installations (2009)

B.4. Assessment and Verification

GSR Part 4 Safety Assessment for Facilities and Activities (2009)
GS-G-4.1 Format and Content of the Safety Analysis report for Nuclear Power Plants (2004)

Two Safety Guides on risk informed decision making and on criticality are also being developed.

B.5. 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) (under revision)
NS-G-3.3 Evaluation of Seismic Hazard for Nuclear Power Plants (2003) (under revision)
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)

B.6. 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 Safety Guides on protection of the public against exposure to natural sources of radiation, including NORM and on justification of practices are being developed.

B.7. Radioactive Waste Management

GSR Part 5 Predisposal Management of Radioactive Waste (2009)
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 Safety Guide on safety assessment is being developed.

B.8. 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)
WS-G-5.2	Safety Assessment for the decommissioning of Facilities Using Radioactive Material (2008)

B.9. 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)
TS-R-1	Regulations for the Safe Transport of Radioactive Material 2009 Edition (2009)
TS-G-1.1 Rev1	Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2008)
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)
TS-G-1.4	The Management System for the Safety Transport of Radioactive Material (2008)
TS-G-1.5	Compliance Assurance for the Safe Transport of Radioactive Material (2009)

One Safety Guides on schedule of provisions is being developed.

C. Facility Specific Safety Standards

C.1. Design of Nuclear Power Plants (NPPs)

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)
SSG-2	Deterministic Safety Analysis for Nuclear Power Plants (2009)
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)

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

C.2. Operation of NPPs

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) (under revision)
NS-G-2.11	A System for the Feedback of Experience from Events in Nuclear Installations (2006)
NS-G-2.12	Ageing Management for Nuclear Power Plants (2009)
NS-G-2.13	Evaluation of Seismic Safety for Existing Nuclear Installations (2009)
NS-G-2.14	Conduct of Operations at Nuclear Power Plants (2008)
NS-G-2.15	Severe Accident Management Programmes for Nuclear Power Plants (2009)

One Safety Guide on chemistry is being developed.

C.3. 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)
NS-G-4.3	Core Management and Fuel Handling for Research Reactors (2008)
NS-G-4.4	Operational Limits and Conditions and Operating Procedures for Research Reactors (2008)
NS-G-4.5	The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors (2008)
NS-G-4.6	Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors (2008)
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)

Three Safety Guides on radiation protection and waste management; use of graded approach, Safety in the Use and Modification of Research Reactors and ageing management are being developed.

I.4. Fuel Cycle Facilities

NS-R-5	Safety of Nuclear Fuel Cycle Facilities (2008)
116	Design of Spent Fuel Storage Facilities (1995) (under revision)
117	Operation of Spent Fuel Storage Facilities (1995) (under revision)

Six 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.

I.5. Radiation Related Facilities

107	Radiation Safety of Gamma and Electron Irradiation Facilities (1992) (under revision)
RS-G-1.5	Radiological Protection for Medical Exposure to Ionizing Radiation (2002) (under revision)
RS-G-1.6	Occupational Radiation Protection in the Mining and Processing of Raw Materials (2004)

Six Safety Guides on industrial radiography, on national strategy for regaining control over orphan sources, on orphan radioactive sources in the metal recycling industry, on radiation safety in well logging and on radiation safety for nuclear gauges are being developed.

I.6. 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)
SSG-1	Borehole Disposal Facilities for Radioactive Waste (2009)

One other Safety Guide on monitoring and surveillance of disposal facilities is being developed.