2008 年核安全评论

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2008 年核安全评论

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国际原子能机构
2009 年 7 月在奥地利印制

前　言

《2008 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。分析性概述辅以两份附录：“2008 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：2008 年的活动”（附录二）。

《2008 年核安全评论（草案）》曾以 GOV/2009/2 号文件提交 2009 年 3 月理事会会议。《2008 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

核技术正日益被视为应对一系列挑战的重要解决方案。要想通过和平利用核技术来支持满足全球能源需求和其他人类需求，就必须同时采取审慎的国际协调行动，最大程度地减少发生核事故和核恐怖主义的可能性。虽然近年来核工业一直保持良好的安全实绩，但必须避免产生任何自满情绪。国际原子能机构继续支持和促进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和保安的一个框架。

2008 年，可从全球核安全领域的趋势、问题和挑战中观察到三个基本主题：在通过国际合作加强世界各地的核安全方面继续取得改进；新加入国家的核电计划如期增多和现有计划得到扩大；安全和保安形成了协同作用。就加强世界各地安全方面的持续改进而言，侧重点是运行经验反馈和知识网络建设；以及自评定和同行评审。在新核计划和现有核计划扩大领域，活动的中心是国家安全基础结构；人力资源和能力建设；监管独立；核事件和应急准备与响应；乏燃料和放射性废物管理；以及核活动的多国性。在安全和保安协同作用领域，2008 年日益认识到需要制订程序，以确保安全活动不损害保安，反之亦然。

正如 SF-1 号《安全基本法则》中所概述的那样，对产生辐射危险的设施和活动负责的人或组织必须承担对安全的主要责任。还必须建立和保持有效的法律和政府安全框架，包括独立的监管机构。发展国家安全基础结构和相关能力建设是一项复杂任务，需要大量的时间和资源。安全基础结构对核电计划特别重要。从选址直至最终退役，核电厂的寿期可能超过 100 年。越来越多的成员国正在首次考虑核电计划。这些新加入者可能拥有对其当前核应用活动来说适当的安全基础结构，但尚无实施核电计划所需的适当基础结构。

核工业正日益具有多国性。在核电部门，核电厂部件供应商和服务提供商为数众多。为保证这些供应商特别是提供主要部件的供应商满足了所要求的高质量标准，一直开展监督审计工作。通过对所开展的工作进行精心协调，供应商、电力公司和监管机构均有机会提高这种监督的效率和有效性。国际上普遍认识到，核技术供应商必须帮助新加入者发展适当的国家安全基础结构。

在事件和应急准备与响应领域，继续需要制订针对任何类型辐射事件或紧急情况的明确通讯程序，以确保公众充分了解情况。还需要增加所有各级在事件和应急响应方面的训练和演习数量，并扩大它们的范围，纳入安全和保安问题及始发因素。截至 2008 年底，14 个成员国在原子能机构“响应援助网”进行了一些专家能力登记。2008 年 7 月，由墨西哥主办开展了一次被称为“ConvEx3”（2008 年）的应急演习，检验了对一座核电厂模拟事故的国际响应。演习期间，原子能机构利用事件和应急中心作为国际通讯和响应的全球协调中心。

落实有效的民事责任机制对核损害造成的人体健康和环境损害以及实际经济损失进行保险的重要性继续受到成员国的关注。美国交存了对《核损害补充赔偿公约》的批准书，这是在使该公约生效方面的一个重要里程碑。国际核责任问题专家组（核责任问题专家组）继续担任原子能机构处理核责任相关问题的主要论坛。2008 年，核责任问题专家组除其他外，特别讨论了外展活动和欧洲委员会正在开展的核责任影响评定。

核电厂营运者在 2008 年继续保持良好的安全实绩，没有发生应当报告的严重事故或对工作人员或公众的重要辐射照射。在原子能机构 2008 年 11 月在印度孟买举行的核装置安全专题问题国际会议上，与会者得出结论认为，基于纵深防御原则和确定论标准的综合核安全方案如能得到适当执行并以概率论分析和运行经验反馈作为补充，则将继续取得成功。已开始重新评价现有核装置的完整性，同时考虑到已发现近来发生的一些强烈地震和极端自然事件的严重性正在提高。应成员国请求，原子能机构开展了一般性研究堆安全审查，以评定新核电厂的设计与原子能机构安全标准的一致性。

2008 年 4 月，《核安全公约》缔约国举行了第四次审议会。会议得出结论认为，所有与会缔约国都遵守了“公约”的要求。缔约国还注意到若干挑战依然存在，包括在有效监管分离和独立性及新反应堆许可证审批方面。

全世界的研究堆在 2008 年继续安全运行，没有发生严重事故。已有更多的成员国使用《研究堆安全行为准则》来指导它们的研究堆活动。具备经验的工作人员因退休而减少的问题继续因难以招聘到新工作人员而加剧，这在一些研究堆设施仍是一个关键问题。虽然许多成员国已认识到制订研究堆初步退役计划的必要性，但在多数情况下，这种认识并没有具体行动作为后续。

正如前几年报告的那样，燃料循环设施营运者在交流安全信息上日益开放，对“燃料事件通报和分析系统”的使用正越来越多。燃料循环设施面临着独特的安全挑战，虽然燃料循环安全原则与核电厂类似，但必须对安全方案进行适当的分级。

总体而言，世界各地核装置的职业辐射防护管理良好。最严重的职业辐射照射涉及从事同位素工作的人员。过度照射时常发生在监管有限和辐射防护计划不完善的偏远场址。全部辐射受照工作人员中，一半以上现都在医学领域。由于辐射正日益在医学领域得到创新利用，医疗人员的职业辐射防护正在出现新的挑战。

在阿根廷布宜诺斯艾利斯举行的国际辐射防护协会第十二届国际大会上，职业范围广泛的专业人士聚集一堂，讨论了促进和加强辐射防护的问题。大会为进行电离辐射应用的所有领域作出反馈提供了重要机会，这些领域除其他外，特别包括医疗工作人员和患者防护、放射性物质运输、放射源安全和保安、退役和放射性废物管理。

在过去的 10 年中，医疗辐射照射以引人注目的速度增加。电离辐射的医疗应用正在快速发展，医疗辐射技术越来越先进，但也越来越复杂。患者受照数据可能很难获

得或根本没有，许多成员国继续感到难以管理或控制医疗辐射照射。业已发现，如质量保证计划扩展至图像质量和患者剂量评价，则图像质量提高，患者剂量减少。

尽管对环境保护的各个方面仍存在着各种不同观点，但对环境保护的关注继续增加。2008 年 6 月在挪威举行的放射生态学和环境放射性国际会议确认有必要保持和加强放射生态学领域的能力，并支持采取综合环境保护方案，包括既考虑到非放射性因素也考虑到放射性因素。

高活度放射源在世界各地使用广泛。在为数有限的应用中，放射源正在为其他技术如粒子加速器所取代，但在许多情况下，放射源将继续被用于医学、工业和学术应用领域。虽然成员国认识到确保放射源受到监管控制的重要性，但维持全面的国家放射源登记簿对许多成员国来说仍是一项挑战。越来越多的国家认识到，《放射源安全和保安行为准则》及其补充导则《放射源的进口和出口导则》为放射源安全和保安提供了基础，许多成员国正在将它们的规定纳入其国家法律中。

拒绝和拖延运输放射性物质的情况继续在世界各地发生。运输可用路线减少的基本趋势似乎是拒绝的先兆，但由于商业敏感性，仍然难以对此进行客观测量。这反过来为确定可接受的解决方案造成了困难。但毫无疑问，除其他外，对其主要活动不是搬运放射性物质的运输业工作人员开展有效的外展活动、与他们进行有效的交流和对他们进行有效的培训，对应对不正当的拒绝和拖延至关重要。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处理这一问题。

对乏燃料安全和放射性废物管理的信任是公众接受核能的一个重要因素。但许多成员国在选址和将废物处置设施投入运行方面存在困难，导致不得不作出延长贮存期的安排。从中短期而言，可以进行这样的贮存，但长期而言，这不具有可持续性。2008 年，原子能机构公布了经更新的放射性废物分类安全标准，该标准连贯一致，并且涵盖了全部的放射性废物类型。为地质处置的安全提供连贯和统一框架的全球核安全制度的重要性，特别是《乏燃料管理安全和放射性废物管理安全联合公约》在为此提供国际同行评审机制方面的重要性正在得到越来越广泛的公认。

由于现有核装置和使用放射性物质的其他设施继续老化，它们最终退役的时间越来越近。从技术角度讲，核装置的安全退役有许多可供选择的方案。但在许多情况中，退役规划还远远没有完成，有的甚至还没有就基本退役方案包括责任分配、筹资制度和废物技术路线达成一致。虽然若干成员国已采取步骤确保财政和人力资源可得，但对于全世界的许多设施来说，它们的退役活动并没有充足的资源。

绝大多数受污染场址都是世界各地以前的铀矿开采和生产活动造成的。在许多情况下，有关国家的安全安排不符合原子能机构的安全标准，而且往往没有充足的财政或人力资源来有效处理这些受污染场址。为努力协助有关国家管理铀矿和铀生产，原子能机构重新制订了其铀生产场址评价工作组计划，该计划的宗旨是向成员国提供铀矿开采和生产设施的同行评审服务。

目　录

分析性概述

A. 导言

1. 在许多成员国，核技术被视为对于解决以下问题愈来愈重要的方案：满足日益增长的能源需求；减少温室气体排放；缓解气候变化；平抑油价波动；治病救人；促进人类发展和创造就业。伴随这种趋势的是人们越来越认识到，和平利用核技术如果不能防止相关的危险，就无法实现其所带来的利益。要想促进和平利用核技术以满足全球能源需求和其他人类需求，就必须伴随着采取审慎的、通过国际协调的行动，以最大程度地减少发生核事故和核恐怖主义的可能性。

2. 随着核技术使用和引进范围的扩大，全球核能界必须对于加强核安全继续保持警惕并采取具体措施。尽管近年来核工业的安全实绩水平一直很高，但还必须避免出现骄傲自满情绪。因此，有必要保持现行全球核安全和核保安制度持续改善的势头，以激励全世界增强信心，使安全和保安水平赶上新兴技术的步伐，同时扩大核计划和全球核能界新加入者的范围。

3. 原子能机构继续支持和促进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和保安的一个框架。该体系的重点是各国政府、监管机构和许可证持有者为确保安全和保安开展的活动。得到有法律约束力的公约、无法律约束力的行为准则、国际标准和导则、同行评审、咨询服务和全球知识网络支持的国际合作是该制度的关键因素。

4. 《2008 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 2008 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。

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[1] “2008 年世界范围内与安全有关的事件和活动的说明”（2009/Note 4 号文件）和“国际原子能机构的安全标准说明：2008 年的活动”（2009/Note 5 号文件）。

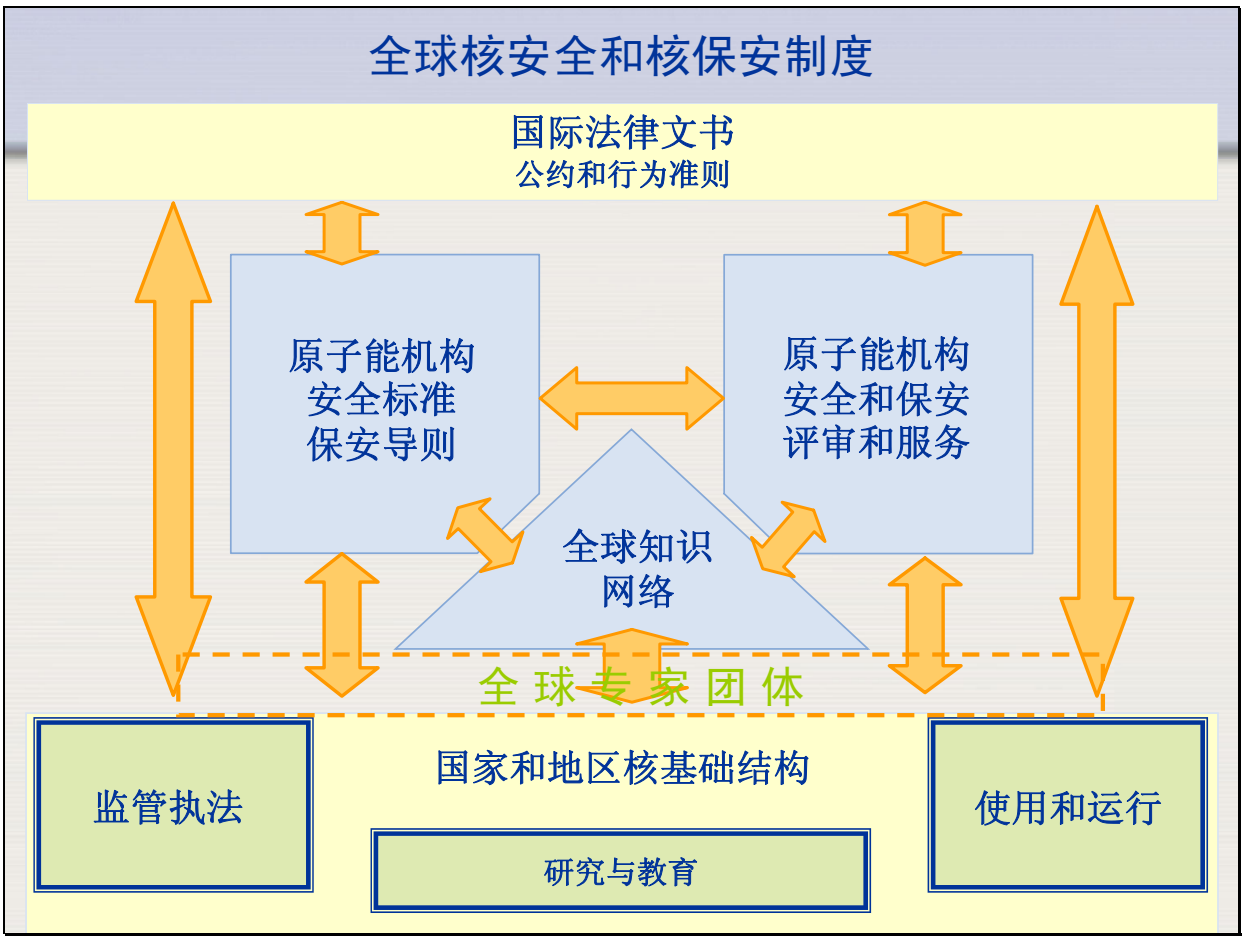

图 1. 全球核安全和核保安制度

B. 全球核安全的趋势、问题和挑战

5. 2008 年，可从全球核安全领域的趋势、问题和挑战中观察到三个基本主题：在通过国际合作加强世界各地的核安全方面继续取得改进；新加入国家的核电计划如期增多和现有计划得到扩大；安全和保安形成了协同作用。此外，许多具体技术问题也得到了确定。

B.1. 通过国际合作持续改进全球核安全

B.1.1. 导言

6. 2008 年，国际合作继续推动开展旨在改进全球核安全的努力。核能界通过合作和相互学习支持持续改进目前已建立的全球核安全和核保安制度。核能界的这种合作取得了一些成就，除其他外，还包括导致制订了补充公约和行为准则等国际文书的高质量安全标准、准则、同行评审和咨询服务。尤其在知识网络活动、同行评审和自评定以及核安全和核保安之间的协同作用方面出现了引人注目的改进。

B.1.2. 运行经验反馈和建立知识网络

7. 2008 年，国际核安全组（核安全组）出版了《改进国际运行经验反馈系统》（INSAG-23）。核安全组注意到，在所有人为活动领域，严重事故发生前几乎总是有不太严重的事件先兆。如果能够从事件先兆中汲取经验教训，那么发生严重事故的概率就会明显降低。全世界的核电厂取得了高水平的运行安全实绩，其中的部分原因是制订了有效的运行经验反馈计划。大多数运行核电厂的电力公司都制订了强有力的运行经验计划，并根据计划对低水平事件和险发事件进行分析和做出改进，以消除事件发生的根源。在某些情况下，在国家一级也会这样做。在国际一级，较严重事件的信息交流比较顺畅。但低水平事件和险发事件信息的交流机会有限，妨碍了全世界从中汲取经验教训。研究堆的情况也是如此，在这方面，有 50 个成员国参加了“研究堆事件报告系统”。就电离辐射的其他应用如医学应用而言，运行经验反馈十分有限，甚至在操作人员一级也是如此。国家一级只有有限的交流，在国际一级几乎没有任何交流。需要考虑将国家核电厂运行经验计划的成功推广到所有其他核应用领域。

8. 亚洲核安全网、伊比利亚-美洲核安全和辐射安全网、欧洲 ALARA[2] 网络、亚洲心脏病学专家辐射防护网和国际退役网等核安全网络继续提供有效的知识、经验和信息交流的平台。原子能机构还在着手建立一个全球核安全网络，它的建立将进一步促进开展有效的国际合作以及共享所汲取的知识、经验和教训。此外，2008 年还启动了国际监管者网方面的工作，以使核安全监管者能够交流运行经验和最佳实践。还就建立其他地区和专题核安全网络进行了讨论。国际公约和无约束力的行为准则还为建立核安全知识网络提供了良好的机会。成员国、核技术使用者和监管机构越来越多地参与这种网络，这将有助于更广泛地分享所汲取的经验教训以及更广泛和更有效地应用其中的经验。

B.1.3. 自评定和同行评审

9. 衡量、评定和改进是任何管理系统的一个重要方面。自评定和同行评审则是评定核安全文化工作实绩和改进情况所采用的主要过程。核电公司很早就认识到了自评定和同行评审的重要性。包括原子能机构运行安全评审组计划和世界核电营运者联合会的同行评审在内的一些机制都可用于确定核安全所需的过程是否到位和是否有效。

10. 对于包括燃料循环设施以及利用放射性同位素的医院和实验室在内的其他核应用而言，同行评审尚未成为共同实践。在许多情况下，外部评审限于监管当局的视察。这种视察的范围通常限于遵守监管要求，不能被看作是确定基准的活动。这就使得相互学习最佳实践难以被采用和落实在所有活动之中。

11. 原子能机构的全部安全评审服务都部分地以同行评审机制为基础，而且许多服务包括自评定活动。例如，综合监管评审服务的一个具体特别是要求成员国在接受综合

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[2] ALARA 意即“合理可行尽量低”。

监管评审服务工作组访问之前完成自评定。这种自评定的结果将是评审过程的一项重要输入。此外，《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》（联合公约）除其他外，还特别要求提交概述各缔约国如何遵守公约规定的自评定报告。这些报告须经为三年一次的缔约国审议会做准备的广泛的同行评审以及在这种会议期间广泛的同行评审。这种同行评审过程的性质和方式提供了就趋势、挑战和最佳实践开展开诚不公的讨论的机会。

B.1.4. 欧洲理事会关于制订共同体核安全框架的指令经修订的建议

12. 2008 年 11 月 26 日，欧洲委员会通过了关于制订共同体核安全框架的指令经修订的建议。该建议确定了关于欧洲联盟核装置安全的基本义务和一般原则，同时加强了国家监管机构的作用。该建议的总体目标是实现、维护和不断改进共同体内的核安全及其监管，以及加强监管机构的作用。其适用范围是必须根据相关成员国的立法和监管框架对其安全做出考虑的核装置的设计、选址、建造、维护、运行和退役。各成员国是否将核能纳入其能源结构的权利得到了承认和充分尊重。该建议以《核安全公约》和原子能机构的《安全基本法则》规定的义务为基础。欧洲核安全监管者小组将成为在监管者之间开展合作的协调中心，并将促进不断改进核安全要求，特别是对新反应堆的要求。

B.2. 新加入国家的核电计划和现有计划的扩大

B.2.1. 导言

13. 世界上目前在运的核反应堆共有 438 座，已规划或在建的新核电厂数量继续增加。原子能机构更新的预测显示到 2030 年会大量增加利用核能，核电装机容量可能翻番。但所有来源的发电总量也可能翻番，在这种情况下，核电占总发电量的比例将会稳定地保持在目前约 14%的水平。尽管定购或规划中的大多数反应堆都在亚洲，但所有地区的新核电厂计划都在进一步得到加强。除正在保持能力的电厂延寿计划外，还正在通过提高出力进一步大幅度增加能力。

14. 核技术还为增进全世界人类福祉带来重要惠益。这种核应用有助于支持和改进医疗、粮食和农业以及自然资源的开发和管理。在所有成员国，核应用将在支持人类需求和社会发展方面发挥重要的作用。

B.2.2. 国家核安全基础结构

15. 正如 SF-1 号《安全基本法则》中所概述的那样，对产生辐射危险的设施和活动负责的人或组织必须承担对安全的主要责任。还必须建立和保持有效的法律和政府安全框架，包括独立的监管机构。发展国家核安全基础结构和相关能力建设是一项复杂任务，需要大量的时间和资源。只要打算利用核能，就肯定要对核安全做出坚定承诺，而且必须拥有可靠的政府和监管框架以及合格的独立监管机构。

16. 2008 年，核安全组发表了《原子能机构基本安全原则支持的国家核电计划中的核安全基础结构》（INSAG-22）的报告。该报告确定了跨越从做出启动核电计划的决定之前到建造、运行和最终退役的核电厂寿期的各个主要阶段。该报告尽管侧重于核电计划，但却部分地论述了铀采冶和生产设施、研究堆和燃料循环设施等其他核装置以及核能其他应用的相关性。

17. 核安全基础结构对核电计划尤其具有重要意义。从选址到设计、建造、运行和最终退役，核电厂的寿期可以超过 100 年。有效和可持续的核安全基础结构对于保证长期核安全至关重要。随着时间的推移，国家边界可能改变，提供核技术的公司可能不复存在，部件会被淘汰，核安全知识会有很大的发展。核工业将继续进行创新，以解决过时问题和提高实绩。因此，牢固的国家核安全基础结构将确保核安全在核电厂的整个寿期内继续得到必要的关注。任何核电厂发生的严重事故都会对公众关于所有核电厂安全的概念产生影响。

18. 越来越多的成员国正在首次考虑核电计划。这些新加入国家可能拥有与其当前核应用相适应的适当的核安全基础结构，但尚无适当的核电基础结构。原子能机构不是惟一向新加入国家提供援助的组织。欧洲联盟也制订了支助活动，由美国能源部发起的“全球核能伙伴关系”等其他国际倡议也在计划提供这方面的援助。面临的挑战是确保在国际一级协调这些活动，以使资源得到有效和高效的利用。原子能机构在这方面大有可为，可以充当协调旨在促进安全可靠地引进核电计划的国际努力的交流中心。国际上越来越普遍认识到，核技术供应应当协助新加入国家发展国家核安全基础结构。国家间旨在支持发展有效和可持续的核安全基础结构的双边或多边协定和谅解备忘录就证明了这一点。

19. 目前运行核电厂的大多数国家都已经逐步建立了当前核计划所需的核安全基础结构。但其中一些国家多年来甚至数十年来一直未启动新的核电厂项目，因此，它们将需要扩充其核安全基础结构，以适应其核电计划的扩大。正在重新考虑核电方案的其他成员国也需要重建其国家核安全基础结构。

B.2.3. 人力资源和能力建设

20. 许多成员国继续报告重要的挑战是维持适当的核安全职工队伍和能力水平，这种挑战还扩大到技术使用者和监管机构及其技术支持组织。由于最近宣布扩大核工业以及核技术的其他应用，对于合格工作人员的竞争开始加剧。在许多情况下，根本无法获得专才，或者没有足够专才供营运者或监管机构挑选。即便如此，一些监管机构还是提高了工作人员配备水平，并计划进一步提高工作人员配备水平，以处理由于核计划扩大、新建核电厂和核技术的新应用而增加的工作负担。在《核安全公约》缔约国第四次审议会期间，一些缔约国概述了支持核研究和核教育的举措以及一些积极主动的措施，如在新核电厂建造或资深人员退休前提前做好聘用工作、指导和培训计划、具有竞争力的一揽子薪酬方案和国际协作。

21. 除了许多成员国成熟的国家教育和培训研究机构外，大韩民国于 2008 年开设了国际核安全学院 — 一个旨在在全球和地区基础上推动对核安全专家实施国际教育的中心。该学院还是原子能机构的一个地区培训中心。它配备了基于信息技术的最新教学设施，将开办现场讲座、培训班和有课程安排的远程教学班。

B.2.4. 监管独立

22. 对监管独立含义的认识在过去几年有了长足的发展。以前，监管独立侧重于建立在法律上与促进或利用核技术的其他机构或组织分离的监管机构。许多成员国制订或修订了支持这种法律意义上的分离的立法，尽管在一些成员国仍然缺乏这种法律和行政分离。目前流行的关于监管独立的观点是从法律上分离的监管机构只是朝着监管独立迈出的第一步。监管机构要做到完全独立，除拥有行使其职权的全部法律授权外，还必须拥有充足和可预见的财政资源、充分合格的人力资源以及能够免于无论政治还是商业性质的任何不适当干预。应当指出的是，在甚至发展监管机构的基本核心能力方面，许多成员国都仍然需要原子能机构提供大量援助。《核安全公约》缔约国第四次审议会注意到监管独立的重要性，并认为这一问题需要进一步加以关注。

B.2.5. 核事件和紧急情况的应急准备与响应

23. 成员国越来越认识到，国家核安全基础结构必须包括充足的资源以及核事件和紧急情况的应急准备和响应安排。一般而言，拥有核装置的成员国往往拥有应付现场事件和紧急情况的适当应急准备和响应能力。但仅有少数几个成员国拥有充分应对大规模核紧急情况的能力。

24. 新核加入国家的出现凸现出有效应急准备和响应能力的必要性。通过响应成员国关于派遣应急准备和响应工作组评定和评价应急准备和响应计划和能力的请求，原子能机构完全能够促进发展和完善这些制度。原子能机构的综合监管评审服务还包括关于国家监管体系应急准备和响应的模块。

B.2.6. 乏燃料和放射性废物管理

25. 每个国家都应该制订某种形式的乏燃料和放射性废物管理政策和战略。这种政策和战略十分重要；它们提出国内一致同意的乏燃料和放射性废物管理立场和计划，而且具体证明政府和相关国家组织确保妥善照管乏燃料和放射性废物的关切和意图。在成员国乏燃料和放射性废物的种类和数量方面存在广泛的多样性，其结果是执行这种政策的战略时有不同，尽管主要政策要素显示国与国之间存在很大的类似性。原子能机构继续促进为统一战略所作的努力。

B.2.7. 核活动的多国性

26. 核工业正日益具有多国性。在核电部门，核电厂部件供应商和服务提供商为数众多。一个供应商可以为许多不同国家提供部件。为保证这些供应商特别是提供主要部件的供应商满足所要求的高质量核安全标准，开展了监督审计工作。通过精心协调的

努力，供应商、电力公司和监管机构获得了高效开展必要监督以应对这种持续挑战的机会。多国设计审查如“多国设计评价计划”或原子能机构的设计审查服务正在集中技术专长，以提供一定程度的保证，即设计中包含了适当的核安全规定。

27. 在放射源领域，仍然是只在几个国家经营的为数有限的供应商负责提供用于医学、工业和学术应用的大多数源。一个日益严重的问题似乎是放射源由于多种原因被拒绝或拖延运输，除其他外，特别包括在口岸被拒绝入境和飞行员拒绝在航空器上装载放射源。要应对的挑战是确保这种源能及时、安全和可靠地到达预期用户手中。

B.3. 核安全和核保安的协同作用

28. 核安全和核保安有着共同的目的，那就是保护公众健康和安全以及环境。近年来人们提高了对核保安的认识，每个成员国都必须继续力争高水平的核安全和核保安。人们认识到安全要求已经非常成熟，而保安要求则在继续发展。必须注意确保这种持续改进过程导致核安全与核保安中与设施和对源的控制有关的那些问题之间的协调一致。全球核安全和核保安专业工作人员日益认识到需要制订程序，以确保核安全活动不损害保安工作，反之亦然。这一点在安全委员会主席的第三任期报告[3]中作了强调。最终目的必须是最大程度地扩大保护健康、安全和环境的利益；核安全和核保安相关方面的协调一致是实现该目的的一个手段，而不是目的本身。

29. 核安全与核保安之间有许多共性。两者都依赖详细的分析才能对威胁和薄弱环节作出评定，而且两者都采用实物和程序上的多重屏障多层次防御理念，以最大程度地减少这种薄弱环节。在许多情况下，为加强核安全所采取的措施也有助于加强核保安，反之亦然。核安全与核保安之间也存在诸多差异。安全专家和保安专家具有十分不同的背景和经验。核安全和核保安活动的公开性和透明度有着根本对立但又同样有效的方案。安全专家通过公开分享核安全信息提高了所有核应用的安全；在保安领域，长期的经验表明，在“需要知晓”的基础上对信息加以限制是高水平保安的关键。其他差异可能包括各国立法和监管基础方面的差异，因为核安全立法一般属于行政法或民法问题，而保安通常属于刑法问题。国际上实现核安全和核保安之间协同作用的努力需要考虑到这些共性和差异。

B.4. 具体技术问题

B.4.1. 导言

30. 为了对由于技术和情况的不断变化引起的发展和事件作出积极主动的响应，原子能机构已经确定了一些具有全球影响的具体技术问题。

B.4.2. 技术不断变化

31. 在许多领域，技术的进步在提供对长期问题解决方案的同时，也可能对核安全带

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[3] http://www-ns.iaea.org/committees/files/css/204/CSS4yreportfinal.pdf。

来新的挑战。一个例子是数字化仪器仪表和控制系统的采用。这些系统在核装置中可能非常有用，但作为安全验证的一部分来证明它们的可靠性也很有挑战性。必须对所有变化进行全面审查才能确保避免不希望的后果。必须在创新与稳定之间寻求平衡。许多新技术正在由少数国家的有限数量的供应商进行开发。供应商和供应国的核安全基础结构是核安全信息的重要来源，因为它们提供核安全和许可证审批所需的主要详细评定。供应商有责任确保使用者能获得安全运行所需的所有资料和资源。打算利用具体核技术的国家和供应国合作确保有效转让核安全知识也同样重要。

B.4.3. 铀工业复苏

32. 在经过多年活动减少后，全球铀工业正在迎来复苏。正在对重新启用废弃的矿井或处理其残渣的可能性进行审查以及考虑开采以往已知的铀矿床，全球的铀勘探也在扩大。由于开展这种新的活动，已使得有机会确保铀资源的勘探、开发和生产在适当顾及健康、安全和环境的情况下进行。至关重要的是在开始进行这些活动前确立了监管控制。在过去数年中，由于铀矿开采作业遗留残渣和废物管理不善，已导致产生了不利的人体健康和环境影响。许多成员国继续被这些遗留场址弄得焦头烂额，因此，需要有适当的监管框架和规划才能避免再次出现与这种遗留场址有关的问题。

B.4.4. 强烈地震和极端自然事件

33. 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。受这种严重事件影响的核装置的安全系统作出了必要的反应，避免了工作人员、公众和环境受到不适当的影响。然而，在若干情况下，事件的强度比受影响装置设计和建造期间原先认为可能或预期的强度要大得多。已开始重新评价现有核装置的完整性，同时考虑到在这些事件中观察到的已增加的强度。此外，新装置的设计还应考虑到是否需要采取补充措施。

C. 事件和紧急情况的应急准备与响应

C.1. 趋势、问题和挑战

34. 2008 年，原子能机构收到或获悉 183 起涉及或怀疑涉及电离辐射事件的报告。对于 140 起事件，确定不需要原子能机构采取行动。原子能机构对其他 43 起事件采取了行动，如与外部对口方一道鉴别和核实信息，分享和提供正式信息或提供原子能机构服务。

35. 继续需要制订针对任何类型辐射紧急情况的明确的通报程序，以供新闻官员和媒体代表在应急准备阶段和响应阶段用于确保公众充分了解情况。因此，目前正在编写关于在核或放射性紧急情况期间与公众进行交流的应急准备和响应手册。

36. 《放射性应急一线响应人员手册》继续是原子能机构网站上下载量最大的出版物之一，并且继续被翻译成数种语文（最近是阿拉伯文和法文）和以各种格式提供，以更方便成员国的使用。最近对该手册的个人数字助理版所作的改进是采用了一种基于网络浏览器的工具，这使得能够更方便用户在现场进行查阅。该手册为将在发生放射性事件或紧急情况头几个小时内做出响应的人员以及将支持这种早期响应活动的国家官员提供了实用指导。该手册由国际防火和灭火技术委员会、泛美卫生组织和世界卫生组织（世卫组织）共同倡议编写。一个基于该手册的网站已经建立，一个包含该手册和其他培训材料在内的“一线响应人员成套工具”目前正在开发之中。此外，目前还在开发电子学习培训教材，以增加原子能机构培训工具的使用和最终用户的数量。

37. 需要增加当地、国家和国际各级在应急响应方面的训练和演习数量，并扩大它们的范围，以纳入安全和保安问题及始发因素。2008 年，原子能机构在地区一级和国家一级开办了关于应急准备和响应各方面问题的 20 个培训班。

38. 尽管每个成员国都必须拥有处理事件和紧急情况的计划和可利用的核心资源，但每个成员国都拥有全面的专业能力并不现实。确切地讲，必须加强地区和国际合作。原子能机构的“响应援助网”计划提供了一种方便的方法，既能记录国家能力，又能将能力与需求进行配比。许多成员国均报告加强了双边和多国合作，包括进行数据交换，以促进有效开展厂外事件和紧急情况的应急准备。

39. 《国际核和放射性事件分级表》已经使用了 18 年。在此期间，对该分级表进行了扩大和调整，以满足不断发展的对通报与放射性物质和辐射源的使用、运输和贮存有关的所有重要事件的需求。2008 年 7 月，《国际核和放射性事件分级表》咨询委员会成员和代表参加该分级表的成员国的国家官员核可了对《国际核和放射性事件分级表用户手册》的使用。该用户手册对经过更新的放射源和运输事件分级补充导则和其他必要的澄清做了合并。

C.2. 国际活动

40. 截至 2008 年底，14 个成员国在原子能机构“响应援助网”进行了一些专家能力登记。虽然这是一个良好开端，但还不足以使“响应援助网”成为登载可根据《核事故或辐射紧急情况援助公约》应请求调动关于国家援助能力信息的全球性网站。

41. 2008 年 7 月，机构间核事故响应委员会协调了一个被称为“ConvEx3”（2008 年）的应急演习，演习内容是对一座核电厂模拟事故的国际响应进行检验。这次演习与 75 个国家和 9 个国际组织合作举行，历时两天。模拟事故发生在墨西哥拉古纳贝尔德核电厂。演习期间，原子能机构将事件和应急中心用作了国际通讯和响应的全球协调中心。对实际紧急情况下将需要的关键系统进行了检验。这次演习除肯定了若干优点外，还确定了一些需要改进的领域。

42. 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的系统，以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”。

43. “加强核和放射紧急情况国际准备和响应系统国际行动计划”已进入其第三个也是最后一个阶段，该阶段将侧重于加强国际准备和响应系统所需的可持续、有效和高效的基础设施。

D. 核损害民事责任

D.1. 趋势、问题和挑战

44. 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进行保险的重要性仍然是各国更加关注的一个主题，特别是在全世界对核电重燃兴趣的情况下尤其如此。

45. 总干事在 2003 年设立的国际核责任问题专家组（核责任问题专家组）继续作为原子能机构处理核责任相关问题的主要论坛，目的是促进更好地理解和遵守在原子能机构主持下通过的国际核责任文书。

46. 美国于 2008 年 5 月交存对《核损害补充赔偿公约》的批准书标志着在原子能机构努力加强全球国际核责任制度方面达到了一个主要里程碑，因为此举使得核装机容量的数量接近达到该条约生效所需数量的 80%。

D.2. 国际活动

47. 2008 年 5 月 21 日至 23 日在维也纳原子能机构总部举行了核责任问题专家组第八次会议。这次会议审议了自 2007 年举行上次会议以来的活动和进展情况。会议期间讨论的主要专题除其他外，特别包括核责任问题专家组的外展活动、欧洲委员会正在开展的核责任影响评定和德国关于允许经修订的《关于核损害民事责任的维也纳公约》和《核损害补充赔偿公约》的缔约国将正在退役的某些小型研究堆和核装置排除在这些公约适用范围之外的建议。

48. 关于核责任问题专家组的外展活动，会议审查了 2008 年 2 月 11 日至 13 日在南非森城举行的第三次核损害责任问题地区讲习班的成果，并注意到讲习班的与会者表示，他们对与根据国际核责任文书制订国家实施法律相关的机制越来越感兴趣。核责任问题专家组还讨论了与第四次核损害赔偿问题地区讲习班有关的事项，为表示有兴趣启动核电计划的国家举办的这次讲习班定于 2009 年初举行。

49. 核责任问题专家组同意继续密切跟踪欧洲委员会正在开展的核责任影响评定工作，这一评定的目的是确定可供欧洲委员会选择的不同政策方案可能对在欧盟范围内努力实现统一的第三方核责任制度产生的影响。核责任问题专家组对欧洲委员会所提议的当前替代方案特别是关于邀请欧盟所有成员国加入于（在原子能机构主持下通过

的）维也纳制度不利的（在经济合作与发展组织核能机构主持下通过的）巴黎制度的提议以及关于欧洲原子能联营采用甚至进一步瓦解当前国际核责任制度的单独的核责任指令的建议表示关切。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。

50. 关于德国提出的允许缔约国将正在退役的某些小型研究堆和核装置排除在 1997 年《维也纳公约》和《核损害补充赔偿公约》适用范围之外的建议，核责任问题专家组注意到，德国还在巴黎制度框架内提出了类似建议。这次会议一致认为，应当努力在巴黎制度和维也纳制度之间寻求一种统一办法，并呼吁经合组织核能机构和原子能机构在这方面继续开展合作。作为第一步，会议同意将这些建议转交原子能机构废物安全标准委员会和辐射安全标准委员会进行技术评价。因此，在 2008 年 11 月 10 日至 14 日在维也纳举行的辐射安全标准委员会和废物安全标准委员会联合会议上对此事项进行了讨论，并决定在能够作出技术评价之前需要有关德国建议的进一步技术资料。为此，联合会议决定设立一个辐射安全标准委员会-废物安全标准委员会特别小组，并赋予该小组对两个建议的技术要素进行评定的任务。

E. 核电厂安全

E.1. 趋势、问题和挑战

51. 核电厂营运者在 2008 年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重要辐射照射。大多数运行核电厂的电力公司都制订了甚至对低水平事件和险发事件进行分析和共享的强有力的运行经验计划。在国家一级，一些拥有核电厂的成员国制订了良好的运行经验反馈计划。但总体而言，这些国家计划并未包括所有低水平事件和险发事件。国际一级的运行经验也很有限，因为大多数成员国仅报告一小部分异常事件。

52. 在印度政府于孟买主办的原子能机构核装置安全专题问题国际会议期间，与会者得出结论认为，除其他外，特别是基于纵深防御原则和确定论标准的综合核安全方案如能得到适当执行并以概率论分析和运行经验反馈作为补充，则将会继续取得成功。不过，防止事故风险要求始终保持警惕、具备高超技术能力并不懈努力避免骄傲自满情绪。强有力的领导加上持续的改进承诺以及维持出色实绩的观念是核安全的关键要素。

53. 新核装置的启动建造是非常苛求的，因为早期的经验和资源有很多已从核工业流失。很显然，从原型项目汲取了经验教训，实绩就会得到改进。此外，核电工业的标准化将确保电厂设计特点的改进和建造过程中汲取的经验教训被纳入以后的设计和建造实践中。规划和进度安排应当考虑实施该项目的合格设计者、建造商和制造商的可

获得情况。在建造期间，许可证持有者和监管机构需要进行严密监测和监督，以达到供应商所规定的以及在许可证审批和设计过程中所核准的质量、技术标准和准则。

54. 为了能够扩大现行核计划和启用新计划，对供应链进行精心管理是基本必需的，因为核工业和核业务正变得日益多国化。核技术供应链方面的质量保证是一个新出现的问题。在供应链范围内实现核安全要求和质量标准的统一被公认为需要成员国、国际组织和供应公司之间进一步合作。“多国设计评价计划”是在实现这一目标方面迈出的第一个重要步骤。

55. 场址选择和场址评价活动正在许多申请新场址许可证和申请在现有场址上建新机组许可证的成员国继续进行。

E.2. 国际活动

56. 2008 年 4 月，《核安全公约》缔约国在维也纳召开了第四次审议会，61 个缔约国中有 55 个缔约国参加了会议。与会者对各缔约国的国家报告进行了全面的同行评审。对于每一个缔约国，与会者确认了良好实践和有待改进的具体领域。与会者还得出结论认为，所有与会的缔约国都遵守了《核安全公约》的要求，而且核电厂的核安全实绩仍然保持良好。缔约国还确定需要面对避免由于这种成功所带来的任何自满情绪的挑战。缔约国还注意到一些挑战依然存在，包括在有效监管分离和独立及新反应堆许可证审批方面。一些缔约国还注意到原子能机构安全标准和评审工作组的积极经验。缔约国鼓励正在考虑核电计划的那些国家及早加入《核安全公约》。

57. 2008 年，原子能机构为国际地震安全中心（地震安全中心）举行挂牌仪式，该中心将起到世界范围内核装置地震安全协调中心的作用。地震安全中心将协助成员国评定核装置的地震危害，以减轻强烈地震的后果。为了促进世界范围内核装置的地震安全，地震安全中心将推动国际社会共享知识、通过咨询服务和培训班为各国提供支持以及通过利用从以前的地震事件中获得的经验加强地震安全。地震安全中心得到了一个由来自包括地质学和构造学、地震学、地震危害、岩土工程学、结构工程学、设备和地震风险在内的七个专业领域的高水平专家组成的科学委员会的支持。

58. 应成员国请求，原子能机构开展了一般性反应堆核安全审查，以便对新核电厂的设计进行遵守原子能机构安全标准的评定。这些审查旨在对供应商提供的安全论证文件进行早期统一评价。对照选定的成套原子能机构安全标准进行的这类核安全评价有助于更加有效地管理在与世界范围内核安全统一方案一致的全球框架内开展的活动，并且还为以后开展的更加详细的个案评价或许可证审批过程提供了重点和基础，因为许可证审批仍然是成员国的一项主权活动。这项工作对“多国设计评价计划”的工作是一个补充，并为新反应堆的许可证审批提供了一种重要输入。

59. 原子能机构已建立了一个网基平台[4]，为拥有先进反应堆安全评定培训方法包括培训模拟机的成员国提供支持。这一平台主要在建造或维护独立和合格的核安全基础结构以及进行决策方面为监管当局和技术支持组织提供长期支助。

60. 原子能机构在以评定乌克兰所有 15 座核电厂遵守原子能机构安全标准情况为目的的原子能机构-欧共体-乌克兰预算外大型联合项目下取得了显著进展。该项目涵盖以下四个主要领域：设计安全、运行安全、废物管理和退役以及监管问题。2008 年，编写完成了关于实施该项目的技术导则，并得到该联合项目指导委员会的核准。作为该项目的一部分，2008 年 6 月派出了一个综合监管评审服务工作组，评审结果已提供给乌克兰监管当局。有关落实该工作组建议的计划已得到乌克兰政府的核准，目前正在实施之中。2008 年 10 月在 Khmelnitski 核电厂成功地开展了首次试验性设计审查工作组访问，2008 年 11 月至 12 月又在 Rovno 核电厂 3 号机组和 4 号机组进行了运行安全评审工作组访问。该项目预定于 2010 年 2 月完成。

F. 研究堆安全

F.1. 趋势、问题和挑战

61. 50 多年来，研究堆继续是世界各国核科学技术计划的基石，也是成员国核基础设施的重要组成部分。全世界的研究堆在 2008 年继续安全运行，没有发生严重事件。已有更多的成员国使用《研究堆安全行为准则》来指导它们的研究堆活动。尽管如此，仍有很大的改进余地，因为许多研究堆继续缺乏运行和安全专用资源。在许多成员国，研究堆不进行正规定期安全审查。鉴于研究堆设施老化是一个持续性问题并且已证明核电厂定期安全审查过程具有成效，应当认真考虑执行这种审查过程。具备经验的工作人员因退休而减少的问题继续因难以招聘到新工作人员而加剧，这在一些研究堆设施仍是一个关键问题。若干成员国正在制定建造新研究堆和升级现有研究堆的计划。就此而言，正在计划建造其第一座研究堆的成员国还有必要建立技术和核安全基础结构。

62. 已确定有必要建立一个网络，以使营运者和监管者能够交流与研究堆有关的核安全信息，原子能机构目前正在探讨建立研究堆信息网的可选方案。需要继续努力提高研究堆安全委员会的有效性和确保委员会成员更广泛地使用原子能机构的安全标准。

63. 成员国普遍认识到制订初步退役计划的必要性，但这种认识并没有具体行动作为后续。在一些成员国，对编制退役计划继续存在抵触情绪，这是编制计划就表明设施将关闭的观念所致。

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[4] http://www-ns.iaea.org/tech-areas/safety-assessment/casat-home.htm。

F.2. 国际活动

64. 2008 年 10 月在维也纳举行了《研究堆安全行为准则》适用问题国际会议。众多成员国派代表出席了会议，这表明它们对“行为准则”及在监管和运行中适用“行为准则”具有兴趣。这在当今核技术重新引起兴趣的情况下特别具有意义。在许多领域，研究堆是有关国家建设必要核安全和技术基础结构和实现核技术惠益的基本组成部分。许多发言侧重于法律和监管基础结构，特别是根据“行为准则”的建议改进法律和条例。一些成员国报告，它们在反应堆延期关闭和退役安排方面存在不足。成员国表示，它们实行了进行定期安全审查的要求，这一般作为许可证再审批或许可证延期过程的一部分来进行。但这些要求和执行过程仍需改进。许多成员国认为，它们的安全文化令人满意，但也认识到对此需要继续给予重视。若干发言者倡议将运行职能与利用职能分开，以此作为改进核安全的一项措施。若干成员国强调了加强核安全管理以及透明度、利益相关者合作及公众参与监管和运行的必要性，从而改进核安全观念和改善核安全现状。设施老化和工作人员老龄化及营运组织和监管机构都需要经过良好培训的合格工作人员的问题继续是一项挑战。营运组织和监管机构制订适当的老化管理计划和获得适当的资金在许多国家也是一项挑战。

65. 原子能机构旨在解决正在计划建造其第一座研究堆的成员国建立技术和核安全基础结构需求的工作计划包括：

- 编写一份关于建设新研究堆中的里程碑的原子能机构《技术文件》，它与已出版的关于核电厂的原子能机构《技术文件》相似；
- 设立一种新类型的原子能机构评审服务，以便应请求审查成员国研究堆方面的技术和安全基础结构状况、查明不足和确定改进行动；
- 与维也纳原子研究所合作组织一个为期六周的培训班，向正在计划建造其第一座研究堆的成员国的进修人员开放。

66. 2008 年，继续制订了研究堆安全标准。这些标准提供了执行“行为准则”和加强核安全所需关键技术的要求和建议，并为原子能机构的研究堆综合安全评定服务提供了依据。

G. 燃料循环设施的安全

G.1. 趋势、问题和挑战

67. 正如去年报告的那样，燃料循环设施营运者在交流核安全信息方面日益开放，对原子能机构与经合组织核能机构合作开发的“燃料事件通报和分析系统”的使用正越来越多。

68. 燃料循环设施面临着独特的核安全挑战，例如临界控制、化学危害以及易发火灾和爆炸。其中许多设施高度依靠营运者的干预和行政控制来确保核安全。虽然燃料循环设施的安全原则与核电厂类似，但必须对核安全方案进行适当分级。大多数小型设施必须处理缺乏人力和财政资源的问题。在一些成员国的监管机构也可以看到这些资源制约情况。同时，许多设施正在以其全部能力的一小部分运行，这种情况加剧了财政制约，并导致了其他一些挑战，例如以可预见的方式保持人力绩效技能和实施系统运行。因此，这些设施中的许多设施很难在所有核安全领域都保持合格的能力。

69. 继续需要交流运行经验。特别是，没有系统地利用同行评审活动如原子能机构“燃料循环设施运行期间的安全评价”服务来评价和加强核安全措施。将继续努力制订能够涵盖全部燃料循环设施类型的整套安全标准。

G.2. 国际活动

70. 与“事件报告系统”[5] 和“研究堆事件报告系统”使用共同平台的网基版“燃料事件通报和分析系统”已于 2008 年投入运行。

H. 职业辐射照射

H.1. 趋势、问题和挑战

71. 总体而言，世界各地核装置的职业辐射防护管理良好，这些装置中的工作人员极少接受重要量的辐射剂量。图 2 显示了核电厂工作人员接受的年集体总剂量的发展趋势。应当注意，最近三年中集体剂量保持稳定，主要是过去 10 年中成功和大力开展的辐射优化努力提前完成的结果。鉴于在电厂运行和维护性停堆期间提供跨境支持服务的核职工队伍已经全球化，应当继续作出努力，使辐射工作人员的辐射剂量限值和约束值包括相关记录工作标准化。最严重的辐射照射涉及从事同位素工作的人员。过度照射时常发生在监管有限和辐射防护计划不完善的孤立场所。此外，大多数核装置都作出了某种形式的运行经验反馈，而放射性同位素的孤立用户则没有这样做。这种情形减少了这些放射性同位素用户相互学习的机会。

72. 根据联合国原子辐射效应科学委员会（辐射科委会）的报告，职业辐射照射所致集体剂量将继续增加，其主要原因是辐射利用在不断扩大。

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[5] 用于核电厂。

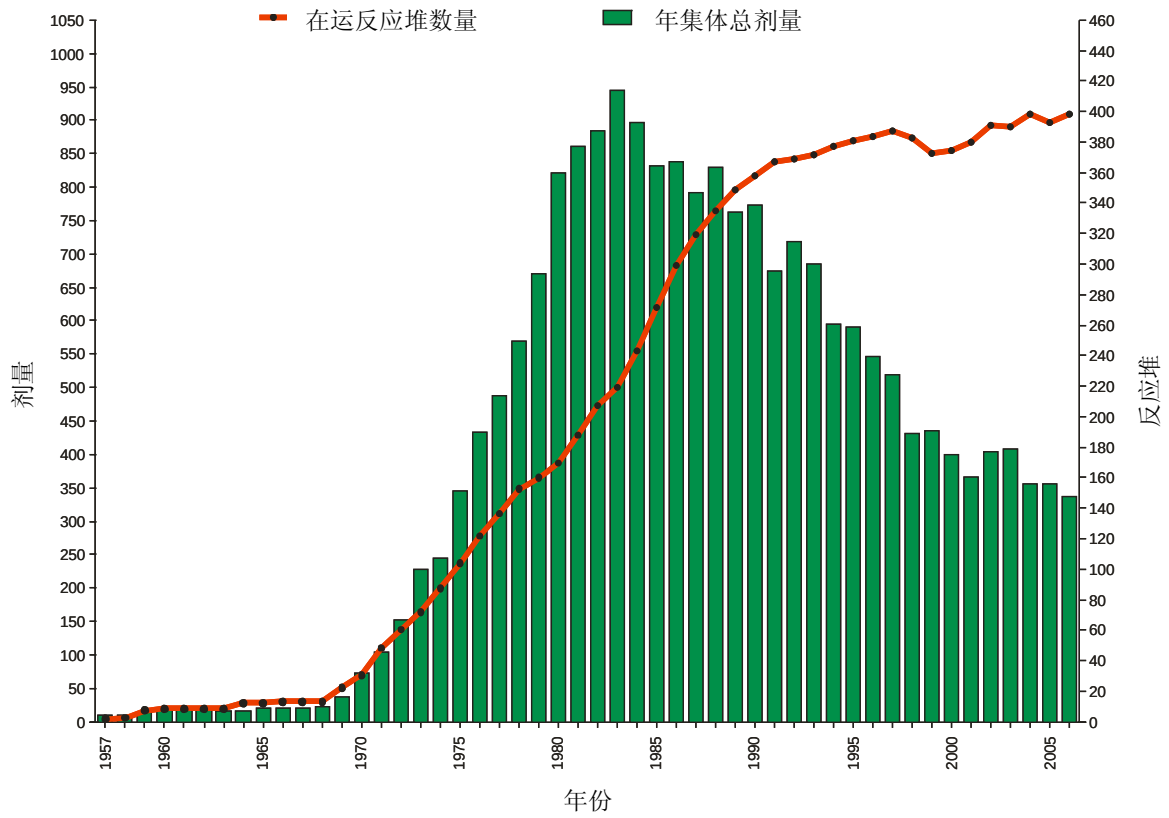

图 2. 年集体总剂量（人·希）和在运反应堆数量的变化情况

73. 全部辐射受照工作人员中，一半以上现都在医学领域。由于辐射正日益在医学领域得到创新利用，医务人员的职业辐射防护正在出现新的挑战。这些创新利用为患者保健提供了令人激动的可能性，但它们也造成了一些情况，即辐射防护专业人员可能在向医务人员提供适当防护方面遇到困难。医务人员的辐射防护问题对于根据 X 射线荧光检查导则执行的一些医疗程序来说尤其严重。适当使用辐射防护工具和技术将继续确保医务人员在工作中的安全。

74. 随着更多的成员国考虑建造核电厂或研究堆，必须加强职业辐射防护方面的能力和基本的基础结构，包括（例如）中子剂量学。工作人员监测仍将需要引起更多的关注，以便例如在铀矿中改进监测战略和相关技术。

75. 将需要进一步考虑的另一个领域是出于保安或法律目的有意进行人员照射所涉及的道德和正当性问题。

H.2. 国际活动

76. 2008 年 10 月 20 日至 25 日在阿根廷布宜诺斯艾利斯举行了国际辐射防护协会第十二届国际大会。会议的目的是通过专门从事辐射防护促进和加强工作的专业人员的广泛与会，加强世界范围内的辐射防护，以及取得确切成果，提出能够付诸实践的具体结论和后续建议。大会为进行电离辐射应用的所有领域作出反馈提供了重要机会，这些领域除其他外，特别包括医务人员和患者防护、放射性物质运输、放射源安全和保

安、退役和放射性废物管理。这种反馈是发展原子能机构安全标准特别是修订“基本安全标准”时的宝贵要素。

77. 必须保持与诸如国际劳工组织在“职业辐射防护行动计划”或与经合组织核能机构在“职业照射信息系统”联合秘书处方面的现有合作，以便加强原子能机构安全标准的统一执行。由于缺少一些医疗、工业和研究领域的剂量数据，有必要制订适当方案，以收集、验证和分析这些缺失数据。

78. 原子能机构于 2008 年 11 月 17 日至 19 日在维也纳召开了一次关于医务人员辐射防护指导的技术会议。会议为卫生部门和监管机构的专家讨论与医务人员辐射防护有关的问题包括监测、信息和教育、具体方式问题、妊娠、监管程序和事件情况提供了机会。

I. 医疗辐射照射

I.1. 趋势、问题和挑战

79. 与过去 10 年一直保持不变或减少的其他电离辐射照射相反的是，医疗照射以引人注目的速度在增加。医疗照射是天然本底辐射之后对世界人口的第二大电离辐射来源（见图 3）。全世界每年进行差不多 40 亿次内科和牙科辐射治疗程序，其中 90%以上属于 X 射线诊断检查。据辐射科委会估计，世界人口由于内科和牙科 X 射线诊断检查接受的集体有效剂量约为 400 万人·希，在不到 10 年的时间内上升了 70%以上。在一些发达国家，医疗照射现在等于或超过了天然本底照射。

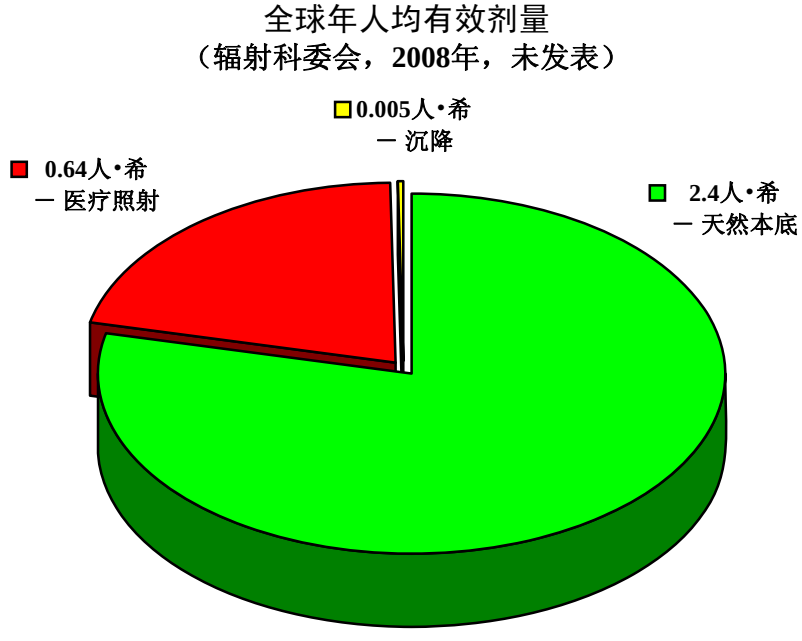

图 3. 全球年人均有效剂量

80. 电离辐射的医疗应用正在快速发展，医疗辐射技术越来越先进和越来越复杂。患者照射数据可能难以获得，或者根本无法获得。从业人员之间分享经验教训仍然处于早期阶段。在许多情况下缺乏患者的监管监督，甚至高度发达的国家也是如此。必须指出的是，医疗照射有必要实行合理化和最优化。

81. 由于设备差以及剂量学和辐射防护准则及培训不足，许多国家认为难以管理或控制医疗辐射照射。发展中国家经常依赖捐赠的设备来控制或管理患者剂量，而与新设备相比，这些通常都是用过的或经过了改造而且性能有可能已经下降的设备。在许多发展中国家，许多医院严重缺乏关于 X 射线图像质量和患者剂量的关键信息。在一次调查中，所评价的全部 X 射线图像中有 50%以上质量很差，对诊断信息造成了影响。对患者进行了重复检查，使得其必须承受额外的照射和费用。

82. 质量保证计划过去主要限于检验放射照相设备。业已发现，如质量保证计划扩展至图像质量和患者剂量评价，则图像质量提高，患者剂量减少。

83. 对事故性照射和非预期医疗照射进行了报告。引进用于医疗辐射照射的新设备或新程序是一个促进安全的关键步骤。保健专业人员之间分享这一主题的经验教训也处在早期阶段。

I.2. 国际活动

84. 患者放射防护国际行动计划指导小组第三次会议于 2008 年 2 月 25 日至 27 日在维也纳举行。一些国际机构的代表和其他专家举行了会议，审查了根据该行动计划所采取行动的进展情况，这些国际机构是：国际放射防护委员会（国际放射防护委）、国际辐射单位与测量委员会、国际电工技术委员会、国际医用物理学组织、国际射线照相师和放射学技师学会、国际放射学会、国际标准化组织（标准化组织）、辐射科委会、世界核医学和生物学联合会和世界卫生组织。指导小组还就继续采取的行动提出了按优先次序排列的新的具体建议，包括进一步加强患者放射防护网站和制订关于放射治疗的安全报告制度。

85. 在国际辐防协会第十二届国际大会期间，阿根廷国家原子能委员会与原子能机构合作主办了医学最新成像和辐射治疗技术的辐射安全技术会议。这次会议的重点是审议在医学成像和治疗设备（侧重于辐射安全）方面取得的技术进步，以及确定原子能机构在医疗辐射安全领域可能采取的行动。

86. 欧洲联盟主席国法国与原子能机构和欧洲委员会合作，于 2008 年 9 月 29 日在维也纳主办了关于电离辐射医疗照射的简况介绍会和圆桌讨论。80 多人出席了会议，其结论有助于加强原子能机构在医疗照射领域正在实施和今后实施的举措。

J. 保护公众和环境

J.1. 趋势、问题和挑战

87. 在环境保护和危险评定的各个方面，特别是在将现有的辐射防护原则和方法与环境保护的新方案如适用保护非人类生物种群的合理化、最优化和限制原则或发挥保护非人类生物种群的随机效应结合起来方面，仍然存在多种观点和一定程度的争议。

88. 虽然如此，一些成员国还是向原子能机构报告了 2008 年它们在保护公众和环境方面取得的进展，包括：

- 加拿大核安全委员会自 2000 年以来一直在实施定量的危险评定综合方案。该方案一直运行良好，所提供信息的质量也得到了改善。根据这一经验，加拿大建议不要只强调数值标准，运用与特定系统有关的专家判断也很关键。
- 法国继续发展建立环境保护监管控制模型方面的应用以及化学危险和放射性危险等多重压力情形的相对危险评定方法。
- 英国环境机构采用普查方法确定了英国的栖息地保护方面需要加以考虑的领域。只确定了几处需要建立场址针对性更强的模型场址。在这种场址上，有一个受保护的栖息地靠近塞拉菲尔德核场址，目前正在从环境保护的角度对其进行当前排放、历史传统和环境保护方面的详细审查。

89. 放射生态学专业技能的可持续性正在成为关注事项，有必要培训年轻的专业人员和知识的代际传承。

J.2. 国际活动

90. 2008 年 6 月在挪威卑尔根举行的辐射生态学和环境放射性国际会议确认有必要保持和加强放射生态学领域的能力。会议还对既考虑非放射性因素又考虑放射性因素的环境保护综合方案表示支持。会议表明，工业环境影响的评定工作如果开展得法，就能够促进制订适当的保护措施和实行适当的监管控制。会议突出强调有必要在原子能机构的协调下进一步详细制订和统一人与环境辐射防护的方案和方法。

91. 根据“环境辐射防护活动计划”设立的环境辐射防护国际协调组于 2008 年 6 月举行了第三届年会。来自原子能机构、其他国际组织（欧共体、国际放射防护委员会、国际放射生态学联盟、经合组织核能机构）和若干成员国（巴西、加拿大、法国、日本、挪威、英国和美国）的与会者参加了这次会议。

92. 经合组织核能机构已开始审查国际放射防护委的范式（即已有的保护人类的控制措施也将确保保护环境）不一定适用的情形。国际放射防护委第五委员会正在继续致力于制订与人类保护系统相一致的动物和植物参考方案。辐射科委会正在编写关于生物群辐射效应的报告。

93. 《防止倾倒废物及其他物质污染海洋公约》缔约方第 30 次咨询会议于 2008 年 10 月在英国伦敦举行。这种其他物质除其他外，特别包括放射性物质。在这次会议上，原子能机构为与会者提供了关于在更新海上处置的放射性物质存量数据库和涉及放射性物质的海上事故和丢失数据库方面取得进展的最新情况。原子能机构还提供了关于法国和美国纠正其涉及太平洋历史性放射性废物处置场的具体信息的两份通知的资料。初步评定表明，这些处置并不意味着给太平洋地区造成了额外重要的放射性影响。预计 2010 年将完成最后评定。

K. 放射源的安全和保安

K.1. 趋势、问题和挑战

94. 高活度放射源在世界各地使用广泛。目前还没有关于正在使用的高活度放射源数量的可靠资料。不过，2007 年美国核管会的一份报告估计，仅美国正在使用的一类和二类源就有 53 700 个，这对世界范围内的源数量具有说明意义。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，放射源将继续被用于医学、工业和学术应用。虽然全体成员国认识到确保放射源受到监管控制的重要性，但维持国家源登记簿对一些成员国来说仍是一个问题。

95. 越来越多的国家认识到，《放射源安全和保安行为准则》为放射源安全和保安提供了基础，许多成员国正在将“行为准则”的规定纳入其国家法律中。大多数成员国都使用“行为准则”建议的分级方案来管理放射源，而且正有越来越多的成员国使用“行为准则”的补充导则《放射源的进口和出口导则》。

96. 每年都在世界各地的入境港和金属回收设施发现无监管控制的放射源（无看管源）。一旦发现无看管源，均应考虑发生安全问题和安全威胁的可能性，并应报告有关当局。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。

K.2. 国际活动

97. 原子能机构 2008 年 5 月在维也纳举行了就各国从执行《放射源的进口和出口导则》中获得的经验教训交流信息的不限人数的技术和法律专家会议。会议揭示了若干重要问题，包括在向出口国提供有关进口国监管和技术能力的信息方面存在困难；在建立地区网络和（或）利用现有网络讨论“导则”执行问题方面需要协助；以及在通报放射源在有关国家领土过境或转运的情况上可能出现空当。与会者还呼吁在下次信息交流会议上对“导则”进行一般性审查，目前计划下次会议于 2010 年举行。

98. 原子能机构的无看管源查找和保护项目继续协助各国建立查找和保护无看管放射

源的能力及建立经过核实的源库存。必要的能力包括以经过核实的国家源库存为基础的查找和保护无看管源的国家战略的建立、能够实施查找活动的经过认证和培训的工作人员，以及用于盘存和查找设备的硬件和软件等适当的技术手段。为在布基纳法索、喀麦隆、刚果民主共和国、肯尼亚、马里、尼日利亚和赞比亚建立这些能力，2008 年提供了包括查找设备采购与服务专家咨询在内的援助。

99. 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。下一阶段的改进即“监管部门信息系统网络门户”已于 2008 年推出，它为监管部门信息系统 3.0 版提供了一个网络界面，这有助于例如现场视察员、监管机构地区办公室以及经授权的设施代表等能够利用该网络界面接触设施数据。

100. 为了加强对废密封放射源的控制以及为没有适当处置系统的成员国提供可行的方案，在原子能机构的主持下开发了废密封放射源钻孔处置概念。该概念还包括废密封放射源整备。原子能机构已设计了一个一揽子综合文件包，其中将包括“安全导则”、技术指导以及需要适应感兴趣成员国当地条件的设施的总体设计和安全评定。通过在已对此表示出兴趣的非洲、亚洲和拉丁美洲成员国实施技术合作项目，对废密封放射源钻孔处置的实施给予了支持。

L. 放射性物质的运输安全

L.1. 趋势、问题和挑战

101. 拒绝和拖延运输放射性物质的情况继续在世界各地发生。可用运输路线减少的基本趋势似乎是拒绝的先兆，但由于商业敏感性，仍然难以对此进行监测和测量。增加监测和记录有可能导致拒绝情况显著增加，尽管实际趋势可能在开始时更加难以确定。显然，与其主要活动不是处理放射性物质的运输工作人员进行有效交流，是应对不正当拒绝和拖延的一个重要手段。因此，促进交流和培训是拒绝运输放射性物质问题国际指导委员会行动计划的重点。

102. 另一个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接触。还有必要将评价和信息收集与国际民用航空组织（民航组织）和国际海事组织（海事组织）在危险货物审计中获得的信息加以整合，另一个更具普遍性的需要是改进提供给成员国的评定工具的质量。

L.2. 国际活动

103. 拒绝运输放射性物质问题国际指导委员会继续指导开展有关国际活动，在 2008 年，这包括为建立处理这一问题的地区网络而举办了四个地区讲习班。这些地区网络

将执行讲习班期间制订的地区行动计划，包括拟订和实施一项宣传战略，以促进决策者和其他方面的认识。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 2008 年底，它共收到 100 多份拒运报告。

104. 2008 年，理事会核准了对 2005 年版“运输条例”的修订，整套运输安全标准的更新工作也已接近完成。今后的工作将包括按照大会要求制订放射性物质运输适用的不属于易裂变材料的新要求。

105. 2008 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四轮非正式讨论，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。

106. 2008 年 10 月 1 日，即在大会第五十二届常会期间，秘书处和加拿大政府联合主办了一个圆桌会议，提供了关于拖延和拒绝运输问题的资料和进一步提高人们对这一问题的敏感度。除了许多发言外，会议还对英吉利海峡隧道发生大火后被关闭对医用放射性同位素运输造成的影响进行了案例研究。

M. 放射性废物管理和处置的安全

M.1. 趋势、问题和挑战

107. 放射性废物管理的安全既有短期的一面，也有长期的一面。前者涉及材料跨境移动和发生具有跨境影响的潜在事故的可能性，后者则涉及放射性核素在较长时间内的迁移，此时国家边境的意义十分有限。此外，对放射性废物管理和处置安排之安全的信任是公众接受核能的一个重要因素。这类情况再加之一系列完善的原子能机构放射性废物管理安全标准，各国越来越趋向于自愿采用这些标准和证明放射性废物管理活动和设施安全性的统一方案。

108. 核能的潜在增加利用强调了继续向前推进高放废物处置计划的必要性。这类计划应提供一个安全的燃料循环清理方案，并向公众保证这是一种现实而可行的结果。对放射性废物管理包括处置安排之安全的信任是公众接受核能的一个重要因素。许多成员国由于社会政治影响而在发展废物处置设施方面存在的困难已导致不得不作出延长贮存期的安排。从中短期来看，可以安全地进行这样的贮存，但大多数技术专家的集体意见是，就长期而言，这不是一种可持续的选择。在近地表放射性废物处置和地质处置的安全标准方面已取得了国际共识，而在中放废物的处置方面却尚未达成这类共识。一些国家在地质处置计划方面已取得了实际进展，目前正在将注意力转向地质处置设施的实际许可证审批过程，这些国家除其他外，特别是芬兰、瑞典和美国。为地

质处置的安全提供连贯和协调框架的全球核安全制度的重要性，特别是提供国际监督机制的“联合公约”的重要性正在得到越来越广泛的公认。

M.2. 国际活动

109. 2008 年，原子能机构发布了更新的放射性废物分类安全标准（见图 4）。更新后的标准以连贯的方式涵盖了所有放射性废物类型，并确认了确定需要作为放射性废物管理的废物与可以作为常规废物管理而解除监管控制的废物之间边界的清洁解控概念。

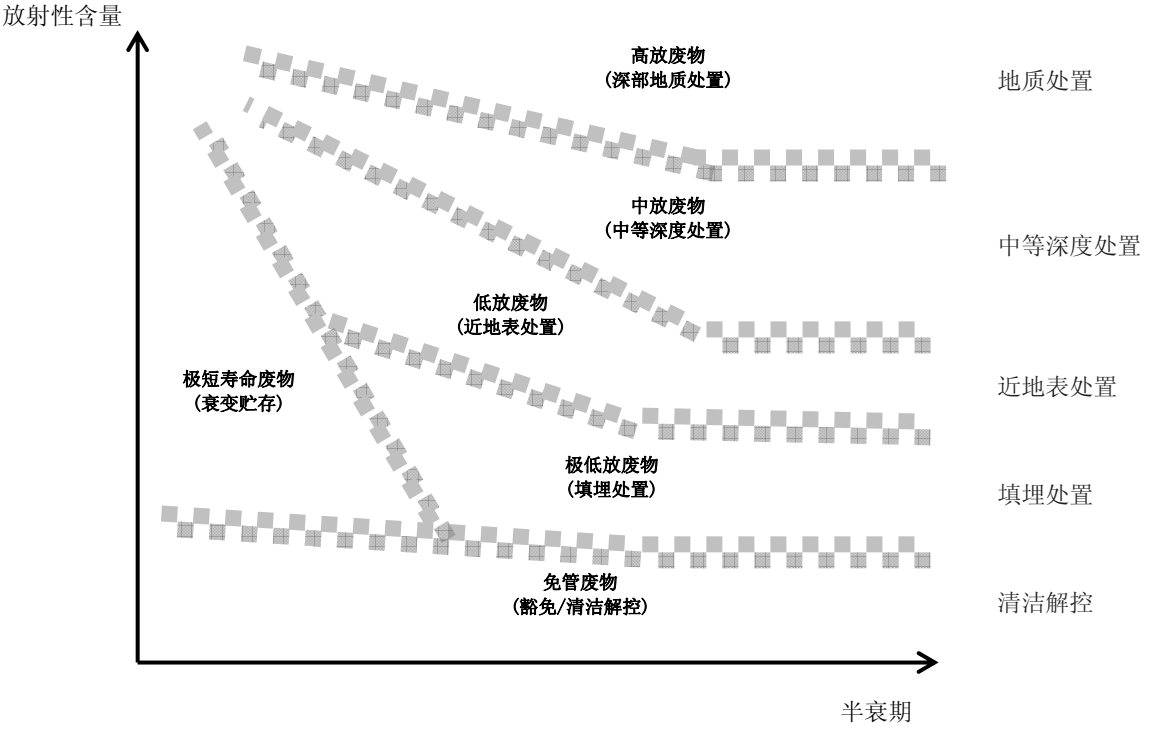

图 4. 放射性废物的分类

110. 原子能机构在 2008 年组织了一次关于中放废物处置方案的讲习班，这是第一次就此问题展开国际讨论。若干成员国介绍了它们的处置概念，其中大多数要求在低于地表的深度进行处置，以防止人为闯入。这次讲习班要求在安全示范方面进行进一步协调，并做出决定认为原子能机构当前的“安全要求”足以解决这种形式的处置问题。提出了拟订进一步导则的建议。

111. 第七届欧洲委员会放射性废料管理和处置会议报告了欧盟的“第六个框架计划”。会议重点是乏燃料及高放和长寿命废物的处置在政策层面和技术层面的最新发展。对多国地质处置解决方案进行了有意义的探讨。会议得出结论认为，实施者之间的协作已充分建立，而监管者之间尚需做更多的工作。英国就选择地质处置设施场址的新举措提出了报告，德国报告了用于处置非产热废物的康拉德矿山许可证审批工作的积极进展。

112. 美国环境保护署已为建议的内华达尤卡山乏核燃料和高放废物处置设施制订了辐射标准。尤卡山标准与国际放射性废物管理界和原子能机构“安全要求”中采取的方案是相符的。该标准将用于审查美国能源部 2008 年 6 月提出的关于在尤卡山选择地质处置设施场址的许可证申请。

113. 2008 年高放废物管理国际会议于 9 月在美国拉斯维加斯举行。这次会议吸引了来自世界各地的众多与会者参加，从而表明了对该主题的日益重视。致力于合作制订安全标准的必要性受到了相当程度的关注，监管审查过程亦是如此，该过程正开始用于尤卡山的启动，并将不久在芬兰和瑞典启动。

N. 退役

N.1. 趋势、问题和挑战

114. 由于现有核装置和使用放射性物质的其他设施继续老化，它们最终退役的时间正在迫近。除了世界上正在运行的 439 座反应堆外，各种报告表明，还有 30 台机组正在计划建造，另有 39 台机组等待退役。原子能机构核燃料循环综合信息系统数据库报告有 297 座燃料循环设施在运行，有 69 座这种设施目前正在进行退役，还有其他 43 座这种设施正等待退役。从技术角度讲，核装置的安全和可靠退役有许多可供选择的方案。但在许多情况中，退役规划还远未完成，在一些情况下甚至连基本退役方案包括责任分配、筹资制度和废物运输路线都没有达成一致。虽然一些成员国已采取步骤确保财政和人力资源可以获得，但对于全世界的大量设施来说，退役活动还没有充足的资源。

N.2. 国际活动

115. 国际退役网络目前正在协调和建立当前为协助成员国共享实际退役知识所作的努力。2008 年开展了一些活动，包括西班牙国家放射性废物管理公司主办的废物管理和清洁解控讲习班，以及比利时主办的缩小退役核设施部件尺寸的讲习班。国际退役网络指导委员会 2008 年 6 月在西班牙举行会议，讨论了退役方面新的基础课程，并对一些设施进行了科学访问。

116. 原子能机构帮助伊拉克政府对以往使用放射性物质的设施进行评价和实施退役的项目进展良好，并正在通过来自德国、意大利、英国、乌克兰和美国的专家给予继续支持。按 2007 年商定的优先次序系统确定的第一个设施即图瓦萨轻度受污染的 LAMA 建筑物已开始进行退役，从设施周围清除了未爆弹药和废材料。由于在乌克兰普里皮亚季一个受污染场址对伊拉克专家小组开展的实际培训，使得上述工作成为可能。

117. 2008 年，原子能机构对英国镁诺克斯退役计划开展了国际同行评审，重点是

Bradwell 核电厂。在 2008 年 11 月举行的国际会议上对这次同行评审的结果进行了审查。英国对这一基准过程评价很高，并鼓励其他退役营运者利用这种同行评审。原子能机构将利用这次试点活动期间汲取的经验教训来改进这种评审服务。

118. 两年一度的法国核能学会退役挑战会议于 2008 年 9 月 28 日至 10 月 2 日举行。在这次会议期间显然可见，退役中汲取的经验教训并没有在核工业领域进行非常充分的交流，而且很明显，原子能机构在向成员国传播这些汲取的经验教训以及最佳实践方面继续起着至关重要的作用。

O. 受污染场址的恢复

O.1. 趋势、问题和挑战

119. 绝大多数受污染场址都是世界各地以前的铀矿开采和生产活动造成的。在许多情况下，原子能机构的相关安全标准没有得到遵守，而且无法获得充足的财政资源或人力资源来有效地处理这些受污染的场址。

120. 一个重要挑战是，通过在整个全球铀生产业界建立和适用可持续的最佳实践和管理原则，防止过去在铀矿山和生产场址发生的错误重演。

O.2. 国际活动

121. 就以前的铀矿开采和生产活动而言，原子能机构最近在中亚开展的主动行动包括与欧洲安全和合作组织（欧安组织）、联合国开发计划署（开发计划署）和世界银行等其他国际机构进行合作和交流。原子能机构正在国家一级和地区一级提供以提高成员国的制度性能力为目的的全面援助。这些计划的主要重点是全面按照原子能机构的安全标准改进监管控制以及扩大环境监测和实验室分析能力。

122. 原子能机构和世界核协会于 2008 年 10 月在奥地利维也纳组织了一次关于铀矿开采的环境、健康和安全问题的联合技术会议。认识到主要铀矿开采生产国和铀矿开采公司为新兴铀矿生产国提供管理和支持的必要性。由此产生的共识是，这些主要的国家和公司共同承诺携手为原子能机构的地区会议等建设性主动行动以及为基准测试新兴铀矿开采地区和国家的新场址提供持续的领导和支持。

123. 原子能机构已重新制订了其铀生产场址评价小组计划，该计划将向成员国提供铀矿开采和生产设施的安全相关同行评审服务。该计划的一个关键要素是共享最佳实践。

124. 在天然存在的放射性物质方面，磷酸盐工业工作组的工作通过在原子能机构举行一系列会议一直在持续进行。从长期来看，一个重要的可交付成果将是一个提供了磷酸盐工业监管、残留物和废物管理以及安全最优方案的全球最佳实践模型。

Appendix 1
Safety related events and activities worldwide during 2008

A. Introduction

125. This report identifies those safety related events or issues during 2008 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 2008.

B. International instruments

B.1. Conventions

B.1.1. Convention on Nuclear Safety (CNS)

126. In 2008, Iceland ratified and Malta and Senegal[1] acceded to the CNS, which had 62 Contracting Parties at the end of 2008, including all Member States operating nuclear power plants (NPPs).

127. The Secretariat gave support for the 4th Review Meeting of Contracting Parties to the CNS in April 2008. At the request of the 3rd Review Meeting of the CNS, the Agency also provided Contracting Parties with a report entitled *Major Issues and Trends in Nuclear Safety*, which summarizes the significant issues, developments and trends in enhancing nuclear safety derived from the Agency's safety review services over the past three years, such as the need for a nuclear safety infrastructure, leadership and management for safety and safety culture, operational safety performance, and long term operation. This report was intended to help the Contracting Parties to prepare their national reports. The Agency also produced and distributed a report to Contracting Parties entitled *Synopsis of the relevant IAEA Safety Requirement Statements* reflecting the issues addressed by Articles 6 to 19 of the CNS.

128. In 2004, the Agency introduced a secure website for the CNS and, based on feedback from Contracting Parties, a number of upgrades were made in 2007 and 2008. The website is now a well established tool for communication in the peer review process, with over 4000 questions and answers provided electronically.

129. The 4th Review Meeting emphasized nine issues in the Summary Report: legislative and regulatory framework; independence of the regulatory body; safety management and safety culture; staffing and competence; probabilistic safety assessment; periodic safety review; ageing management

[1] For Senegal, the Convention on Nuclear Safety will enter into force on 24 March 2009

and life extension; emergency management; and new NPPs. For all of these issues, Agency safety standards have either already been published or are in an advanced state of preparation or planned. It was recognized that the Agency's Safety Requirements and their supporting guides are not only increasingly referred to by the Contracting Parties, but are also more and more implemented in national regulations. However, from the Agency's perspective, application of the safety standards needs to be further facilitated with respect to implementing them in the peer review process.

130. Many Contracting Parties reported on their positive experiences with Agency missions, especially the Operational Safety Review Team (OSART) and the Integrated Regulatory Review Service (IRRS), and recognized their importance. Contracting Parties were encouraged to invite such missions if they had not yet done so.

131. For the next review meeting in April 2011, Contracting Parties again requested that the Agency produce a report on major trends and issues in nuclear safety and distribute this report before Contracting Parties start to prepare their national reports. The Agency was also requested to prepare a brochure introducing the CNS and its associated rules of procedure and guidelines. This brochure is intended to pass on basic information to those who are new to the CNS and the peer review process.

132. The Contracting Parties discussed and agreed to a number of improvements to the review process for the CNS, including provisions for continuity between review meetings, increased transparency of the review process and expanded outreach activities.

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)

133. In 2008, Denmark ratified the Assistance Convention and Gabon acceded to and Senegal[2] ratified both the Early Notification and Assistance Conventions. The Early Notification Convention had 102 parties and the Assistance Convention had 101 parties at the end of 2008.

134. In 2008, no notification messages were submitted under the provisions of the Early Notification Convention. However, in relation to eight events with potential nuclear or radiological consequences, or elevated media interest, advisory messages were submitted by the official designated counterparts under the Conventions using the *Emergency Notification and Assistance Conventions* (ENAC) secured web system and as per the *Emergency Notification and Assistance Technical Operations Manual* (ENATOM) arrangements.

135. In two cases, the Agency was requested to provide assistance pursuant to the Assistance Convention. In both cases, the Agency deployed assistance missions to the requesting countries in cooperation with the State Party which delivered specialized assistance.

136. Every year, a number of activities, including Convention Exercises (ConvEx), are organized to evaluate and confirm various aspects of the practical arrangements for implementing the provisions of the Early Notification and Assistance Conventions. In 2008, four ConvEx were conducted, including one large-scale international exercise based on a simulated accident at Mexico's Laguna Verde NPP, as well as four exercises with the World Meteorological Organization (WMO) and 12 communication tests.

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[2] For Senegal, the Early Notification and Assistance Conventions entered into force on 23 January 2009

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

137. The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear activities and to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities. In 2008, Senegal[3] and Tajikistan acceded to the Joint Convention, which had 46 parties at the end of 2008. Considering that the vast majority of Member States have some requirements for radioactive waste management, it would be beneficial that more States become Contracting Parties to the Joint Convention.

138. The Organizational Meeting for the Third Review Meeting of the Contracting Parties to the Joint Convention was held in Vienna in October 2008 with 40 Contracting Parties participating. The meeting elected Mr. Kunihisa Soda of Japan as the President of the Third Review Meeting. Mr. Frank Marcinowski of USA and Mr. Laszlo Koblinger of Hungary were elected Vice-Presidents. Six Country Groups were established and Contracting Parties were allocated to the Country Groups. Contracting Parties also met separately in Country Groups to elect Country Group Officers.

139. The Third Review Meeting will be held from 11 to 20 May 2009.

B.2. Codes of Conduct

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

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

141. An international meeting on the application of the Code of Conduct on the Safety of Research Reactors was conducted in October 2008 in Vienna. The large number of Member States represented at this meeting showed evidence of interest in the Code of Conduct and its application in regulation and operation. In many Member States, research reactors are an essential part of the nuclear safety and technical infrastructures. Many of the presentations focused on the legal and regulatory infrastructure, in particular improvements to laws and regulations to comply with the recommendations of the Code of Conduct. Some Member States reported deficiencies in arrangements for reactors in extended shutdown and for decommissioning. In many cases, periodic safety reviews are required for research reactors, generally as part of a relicensing or licence extension process. Even so, participants noted that improvements could be made to the review process. Participants identified a number of challenges that both operating organizations and regulatory bodies will need to address, including the availability of well-trained and competent staff, ageing facilities, appropriate financing and stakeholder engagement.

[3] For Senegal, the Joint Convention will enter into force on 24 March 2009

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

142. By the end of 2008, 93 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 51 States had expressed support for the Supplementary Guidance on the Import and Export of Radioactive Sources.

143. In Vienna in May 2008, the Agency held an 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. The meeting brought to light several significant issues including difficulties in the provision of information to exporting States on the regulatory and technical capacity of importing States, the need for assistance in the development of regional networks and/or the utilization of existing networks to discuss the implementation of the Guidance, and a potential gap that might exist in relation to the notification of the transit or transhipment of sources across the territory of States. Participants also made a call for a general review of the Guidance at the next information exchange meeting, which is tentatively planned for 2010.

C. Cooperation between national regulatory bodies

144. 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)

145. INRA comprises the most senior officials of a number of well-established national nuclear regulatory organizations in Europe, America and Asia who wish to exchange perspectives on important issues with the purpose of influencing and enhancing nuclear safety and radiological protection from a regulatory perspective. INRA met twice in 2008 in USA and discussed, inter alia, recent events in each country, operating experience across a range of issues, countries considering developing nuclear energy, and radioactive source controls. In 2008, INRA issued a letter to the Director General strongly encouraging countries that are expanding their programs for peaceful uses of nuclear energy and those developing new nuclear programs to adopt programs of continuous improvement in nuclear safety.

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

146. Under the presidency of Japan, the G8-NSSG met three times in 2008. The Agency, the European Commission (EC), the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) and the European Bank for Reconstruction and Development (ERBD) also attended these meetings. The G8-NSSG discussions focused on: the safety upgrading programme of the Armenian NPP; the Chernobyl Shelter Fund and Nuclear Safety Account managed by the EBRD; the implementation of activities under the EC-Agency-Ukraine Joint Project;

the Global Nuclear Safety Network (GNSN); strengthening of international nuclear safety and security activities; the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on Import and Export; the global initiative to combat nuclear terrorism; the international initiative on 3S-based (safety, security, safeguards) nuclear energy infrastructure; and human resources development in the field of nuclear safety and security.

147. At the last meeting in December 2008, the main themes to be addressed during the 2009 Italian G8 presidency were introduced. These include: Chernobyl NPP projects; earthquake and nuclear safety; improving the safety of NPPs in operation; safety and security of radioactive sources; global initiative to combat nuclear terrorism; multilateral approaches to the nuclear fuel cycle; GNSN; international initiative on 3S-based nuclear energy infrastructure; and nuclear education and training.

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

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

149. In January 2008, the RHWG published its safety reference levels for nuclear reactors, which are based mainly on the Agency's safety standards and best regulatory practice/experience from European countries. As a follow-up, it will regularly revise the reference levels according to the latest development in the field of international standards. In addition, the RHWG was charged by WENRA to perform a pilot study on reactors not covered by the existing reference levels.

150. The WGWD is continuing to develop safety reference levels for radioactive waste and spent fuel storage and decommissioning. In 2008 it also reopened a discussion on terms of reference for study of repositories which aims at the formulation of safety reference levels for geological disposal facilities.

151. In 2008 WENRA invited European countries without nuclear power programmes to participate as observers at all WENRA meetings. At its October meeting, WENRA discussed the draft European Council Directive setting up a community framework for nuclear safety.

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

152. The Forum met in May 2008 in Uruguay, with the chief regulators from Argentina, Brazil, Cuba, Mexico, Spain and Uruguay attending. At the meeting, Chile was accepted as a new member. In addition, the Forum reviewed ongoing projects, including the implementation of the Ibero-American Radiation Safety Network. The presidency has been transferred from Uruguay to Argentina.

153. In 2008, the Forum completed a project on risk analysis and risk reduction in medical exposures. Lessons learned from accidental exposures in radiotherapy were combined with more proactive methods of finding out what else can go wrong and how to prevent accidental exposures. These methods included probabilistic safety assessment and risk matrix approaches. The findings are being used to improve the inspections of regulatory bodies and the safety in the radiotherapy departments.

154. A Forum project on continuous improvement of the regulatory control of medical exposure in Ibero America was also completed in 2008. The project was successful in exploring areas of collaboration between regulatory and health authorities, building up on the methods for self

assessment, identification of gaps and difficulties in implementing safety standards in medical exposure and providing approaches to address them.

155. The results of both of these projects will be provided to the Agency for use by all Member States in the region.

C.5. Cooperation Forum of State Nuclear Safety Authorities of Countries which operate WWER[4] Reactors

156. The Forum conducts annual meetings where senior staff of regulatory bodies in countries that operate WWER reactors discuss regulatory and safety issues related to operation of WWERs. The 15th Annual Meeting of the Forum was conducted in July 2008 in Kiev, Ukraine. The Forum members exchanged information related to the status of regulatory activities and WWER NPP safety performance. Other topics discussed included the Agency's IRRS and risk-informed decision making programmes. The Forum working groups reported on activities completed since the previous annual meeting in the areas of operating experience feedback, regulatory use of PSA methodology, regulatory aspects of organizational, and management and safety culture related issues of NPPs. Forum members also discussed a number of improvements to enhance the work of the Forum. The 16th Annual Meeting will be hosted by Bulgaria in 2009.

C.6. Network of Regulators of Countries with Small Nuclear Programmes (NERS)[5]

157. NERS is an independent organization of nuclear regulators dedicated to the free exchange of nuclear regulatory information among regulators of countries with small nuclear programmes. Members include Argentina, Belgium, Czech Republic, Finland, Hungary, Netherlands, Pakistan, Slovakia, Slovenia, South Africa and Switzerland. The 11th Annual Meeting of NERS was conducted in Prague, Czech Republic from 27 to 28 April, 2008. Topics discussed included general information regarding regulatory issues of interest to the members, licensing process for increasing power in operating reactor units, use of Probabilistic Risk Assessment results for inspection activities, and operational experience feedback.

158. The next meeting of NERS will be held in Brussels, Belgium from 4 to 5 June 2009.

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

159. The annual meeting of senior regulators of countries operating CANDU-type reactors (Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania) was hosted by the Agency at its headquarters in Vienna in October 2008. The issues discussed covered a large variety of topics, including: requirements on operations related to availability of off-site power during long outages; experience and plans for long-term storage and waste disposal; regulatory assessment of new NPP design; regulatory approach and lessons learned from refurbishment; approaches/regulatory tools for independent verification of licensee's submissions; probabilistic safety assessment; technical cooperation; steam generator issues; risk-informed decision making and specific application for

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[4] water cooled, water moderated power reactor

[5] www.ners.info

CANDU; design basis accident for CANDU reactors; radiation protection issues; periodic safety review and licensing; and, experience with respect to IRRS missions.

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

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

161. The International Nuclear and Radiological Event Scale (INES) has been used for 18 years. During this period, it has been extended and adapted further to meet the growing need for communication of the significance of all events associated with the transport, storage and use of radioactive material and radiation sources. In July 2008, the INES User's Manual, which consolidates the additional guidance for rating radiation source and transport events and other needed clarifications and provides examples and comments on the continued use of INES and replaces earlier publications, was endorsed for use by the INES Advisory Committee and INES national officers.

D. Activities of international bodies

162. 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)

163. The United Nations General Assembly established UNSCEAR in 1955 to assess and report levels and effects of exposure to ionizing radiation. UNSCEAR's Programme of Work is approved by the General Assembly, and has extended typically over a 4–5 year period. The secretariat, which is provided through the United Nations Environment Programme (UNEP), engages specialists to analyse information, study relevant scientific literature and produce scientific reviews for scrutiny at UNSCEAR's annual sessions. At the end of the cycle, the United Nations publishes the substantive reports, which are recognized as authoritative scientific reviews and provide the scientific foundation for the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). UNSCEAR also reports annually to the General Assembly. In 2008, UNSCEAR issued a scientific report covering sources of radiation exposure, the Chernobyl accident and effects on non-human biota.

164. UNSCEAR held its fifty-sixth session in Vienna from 10 to 18 July 2008. The Committee scrutinized and approved for publication five scientific annexes. It was also noted that the General Assembly, in its resolution 62/100 of 17 December 2007, had appealed to the Secretary-General of the

United Nations to take appropriate administrative measures so that the secretariat could adequately service UNSCEAR in a predictable and sustainable manner.

165. UNSCEAR has developed a strategic plan to provide vision and direction for all its activities during the period 2009–2013, to facilitate result-based programming by the secretariat, to help foster management of sufficient, assured and predictable resources and to improve planning and coordination among the various parties involved. The strategic objective for the period is to increase awareness and deepen understanding among authorities, the scientific community and civil society with regard to levels of ionizing radiation and the related health and environmental effects as a sound basis for informed decision-making on radiation-related issues. UNSCEAR also established that the thematic priorities for the period would be medical exposures of patients, radiation levels and effects of energy production, exposure to natural sources of radiation and improved understanding of the effects from low-dose-rate radiation exposure.

166. UNSCEAR's fifty-seventh session will be held in Vienna from 25 to 29 May 2009.

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

167. ICRP is an independent group of experts that issues Recommendations on the principles of radiation protection. ICRP Recommendations have provided the basis for national and international standards, including the BSS. Appointments to the ICRP and its Committees are made for five year periods, and the current cycle ends on 30 June 2009.

168. ICRP has revised its 1990 Recommendations and published its 2007 Recommendations in February 2008 as Publication 103. ICRP released two additional publications in 2008.

169. *Scope of Radiological Protection Control Measures* (Publication 104) offers advice to competent national authorities and relevant intergovernmental organizations for facilitating their definition of the scope of control measures for purposes of protecting people against possible adverse consequences of radiation exposure. The main concepts associated with the scope of radiological protection regulations are termed 'exclusion' and 'exemption'. Exclusion refers to the deliberate omission of exposure situations from the scope of regulatory requirements, and exemption refers to waiving regulatory requirements if their application is not warranted. A special case of exemption, termed 'clearance', refers to the relinquishing of regulatory control if such control becomes unwarranted.

170. *Radiological Protection in Medicine* (Publication 105) was prepared to underpin the ICRP 2007 Recommendations with regard to the medical exposure of patients, including their comforters and carers, and volunteers in biomedical research. It addresses the proper application of the fundamental principles (justification, optimization of protection, and application of dose limits) of the Recommendations to these individuals. It is not appropriate to apply dose limits to medical exposure of patients, because such limits would often do more harm than good. The emphasis is then on justification of the medical procedures and on the optimization of radiological protection. In diagnostic and interventional procedures, justification of procedures (for a defined purpose and for an individual patient), and management of the patient dose commensurate with the medical task, are the appropriate mechanisms to avoid unnecessary or unproductive radiation exposure. Equipment features that facilitate patient dose management, and diagnostic reference levels derived at the appropriate national, regional, or local level, are likely to be the most effective approaches. In radiation therapy, the avoidance of accidents is a predominant issue. With regard to comforters and carers, and volunteers in biomedical research, dose constraints are appropriate.

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

171. The ICRU, a sister organization of the ICRP, provides internationally acceptable recommendations concerning concepts, quantities, units, and measurement procedures for users of ionizing radiation in medicine, basic science, industry, and radiation protection. The ICRU held its annual meeting from 22 to 27 September 2008 in Nyon, Switzerland. At the meeting, two ICRU draft reports were reviewed for final approval for publication: *Assessment of Image Quality in Mammography* and *Fundamental Quantities and Units for Ionizing Radiation*. In addition, a joint ICRP-ICRU draft report was reviewed for final approval for publication in the Annals of the ICRP: *Reference Computational Phantoms of the Adult Male and Female*.

172. The current ICRU programme is focused on four areas:

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

D.4. International Nuclear Safety Group (INSAG)

173. The International Nuclear Safety Group (INSAG) is a group of experts with high professional competence in the field of nuclear safety working in regulatory organizations, research and academic institutions, and the nuclear industry. It was initially constituted following the Chernobyl accident in 1986 and is constituted under the auspices of the International Atomic Energy Agency with the objective of providing authoritative advice and guidance on nuclear safety approaches, policies and principles.

174. In 2008, INSAG published *Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles* (INSAG-22) and *Improving the International System for Operating Experience Feedback* (INSAG-23). A report on the interface between safety and security is in preparation.

175. As in previous years, the INSAG forum was held during the 52nd Regular Session of the General Conference. This year the INSAG Forum focused on the challenges faced by countries embarking in a nuclear power programme to establish a nuclear safety infrastructure and achieve a sustainable high level of nuclear safety. Four Member States that have expressed an interest in developing a nuclear power programme for the first time shared their views on how to achieve nuclear safety as a foundation for that programme in a round table discussion.

176. INSAG Chairman Richard Meserve also issued his fifth 'State of Nuclear Safety' letter[6] to the Director General of the IAEA.

[6] http://www-ns.iaea.org/downloads/committees/insag/2008AssessmentLetter.pdf

E. Activities of other international organizations

E.1. Institutions of the European Union

177. In 2008, the European High-Level Group on Nuclear Safety and Waste Management, which was renamed the European Nuclear Safety Regulators Group (ENSREG), met five times in 2008. At these meetings, the chairperson was confirmed, rules of procedure were established, the work programme was discussed, three working groups on safety, waste management and transparency were created and vice-chairpersons designated. The delegates committed to transparency, self-assessment, IAEA peer-review and strengthened cooperation to further improve radioactive waste and spent fuel management practices. ENSREG also endorsed three reports on waste management. On 7 November 2008, ENSREG held an extraordinary meeting to exchange views and make individual recommendations regarding a draft of a revised proposal for a Directive setting up a Community framework for nuclear safety.

178. The European Nuclear Energy Forum (ENEF) is a platform to promote a broad discussion among all relevant stakeholders on the opportunities and risks of nuclear energy. The European Commission's (EC) proposal to create the European Nuclear Energy Forum was endorsed by the European Council in March 2007. Hosted successively in Bratislava and Prague, ENEF meets twice per year. The third plenary meeting of ENEF took place in Bratislava in November 2008. More than 200 high-ranking participants joined the discussions on transparency, risks and opportunities of nuclear energy, representing all relevant stakeholders. First results relate to safety, nuclear waste, and to concrete ways to translate the competitive advantage of nuclear energy into consumer benefit. The discussions also addressed governance and new concepts of electricity grids.

179. On 26 November 2008, the EC adopted a revised proposal for a Directive setting up a Community framework for nuclear safety. It defines basic obligations and general principles for the safety of nuclear installations in the EU while enhancing the role of national regulatory bodies. The general objective of the proposal is to achieve, maintain and continuously improve nuclear safety and its regulation in the Community and to enhance the role of the regulatory bodies. Its scope of application is the design, siting, construction, maintenance, operation and decommissioning of nuclear installations, for which the consideration of safety is required under the legislative and regulatory framework of the Member State concerned. The right of each Member State to use nuclear energy or not in its energy mix is recognized and fully respected. The proposal is based on the obligations of the Convention on Nuclear Safety and the Agency Safety Fundamentals. ENSREG will become the focal point of cooperation between regulators and will contribute to the continuous improvement of nuclear safety requirements, especially with respect to new reactors.

180. The Report from the EC to the European Parliament and the Council of Ministers of the European Union: Sixth Situation Report on Radioactive Waste and Spent Fuel Management in the European Union was issued on 8 September 2008 and gives an overview of the current status of the management of radioactive waste and spent fuel in the EU. It also proposes actions at the Community and national levels with the purpose of ensuring progress towards implementation of radioactive waste and spent fuel disposal facilities. The key messages highlighted by the EC in the Report are the following:

- 'wait-and-see' policies are not acceptable.

- Many scientific and technical areas important to geological disposal have reached maturity level, and moving towards implementation should be encouraged and facilitated.
- All initiatives leading to encouraging and facilitating progress towards identification and operation of safe waste repositories are highly welcome.
- Regional and international cooperation could accelerate decision-making on definitive disposal solutions.
- Proposals from non-EU states for disposal of radioactive waste and spent fuel should not be encouraged.

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

181. The Nuclear Energy Agency 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.

182. To commemorate its 50th Anniversary, the OECD/NEA organized a special event in conjunction with the October 2008 Steering Committee meeting. It also prepared a special publication titled *Nuclear Energy Outlook*, which includes projections of nuclear energy's potential share of the world energy demand up to 2050. It also covers all the issues related to nuclear power, such as safety, waste, environmental issues, economics, fuel resources, non-proliferation and technology development.

183. The topic of NPP life management was selected for the policy debate at the Steering Committee meeting in April 2008 largely due to the fact that an increasing number of NPPs around the world are approaching the end of their original design lifetimes. Because of the characteristics of nuclear power — capital-intensive but low fuel and operating costs — life extensions are very attractive economically. Life extension raises a variety of issues requiring analysis: safety and regulatory issues, legislative issues, socio-political issues, economic issues and many technical issues. The debate concluded that there were different regulatory approaches in member countries regarding the definition of an NPP's lifetime and its extension; that safety is a prerequisite for any life extension; that extending the life of an NPP generally has considerable economic advantages; that in some countries, social and political considerations could play a significant role; and that NPP life management is a very important topic for member countries on which the OECD/NEA should continue its work.

184. The Multinational Design Evaluation Programme (MDEP) Policy Group met in March 2008 and approved the continuation of the programme, merging the current three stages into a single programme. It also approved a working group structure composed of two Design Specific Groups — Evolutionary Power Reactor (EPR) and AP1000 — and three Issues Specific Groups — Codes and Standards, Vendor Inspection Cooperation and Digital Instrumentation and Control Standards. The Codes and Standards Working Group will address the pressure boundary component design codes developed in Canada, France, Japan, Republic of Korea, Russian Federation and USA, and will evaluate differences to improve the effectiveness and efficiency in regulatory decision making. The Vendor Inspection Cooperation Working Group is related to the regulatory inspection of the design, manufacturing and supply of nuclear reactor systems, structures and components that have a safety function. Finally, the Digital Instrumentation and Control Working Group aims to identify and prioritize the MDEP member countries' challenges, practices, and needs regarding standards and guidance for digital instrumentation and control.

185. Drawing on developments in the last decade, the Radioactive Waste Management Committee (RWMC) has finalized a new collective statement on 'Moving Forward with Geological Disposal'. This collective statement expresses the collective views on why geological disposal remains an appropriate waste management choice for the most hazardous and long-lived radioactive wastes, on the current status, on challenges and opportunities associated with implementation and on expectations for further development of geological repositories.

186. The recently established Working Group on the Regulation of New Reactors (WGRNR) agreed on the importance of developing a construction experience database and decided to collect inspection findings during constructions of new NPPs, and the need to develop criteria for reporting. Regarding the regulation of nuclear sites, members agreed to review the various practices used in the regulation of nuclear power plant sites, including seismicity issues, security issues, multi-units aspects and regulator practices on sites where a mixture of activities are taking place (e.g., operating units, new construction, decommissioning, etc.).

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

187. Every organization in the world that operates a nuclear electricity generating 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.

188. WANO conducted peer reviews at 29 NPPs during 2008, altogether 387 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 Institute of Nuclear Power Operations (INPO) and Japan Nuclear Technology Institute (JANTI) reviews.

189. WANO continues to emphasize technical support missions, which focus on providing assistance in selected areas, with more than 200 technical support missions undertaken during 2008. Many of these technical support missions included experts from other WANO regions sharing their experiences to support improvements in operational safety.

190. 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.

191. WANO also conducted its second Plant Managers' Conference in Prague, Czech Republic from 10 to 12 November 2008. More than 120 plant managers attended this successful two-day conference, with discussions focused on the themes of 'Leadership to Improve Performance' and 'Use of Operating Experience.' In addition, each WANO region held workshops and seminars throughout the year on a variety of topics related to NPP operations.

F. Safety significant conferences in 2008[7]

F.1. International Conference on Radioecology and Environmental Radioactivity

192. The International Conference on Radioecology and Environmental Radioactivity was held in Bergen, Norway from 15 to 20 June 2008. It was organized by the Norwegian Radiation Protection Authority and the French Institute for Radiation Protection and Nuclear Safety in cooperation with the Agency, the International Commission on Radiological Protection, the International Union of Radioecology, the Journal of Environmental Radioactivity, the OECD/NEA and the WHO. The Conference provided a forum for experts from industry, government, international organizations and non-governmental organizations to identify environmental risk assessment needs and requirements and included sessions devoted to environmental protection, risk assessment, emergency preparedness and rehabilitation, naturally occurring radioactive material, radioactive waste, and radiation and society.

193. Participants expressed diverse opinions, particularly regarding the integration of radiation protection principles and methodologies with those of environmental protection. Participants supported an integrated approach to protection of the environment that takes into consideration both non-radiological and radiological factors. The Conference highlighted the importance of the Agency's effort to coordinate approaches and methodologies for radiation protection of both humans and the environment and identified the needs for effective knowledge management and a new generation of experts.

F.2. International Workshop on Lessons Learned from Strong Earthquakes

194. This international workshop — hosted by the Nuclear and Industrial Safety Agency (NISA), Nuclear Safety Commission (NSC) and Japan Nuclear Energy Safety Organization (JNES) in Kashiwazaki, Japan —was organized by the Agency from 19 to 21 June 2008 to share recent technical knowledge and approaches on designing and maintaining the robustness of NPPs to safely withstand such severe external hazards. The workshop attracted more than 300 participants from 28 countries and two international organizations. The design of a new generation of NPPs was a primary topic of discussion, along with the concept of 'back-checking' — a process of examining the structural integrity, functionality and seismic safety of existing facilities to a seismic hazard higher than the original design basis. Key conclusions of the workshop included:

- Seismic hazard evaluation continues to be a key element of assuring seismic safety of NPPs;
- Site-specific information and a full understanding of the geological, tectonic and seismological features of an NPP site are critical to seismic safety;
- Design and safety regulations play a critical role in maintaining NPP robustness; and
- Information from the Kashiwazaki-Kariwa NPP experience is providing valuable input to the Agency safety standards.

[7] 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.

195. A related Agency-led workshop on the effects of tsunamis on NPPs was held on 23–27 June 2008 in Daejon, Republic of Korea, where participants exchanged information on training and software available for modeling and calculation of tsunami hazards at NPP sites. Participants will apply the discussed methodology and software at specific sites and the results will be followed up at the next workshop tentatively planned for 2009.

F.3. Workshop on the roles and responsibilities in relation to safety of vendor countries and countries embarking on nuclear power programmes

196. From 1 to 3 July 2008, the Agency conducted a workshop in Vienna on the roles and responsibilities in relation to safety of vendor countries and countries embarking on nuclear power programmes, with participants from 43 countries. The workshop provided a forum for vendors, utilities, regulatory bodies, and industry organizations to share their experiences regarding challenges encountered during the development of nuclear power programmes from financial, project management, construction management, regulatory, and operational perspectives. Countries interested in embarking on nuclear power were encouraged to utilize these experiences in their planning.

F.4. Seventh European Commission Conference on the Management and Disposal of Radioactive Waste (EURADWASTE ´08)

197. EURADWASTE ´08[8] was held in Luxembourg from 20 to 22 October 2008. The conference brought together researchers, radioactive waste management organizations, policy-makers, regulators, engineers and educators to discuss the underground disposal of spent nuclear fuel and long-lived high level radioactive waste, as well as the impact of advanced fuel cycles (partitioning and transmutation) on deep geological repositories.

198. The first day of the conference dealt with the strategic, economic and socio-political aspects of geological disposal. As the strategy and needs of each country vary so widely, finding common ground to some of the issues on a European level proved to be a challenging task.

199. The second part of the conference was dedicated to discussing the scientific and technical aspects of partitioning and transmutation, which aim to reduce the amount and toxicity of radioactive waste, the near- and far-field issues that impact the development of geological repositories, engineering studies, and aspects such as overall performance and safety assessment of these repositories. Approximately 270 scientists, engineers, politicians and regulators, and specialists in converging areas had a rare opportunity to hear about the state of play in the various disciplines related to radioactive waste management. Results from FP6 (Sixth Framework Programme) projects were presented and future directions for projects funded under Euratom in FP7 were discussed.

F.5. 12th International Congress of the International Radiation Protection Association (IRPA 12)

200. IRPA 12, which was co-sponsored by the Agency, was held in Buenos Aires, Argentina from 20 to 24 October 2008. The event attracted more than 1 300 participants from 90 countries and was the largest international meeting on radiation protection to date.

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[8] http://cordis.europa.eu/fp7/euratom-fission/euradwaste2008_en.html

201. IRPA 12 featured an extensive technical programme divided into three sections; Epistemology - status of levels and effects of radiation exposure; the radiation protection paradigm; and radiation safety in practice. The three sections included in total 20 refresher training courses, three seminars, three poster sessions, eight plenary sessions and 40 technical sessions.

202. A number of special plenary sessions were included in the programme with presentations on: the status of levels and effects of radiation; harmonization of recommendations; radiation safety in practice: towards an international safety regime; low dose and low-dose-rate effects and models; the epistemology of radiation protection; radiation protection paradigm; and stakeholder involvement in decision making.

203. All papers and training material from the congress will be available on the IRPA 12 website[9]. The meeting records will contain a summary of the various technical sessions.

204. A highlight of IRPA 12 was the presentation of the Sievert Lecture by Professor Christian Streffer from Germany, recipient of the Sievert Award. His lecture was entitled 'Radiological Protection: Challenges and Fascinations of Biological Research'. In this lecture, Professor Streffer outlined the limitations faced by epidemiological studies in providing low dose radiation effects information. He also provided a review of recent biological studies at the molecular level.

F.6. International Conference on Topical Issues in Nuclear Installation Safety: Ensuring Safety for Sustainable Nuclear Development

205. This conference was organized by the Agency and hosted by the Government of India from 17 to 21 November 2008 in Mumbai. Over 200 participants from 33 countries and three international organizations participated.

206. Conference participants noted that the nuclear safety approach is based on the philosophy developed in the 1960s: defence in depth principle and deterministic criteria. When properly applied and complemented by probabilistic analyses and operational experience feedback, it should continue to be successful. However, guarding against the risk of accidents requires constant vigilance and high technical competence and a never ending fight against complacency. Strong leadership with a commitment to continuous improvement and a vision of sustained excellence is a key element of nuclear safety.

207. To collaborate on safety matters is in the interest of Member States. Conference participants concluded that all Member States should be parties to the relevant international legal instruments applicable to the peaceful use of nuclear energy, including on civil liability for nuclear damage. The Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, international cooperation through the Agency and other organizations, and bilateral and multilateral arrangements are an important element for establishing networks for sharing and transferring knowledge.

208. The Conference also confirmed that countries embarking on nuclear power assume a very important safety responsibility that cannot and must not be delegated. Therefore, the establishment of a sustainable national safety infrastructure is an essential foundation for ensuring the safe design, construction, operation and decommissioning of nuclear power plants. The process involves the development of a governmental, legal and regulatory framework as well as the necessary education

[9] http://www.irpa12.org.ar/index.htm

and training, technical capacity building and integrated approach to safety, and safety management for all nuclear stakeholders.

209. Participants noted that vendor countries that are supplying nuclear technology, materials and equipment to the new entrants have a moral responsibility and common interest in the creation of strong safety infrastructure in the recipient countries. Specific Agency safety guides for countries embarking on nuclear power will be enhanced or developed, and tailored safety reviews should be required at various stages of programme development.

210. In a panel discussion on the synergy between safety and security, it was generally agreed that it is vital in the current environment that synergies should be maximized, and that a culture needs to be developed that harmonizes safety and security requirements. It was recognized that both safety and security have the same purpose: protecting people, society and the environment.

211. Conference participants also discussed operating experience feedback, quality of the supply chain; emergency preparedness and response and the need to build and sustain technical capacity through education and training programmes.

G. Safety significant events in 2008

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

213. 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.[10]

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

215. Events of interest that were reported to the Agency in 2008 include:

- *Ascó NPP, Spain (Pressurized Water Reactor)*: (2007-11-29) During an extended periodic radiological surveillance outside the controlled area on

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

2 April 2008, several solid radioactive particles were detected both within and beyond the site area of Ascó 1 NPP. It was determined that these particles were released through the chimney of the fuel building ventilation system, which was contaminated during cleaning operations of the fuel transfer channel at the end of the refuelling outage on 26 November 2007. The Consejo de Seguridad Nuclear (CSN) sent an inspection team to search for evidence and possible causes, and to make independent radiological verifications. The CSN also ordered a deeper investigation including root cause analysis and a radiological review of exposed people. The CSN was not notified of the 26 November 2007 event, even though this was required. Additionally, the ventilation system was set to normal on 29 November 2007, bypassing HEPA filters, without checking contamination levels inside ventilation conduits.
An extensive program of radioactive measurement has been carried out on workers and others who have been on the site since 28 November 2007, as well as students from local schools and people living in the vicinity of the plant on a voluntary basis. Of the more than 2,500 cases where people have been measured, no contamination has been found.
An INES rating of Level 2 has been assigned to this event. (Level 1 for the uncontrolled radiological release, plus one due to additional factors on safety culture deficiencies.)

- *Rades, Tunisia (radiography)*: (2008-03-23) A worker in industrial radiography carried by hand an unshielded Ir-192 radioactive source. The estimated whole body dose was 2 Gy to one worker and 0.5 mSv to another worker. The regulatory authority became aware of the event on 19 April 2008. Following a request for assistance from Tunisia, the Centre National de Radio-Protection (CNRP) and the Agency made arrangements for the most exposed worker to be treated at a specialist facility in France. The Agency also conducted a mission, with the full cooperation of Tunisian authorities, to Tunisia for the purposes of accident scenario reconstruction and dose reconstruction.
No INES rating was assigned to this event.

- *Seibersdorf, Austria*: (2008-08-03) Pressure build-up in a small sealed sample bottle in a storage safe resulted in plutonium contamination of a storage room at the Agency's Safeguards Analytical Laboratory. Nobody was working in the laboratory at the time. The laboratory's safety system detected plutonium contamination in the storage room where the safe was located and in two other rooms; this was subsequently confirmed by Agency radiation protection experts. The laboratory's safety systems, including an air-filtering system, prevented any release to the environment. A full investigation of the incident was conducted and the laboratory decontaminated.
An INES rating of Level 1 was assigned to this event.

- *Krsko NPP, Slovenia (Pressurized Water Reactor)*: (2008-06-04) The Krsko NPP was safely shut down following detection of a primary circuit leak earlier in the day. The operator classified the event as an unusual event and emergency level zero. It was later determined that the stem seal of the isolation valve on the hot leg loop 2 was found to be leaking. There was no demand on the safety systems. The loss of coolant was controlled by the charging flow. There was no need for off-site protective measures since there were no releases to the environment. The shut down was performed in a controlled way by following the general operating procedures. As this was the first time Krško NPP and Slovenian Nuclear Safety Regulator were mobilized for an actual event (not an

exercise), the event attracted large attention from European emergency centres, media, politicians and general public.
An INES rating of below scale/Level 0 was assigned to this event.

- *SOCATRI Nuclear Facility, Bollène (Vaucluse), France*: (2008-07-07) A tank of the uranium-bearing effluent treatment station (STEU) at the facility overflowed, resulting in spillage of a solution containing uranium to the environment. The solution both percolated in the soil within the SOCATRI facility boundary and flowed through rain collectors to local rivers. On 9 July 2008, SOCATRI removed the contaminated soil to prevent underground migration of uranium. The French Nuclear Safety Authority (ASN) conducted a thorough investigation of the incident and issued a number of directives, including forbidding the use of certain equipment and the implementation of an extended monitoring system. As a precaution, on the advice of ASN, restrictions were placed on nautical and fishing practices and the use of water for irrigation and drinking purposes. These restrictions were lifted on 22 July 2008. The incident resulted in large media coverage and two press conferences were organized to inform the public about the incident and its consequences.
  An INES rating of Level 1 was assigned to this event.

- *Institute for Radioelements (IRE)-Fleurus, Belgium*: (2008-08-22) Following the transfer of liquid radioactive waste from one tank to another, I-131 was released through a vent stack. The quantity of radioactivity released into the environment is estimated at 45 GBq I-131, which corresponds to a dose of 160 microsievert (effective dose) for a hypothetical person remaining permanently at the site's enclosure. A ban on fresh fruits and vegetable and rain water use in the areas was implemented as a countermeasure from 28 August to 7 September 2008. Radioactivity was not detected by the Belgian or European monitoring networks. The incident did not cause a contamination of the personnel, and no dose limits were exceeded.
  An INES rating of Level 3 was assigned to this event.

216. In addition, there have been a number of events involving contaminated goods or radioactive sources detected in scrap metal. In some of them, the Agency has facilitated the exchange of information among Member States or provided assistance in recovering the source. Examples of this type of event include:

- *Port of Colombo, Sri Lanka and Continuo, Benin*: (2008-01-08) On arrival in Sri Lanka, a shipping container was screened for radiation using a portal monitor system and gamma and neutron radiation was detected. The Atomic Energy Authority of Sri Lanka recommended that the container be returned to the point of origin. The ship arrived back at the port of Continuo, Benin on 16 April 2008. Upon request of the Benin authorities, the Agency provided assistance in off-loading the container and recovering the source. Agency staff took measurements of the container before it was off-loaded and provided guidance on the temporary storage of the container to maximize security and minimize exposure to workers. The source recovery was later performed by a field team from France. The source was isolated and locked up in a small storage building until it could be properly packaged and transferred.

- *Puerto Cortes, Honduras*: (2008-10-31) A shipping container loaded with scrap metal triggered alarms from portal monitors at the port and was isolated at the facility. A survey of the outside of the container was completed on 5 November 2008 and the source located. The Honduran Government

requested assistance from the USA and an expert was sent. The source was recovered and placed in a locked shipping container for temporary storage. At the request of Honduran authorities, the Agency is providing advice regarding an appropriate container to transport the source to a more permanent storage facility.

217. The 2008 joint OECD/NEA–Agency meeting of the IRS coordinators discussed corrective actions and lessons learned from 22 recent events that occurred in NPPs. One event was discussed in detail:

- *Pickering 6, Canada (Pressurized Heavy Water Reactor)*: (2007-01-06) On 6 January 2007, with Pickering Unit 6 operating at low power critical, maintenance was performed to eliminate a hot spot associated with a fuse terminal block on the assumption that this was one of the redundant power supplies for the shut-off rod clutch current. Following removal of the fuse, panel meters in the control room indicated two shutoff rods had fallen into the core and that the regulating system was attempting to drive them out. Alternative indications provided conflicting information and the decision was made to manually trip the reactor.
  The resulting investigation determined that the station documentation regarding the fuses was incorrect, even though this had been reviewed in 2005. The investigation concluded that: a questioning attitude was partially applied, but should have been more rigorous; there was a lack of adequate independent verification; complacency and overconfidence led to not documenting uncertainty; and roles and responsibilities were not clearly communicated or reinforced. There were no radiological consequences from this incident.

H. Safety Networks

H.1. Asian Nuclear Safety Network (ANSN)

218. During 2008, the ANSN continued to develop with hubs in China, Japan and Republic of Korea and national centres in Indonesia, Malaysia, Philippines, Thailand and Vietnam. Australia, France, Germany, Japan, the Republic of Korea and USA provide in-kind and/or financial support to ANSN through the Extrabudgetary Programme on the Safety of Nuclear Installations in South East Asia, Pacific and Far East Countries (EBP-Asia).

219. In April 2008, a strategy dialogue meeting was held in Vienna. Senior representatives of the ANSN participating countries discussed the development of the ANSN, its usefulness to date, and, most importantly, strategies for future enhancement of nuclear safety in the Asian region. In view of the rapid expansion of nuclear power programmes in Asia, additional cooperation and timely efforts to establish effective nuclear safety infrastructure will be required. In this regard the ANSN is an existing and powerful tool which could be utilized, at a more strategic level, to promote safety in the region in developing a regional capacity building system.

220. The ANSN Steering Committee, co-chaired by Malaysia and Japan, met in October 2008 in Malaysia. For the first time, in addition to its usual mandate to coordinate ANSN development in the direction given by the strategy dialogue meeting, the steering committee discussed results of 2008 activities and the work programme for 2009.

221. The topical groups are an important part of the ANSN and in 2008 attained higher status and increased resources. The topical groups participate in the integrated safety evaluation process, propose and implement regional workshops and training courses and identify knowledge to upload in the IT network. A new topical group on governmental and regulatory infrastructure was created in 2008 and future activities on siting and public awareness are under consideration.

222. The Agency's ANSN website improved in 2008 with the continuous upload of the material of past ANSN activities and the management of the ANSN. Work started in 2008 to reinforce the security of the network and to update the software.

223. To increase the ANSN outreach, the bi-weekly ANSN Newsletter continues to be widely distributed worldwide. In 2008, a promotional meeting was conducted in Malaysia to present the ANSN to some 300 specialists of the scientific community.

224. Increasing cooperation with the Forum of Nuclear Cooperation in Asia (FNCA) took place in 2008 with Agency participation in a FNCA Panel meeting and a representative of FNCA attending the ANSN steering committee meeting. Discussions are still in progress with the Association of Southeast Asian Nations (ASEAN) to look into the possibility of cooperation between ANSN and the ASEAN nuclear energy safety sub-sector network.

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

225. In 2008, the installation of the server in Brazil hosting the Network was fully implemented. The Network contains technical knowledge of regulatory interest in areas such as radiological protection of patients, safety of radioactive sources, national and Agency safety standards, national legislation and education and training. The Network is populated with resources provided by participating countries. Resources are classified and uploaded according to an agreed taxonomy that allows efficient interrogation and retrieval by registered users. The Network also provides a working environment for implementing specific projects (see section C.4). Project working group spaces provide participants with common access to drafts and results and meeting reports, as well as teleconferencing facilities.

H.3. International Decommissioning Network (IDN)

226. As a 'network of networks', the IDN was formed to coordinate and build efforts aimed at assisting Member States in the sharing of practical decommissioning knowledge. Within the IDN, organizations with a demonstrated record of excellence in a wide range of areas offer to share their experience. In 2008, the IDN organized a workshop hosted by Spain on waste management and clearance, and a workshop hosted by Belgium on size reduction for decommissioning of nuclear facilities.

H.4. International low level waste disposal network

227. To build credibility in national low level waste disposal programmes, the Agency is creating a non-commercial network as a forum for the prompt, open and efficient transfer and exchange of knowledge gained. Member States with less advanced programmes will benefit from the experience of organizations with advanced designs and disposal facilities in operation.

H.5. Global Nuclear Safety Network (GNSN)

228. A major impetus for the GNSN was provided by the G8 NSSG in 2007 and it continues to be supported by them. In addition, the Commission of Eminent Persons recommended in their report on

the future of the Agency that the Agency lead an international effort to establish a global nuclear safety network.

229. The GNSN is the set of existing networks and information resources i.e. internationally accessible information and data sources, whether open or password protected. This includes active or latent interactions between them that can support work related to nuclear safety matters. The aim of the GNSN is to ensure that critical knowledge, experience, and lessons learned about nuclear safety are exchanged as broadly as they need to be.

230. In 2008, a prototype platform for the GNSN was established. The aim is to have all safety related networks and information resources made visible and available through links on this platform. Ultimate responsibility for the content and quality remains with the respective providers of the information.

H.6. International Regulatory Knowledge Network (RegNet)

231. The objective of RegNet is to achieve and promote radiation and nuclear safety and security by: enhancing effectiveness and efficiency of international cooperation in the regulation of nuclear, radiation, transport and waste safety, and nuclear security, as well as preparedness and response to nuclear and radiological emergencies; enabling adequate access for regulators to relevant safety and security information; promoting dissemination of information on safety and security issues as well as information of good practices for addressing and resolving such issues; enabling synergies among different web based networks to strengthen and enhance the global nuclear safety regime; and providing additional information to the public on international regulatory cooperation in safety and security matters.

232. In 2008, the Agency established a task group and held a series of meetings to prepare and design the concept and programme. It is expected that RegNet will be operational in 2010.

Appendix 2
The Agency's Safety Standards: Activities during 2008

A. Introduction

233. 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.

234. The year 2008 marked the 50th anniversary of the IAEA Safety Standards programme. The first IAEA Safety Series publication, entitled Safe Handling of Radioisotopes, was issued in December 1958. Since then more than 200 safety standards have been published. The experience accumulated over these 50 years, and the focus on continuous improvement, have resulted in the global recognition of the high quality and relevance of the safety standards. A wide interest in and use of the safety standards worldwide are observed today.

235. The main achievement during the year was the approval by the Commission on Safety Standards of a roadmap for the long term structure of safety standards, which provides for an improved structure and format for the Safety Requirements and a set of criteria for the collection of Safety Guides.

236. A number of strategies for improving the safety standards programme were discussed by the Safety Standards Committees and the Commission on Safety Standards in 2008. For the Safety Standards Series**,** the strategies pertained to completeness, logical and top-down relationships, consistency, user-friendliness, and manageability of the number of publications. For the safety standards content, the strategies pertained to consensus on high levels of safety and best international practices. For the safety standards review and approval process, the strategies pertained to rigour, transparency, high level approval and effectiveness of feedback mechanisms. The IAEA Safety Standards programme was an agenda item for the Senior Regulators' Meeting, held in conjunction with the 52nd regular session of the General Conference. The discussions during this agenda item confirmed that the programme was headed in the right direction.

237. The Safety Requirement relating to the Safety of Nuclear Fuel Cycle Facilities was published in 2008 and three draft Safety Requirements (on the Predisposal Management of Radioactive Waste, the Safe Transport of Radioactive Material and the Safety Assessment for Facilities and Activities) were adopted as Agency standards by the Board of Governors in 2008.

238. In 2008, the revision of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) continued and a draft 1.0 was reviewed

by the Safety Standards Committees at their meeting in October and November 2008. Revised drafts of Safety Requirements No. GS-R-1: *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety* and No. NS-R-2: *Safety of Nuclear Power Plants: Operation* were submitted to Member States for comment in 2008. The revision of the Safety Requirements No. NS-R-1: *Safety of Nuclear Power Plants: Design* is progressing with a view to its submission to Member States for comment in 2009.

239. 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. These improvements were facilitated by the use of information technologies and in particular, the newly established interactive website[11].

240. The IAEA Safety Glossary, which represents the international consensus on the terminology used in the safety standards, has been published in all official languages. This work will assist in ensuring consistency in the six languages throughout all safety standards. A process of review and revision of the IAEA Safety Glossary has been initiated in 2008 with the aim of the further harmonizing and clarifying terminology usage in the safety standards, through the use and the possible joint sponsorship of a more prescriptive, globally agreed upon set of definitions of terms in the safety standards.

241. Since the establishment of the Commission on Safety Standards and the Committees in 1995, 95 standards have been established; of these, 89 (one Safety Fundamentals, 14 Safety Requirements and 74 Safety Guides) have been published; and 57 further standards (eight Safety Requirements publications and 49 Safety Guides) are being drafted or revised. A list of published IAEA Safety Standards, indicating their status as of 31 December 2008, is attached as Annex I, and an up-to-date status report can be found on the Agency's website[12]. The full texts of published IAEA Safety Standards are also available on the website.

B. Commission on Safety Standards (CSS)

242. The CSS commenced a new four year term starting from 1 January 2008. Mr. Lacoste, Chair of the French Nuclear Safety Authority, was reappointed as Chairman. New countries represented by senior officials at the CSS are Belgium, Finland, Lithuania, Ukraine and Vietnam. An invitation to participate as observers[13] has been extended to the Chair of the International Nuclear Safety Group (INSAG) and to the Chair of the Advisory Group on Nuclear Security (AdSec).

243. The CSS met twice in 2008, in May and in September and endorsed the submission to the Board of Governors for approval of three draft Safety Requirements publications on: Safe Transport of

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

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

[13] In addition to INSAG and AdSec, observers include the European Commission (EC), International Commission on Radiological Protection (ICRP) and Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA).

Radioactive Material, revision of TS-R-1, Predisposal Management of Radioactive Waste Management, revision of WS-R-2, and Safety Assessment for Facilities and Activities. The CSS also endorsed in 2008 for publication the draft Safety Guides on: Compliance Assurance for the Safe Transport of Radioactive Material (DS327), Safety of Uranium Fuel Fabrication Facilities (DS317), Safety of MOX Fuel Fabrication Facilities (DS318), Safety of Conversion and Enrichment Facilities (DS344), Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors (DS340), Safety Assessment for Decommissioning of Facilities Using Radioactive Material (DS376), Borehole Facilities for the Disposal of Radioactive Waste (DS335), Management System for Nuclear Installations (DS349), Ageing Management for Nuclear Power Plants (DS382), Seismic Evaluation for Nuclear Power Plants (DS383), Classification of Radioactive Waste (DS390), and Severe Accident Management Programme for Nuclear Power Plants (DS385).

244. CSS also approved in 2008 document preparation profiles (DPPs) for three new Safety Guides on Establishing a National Nuclear Installations Safety Infrastructure (DS424), Radiation Safety in Well Logging (DS419) and on Radiation Safety for Nuclear Gauges (DS420). The CSS also approved DPPs for the revision of Safety Guides on Evaluation of Seismic Hazards for Nuclear Installations, revision of NS-G-3.3 (DS422) and on Periodic Safety Review of Nuclear Power Plants, revision of NS-G-2.10 (DS426).

C. Nuclear Safety Standards Committee (NUSSC)

245. NUSSC commenced a new three year term on 1 January 2008. Forty eight Member States have nominated experts as members of NUSSC, of whom three are corresponding members. In addition, six international organizations attend NUSSC meetings as observers[14].

246. NUSSC, chaired by Mr. Geoff Vaughan of the Nuclear Installations Inspectorate of the United Kingdom, met twice in May and October 2008.

247. In 2008, five Safety Guides were published: Conduct of Operations at Nuclear Power Plants, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors, Operational Limits and Conditions and Operating Procedures for Research Reactors, The Management System for Technical Services in Radiation Safety, and Core Management and Fuel Handling for Research Reactors.

248. At its meetings in May and November 2008, NUSSC approved ten draft IAEA Safety Standards for submission to the CSS, namely Safety of Uranium Fuel Fabrication Facilities, Safety of MOX Fuel Fabrication Facilities, Safety of Conversion and Enrichment Facilities, Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors, Development and Application of Level 2 PSA for NPPs, Development and Application of Level 1 PSA for NPPs, Deterministic Safety Analysis and their Application for NPPs, Ageing Management for NPPs, Seismic Evaluation of Existing Nuclear Installations, and Severe Accident Management Programmes for NPPs.

[14] EC, FORATOM, International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), OECD/NEA, and World Nuclear Association (WNA).

249. In addition NUSSC reviewed and commented on 13 draft safety standards dealing with nuclear safety issues, such as regulatory infrastructure, operation, ageing, decommissioning, safety assessment, management systems, seismic hazards, as well as radiation protection aspects.

250. In 2008, NUSSC approved DPPs for four new safety standards.

251. NUSSC also discussed twice the ongoing issue of the strategy for the future development and application of the IAEA Safety Standards, in particular the set of Safety Guides for 2015 according to the Roadmap on the Long Term Structure for Safety Standards approved by the CSS.

252. As for working methods, NUSSC has agreed to a new procedure with regard to NUSSC members commenting on documents after the Member State comment period. NUSSC also introduced a new permanent agenda item on 'Feedback on Regulatory Arrangements, Developments and Using IAEA Safety Standards'.

D. Radiation Safety Standards Committee (RASSC)

253. RASSC commenced a new three year term on 1 January 2008. Fifty-nine Member States have nominated experts as members of RASSC, of whom nine are corresponding members. In addition, 13 international and regional organizations attend RASSC meetings as observers[15].

254. RASSC, chaired by Mr. Sigurdur Magnusson of the Icelandic Radiation Protection Institute, met in March-April and November in 2008. Both meetings included a joint session with WASSC to discuss issues of common interest.

255. In 2008, RASSC approved the Safety Requirements "Regulations for the Safe Transport of Radioactive Material" 2009 Edition, the Safety Requirements "Safety Assessment for Facilities and Activities", the Safety Guide on the Application of Management System for Nuclear Installations, and the Safety Guide on the Classification of Radioactive Waste. RASSC approved DPPs for three new Safety Guides.

256. RASSC and WASSC reviewed draft 1.0 of the revised International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources at its meeting in November. More than 1200 written comments were provided, many of which were editorial or suggestions to improve the text, while there were also many substantive issues. More than three days of the November meeting were spent discussing these substantive issues, for RASSC and WASSC to provide guidance on the further development of the revised BSS.

[15] EC, Food and Agriculture Organization of the United Nations (FAO), ICRP, IEC, International Labour Organization (ILO), International Radiation Protection Association (IRPA), ISO, International Source Suppliers and Producers Association (ISSPA), OECD/NEA, Pan American Health Organization (PAHO), United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), World Health Organization (WHO), and WNA.

E. Transport Safety Standards Committee (TRANSSC)

257. TRANSSC commenced a new three year term on 1 January 2008. Fifty Member States have nominated experts as members of TRANSSC, of whom six are corresponding members. In addition, 11 international and regional organizations attend TRANSSC meetings as observers[16].

258. TRANSSC, chaired by Mr. E. William Brach of the US Nuclear Regulatory Commission, met in March and October in 2008.

259. In 2008, TRANSSC approved the Safety Requirements "Regulations for the Safe Transport of Radioactive Material" 2009 Edition, the Safety Requirements "Safety Assessment for Facilities and Activities", approved two draft Safety Requirements documents and two draft Safety Guides for submission to Member States for comments and approved DPPs for three new Safety Guides.

260. TRANSSC reviewed draft 1.0 of the revised International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources at its meeting in October, examining the transport related written comments to support the work of RASSC.

261. In October TRANSSC carried out a comprehensive review of the transport portfolio (all of the Agency activities and outputs related to transport safety) in order to provide guidance for the future programme of work in the transport area. This review confirmed the need for the current transport safety standards, provided advice on how they should be modified in future and suggested changes in the supporting products that are required to provide for the effective implementation of the standards.

262. The issue of denial of shipment of radioactive materials was discussed at both TRANSSC meetings in 2008, and TRANSSC provided a comprehensive examination of the issue in its October meeting accompanied by an extensive list of recommended actions to help address the issue.

F. Waste Safety Standards Committee (WASSC)

263. WASSC commenced a new three year term on 1 January 2008. Fifty five Member States nominated experts as members of WASSC, of whom nine are corresponding members. In addition, six international and regional organizations attend WASSC meetings as observers[17].

264. Mr. Thiagan Pather of the National Nuclear Regulator body of South Africa has been reappointed as Chairman of WASSC.

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[16] EC, International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), International Federation of Air Pilots Association (IFALPA), International Maritime Organization (IMO), ISO, ISSPA, United Nations Economic Commission for Europe (UNECE), WNA, the World Nuclear Transport Association (WNTI) and the Steering Committee of Denials of Shipment Management Group.

[17] EC, European Nuclear Installations Safety Standards Group of FORATOM (ENISS), ISO, ISSPA, OECD/NEA, and WNA.

265. WASSC met in April and November 2008. Both meetings included joint sessions with RASSC to discuss issues of common interest.

266. In 2008, WASSC approved for submission to the CSS two draft Safety Requirements publications: “Regulations for the Safe Transport of Radioactive Material”, 2009 Edition and “Safety Assessment for Facilities and Activities”. WASSC also approved for submission to the CSS draft Safety Guides on: Management System for Nuclear Installations and Classification of Radioactive Waste.

267. In addition, WASSC approved for submission to Member States for comments two Safety Requirements draft documents on: Safety of NPPs; and Operation and Governmental and Regulatory Framework for Nuclear, Radiation, Radioactive Waste and Transport Safety. WASSC also approved for submission to Member States for comments two draft Safety Guides on Licensing of Nuclear Facilities and Evaluation of Seismic Hazards for Nuclear Facilities.

268. WASSC also approved DPPs for Safety Guides on Evaluation of Seismic Hazards for Nuclear Facilities and Establishing a National Nuclear Safety Infrastructure.

269. At both meetings, WASSC received progress reports on the revision of the BSS and the waste safety standards under development. At the April meeting, WASSC members received reports on the working methods and functioning of WASSC including its website, and on the evolution of the structure of waste safety standards related to the long term structure of safety standards. In the November 2008 meeting, WASSC contributed to the discussion of issues arising from the first revision of the BSS and provided guidance on resolving those issues. At the November meeting, WASSC agreed to establish a Joint Subgroup of WASSC and TRANSSC to discuss and elaborate on issues of common interest.

Annex I
The published IAEA Safety Standards as of 31 December 2008

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)

Safety Guides in the Safety Series 50-SG

Q8	Quality Assurance in Research and Development (under revision)
Q9	Quality Assurance in Siting (under revision)
Q10	Quality Assurance in Design (under revision)
Q11	Quality Assurance in Construction (under revision)
Q12	Quality Assurance in Commissioning (under revision)
Q13	Quality Assurance in Operation (under revision)
Q14	Quality Assurance in Decommissioning (under revision)

One Safety Guide is being developed on management system for nuclear installations to replace the above Q8 to Q14 guides.

B.4. Assessment and Verification

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

One Safety Requirement on safety assessment for facilities and activities and 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)
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

WS-R-2	Predisposal Management of Radioactive Waste, including Decommissioning (2000) (under revision)
WS-G-1.2	Management of Radioactive Waste from the Mining and Milling of Ores (2002) (under revision)
WS-G-2.3	Regulatory Control of Radioactive Discharges to the Environment (2000)
WS-G-2.5	Predisposal Management of Low and Intermediate Level Radioactive Waste (2003)
WS-G-2.6	Predisposal Management of High Level Radioactive Waste (2003)
WS-G-2.7	Management of Waste from the Use of Radioactive Materials in Medicine, Industry, Agriculture, Research and Education (2005)
WS-G-6.1	Storage of Radioactive Waste (2006)
111-G-1.1	Classification of Radioactive Waste (1994) (under revision)

One 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)

B.10. Transport Safety

TS-R-1	Regulations for the Safe Transport of Radioactive Material 2005 Edition (2005) (2009 update adopted, awaiting publication)
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)

Two Safety Guides on compliance assurance and schedule of provisions are 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)
NS-G-1.2	Safety Assessment and Verification for Nuclear Power Plants (2002)
NS-G-1.3	Instrumentation and Control Systems Important to Safety in Nuclear Power Plants (2002)
NS-G-1.4	Design of Fuel Handling and Storage Systems for Nuclear Power Plants (2003)
NS-G-1.5	External Events Excluding Earthquakes in the Design of Nuclear Power Plants (2004)
NS-G-1.6	Seismic Design and Qualification for Nuclear Power Plants (2003)
NS-G-1.7	Protection against Internal Fires and Explosions in the Design of Nuclear Power Plants (2004)
NS-G-1.8	Design of Emergency Power Systems for Nuclear Power Plants (2004)
NS-G-1.9	Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants (2004)
NS-G-1.10	Design of Reactor Containment Systems for Nuclear Power Plants (2004)
NS-G-1.11	Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants (2004)
NS-G-1.12	Design of the Reactor Core for Nuclear Power Plants (2005)
NS-G-1.13	Radiation Protection Aspects of Design for Nuclear Power Plants (2005)
79	Design of Radioactive Waste Management Systems at Nuclear Power Plants (1986)

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

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-2.14	Conduct of Operations at Nuclear Power Plants (2008)

Four Safety Guides on ageing management, seismic evaluation of existing nuclear facilities, on severe accident management and on chemistry are 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)
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 and ageing management are being developed.

C.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.

C.5. Radiation Related Facilities

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

Six Safety Guides on medical uses, 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.

C.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)

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