APPENDIX E3

Product stewardship

THE OLYMPIC DAM EXPANSION
IN THE CONTEXT OF THE
INTERNATIONAL NUCLEAR FUEL CYCLE

THE OLYMPIC DAM EXPANSION IN THE CONTEXT OF THE INTERNATIONAL NUCLEAR FUEL CYCLE

1 PURPOSE

The purpose of this Appendix is to:

(a) explain the civil nuclear fuel cycle (NFC) and to show how copper concentrate containing uranium (concentrate) produced from the Olympic Dam expansion and the combined operations at Olympic Dam would form a part of the NFC

(b) discuss the various controls and safeguards in place under international and domestic law which would cover the whole of the NFC from the mining and milling of uranium in Australia through export, transport, processing, storage and use in China, which is the current preferred export destination

(c) describe the systems and controls that BHP Billiton proposes under its incorporated structure with end users of the concentrate in China, and the uranium stewardship program which would apply comprehensive product stewardship principles to the safe handling, transport and use of Australian uranium produced from concentrate from the Olympic Dam expansion.

Although this appendix assumes that China is the preferred export destination there are a range of alternative destinations available in line with applicable law and policy described in this appendix, and final decisions are yet to be made and approvals obtained.

This appendix should be read in conjunction with Appendix E2 on the ESD Principles (Ecologically Sustainable Development Principles).

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1.2 Abbreviations

Table One: Abbreviations	
AONM	Australian Obligated Nuclear Material
ASNO	Australian Safeguards and Non-Proliferation Office
AUA	Australian Uranium Association
CPPNM	Convention on the Physical Protection of Nuclear Material
DSGL	Defence and Strategic Goods List
Early Notification Convention	Convention on Early Notification of a Nuclear Accident
ESD	ecologically sustainable development
HSEC	health safety and environment committee
IAEA	International Atomic Energy Agency
ICMM	International Council on Mining and Metals
NFC	civil nuclear fuel cycle
NNWS	NPT non-nuclear weapon state
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NSG	Nuclear Suppliers Group
NWS	NPT nuclear weapon state
SOLAS	International Convention for the Safety of Life at Sea
SSAC	State System of Accounting and Control of Nuclear Material
SUA Convention	Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation
USONM	United States Obligated Nuclear Material
WNA	World Nuclear Association

2 THE INTERNATIONAL NUCLEAR FUEL CYCLE

2.1 Overview

The international nuclear fuel cycle (NFC) may be described as:

The series of steps involved in supplying fuel for nuclear reactors and managing the resulting waste products. It includes the mining, conversion and enrichment of uranium; fabrication of fuel elements and their use in a reactor; reprocessing to recover the fissionable material remaining in the spent fuel; possible re-enrichment of the fuel material; possible re-fabrication into more fuel; waste processing; and long-term storage or disposal.

A diagram illustrating the NFC is shown in Figure 1 below.

While uranium is a common element in the earth, the mining of uranium occurs only in a few countries. As at 2007, Canada and Australia accounted for approximately 45% of global production while other countries including Niger, Russia, Kazakhstan, Namibia, Uzbekistan, South Africa and the USA accounted for the remainder of production[1]. Given that Australia has about 36% of the world's known reserves of uranium, it has a pivotal role in providing reliable energy to other countries which elect to use nuclear power as part of their energy supply mix.

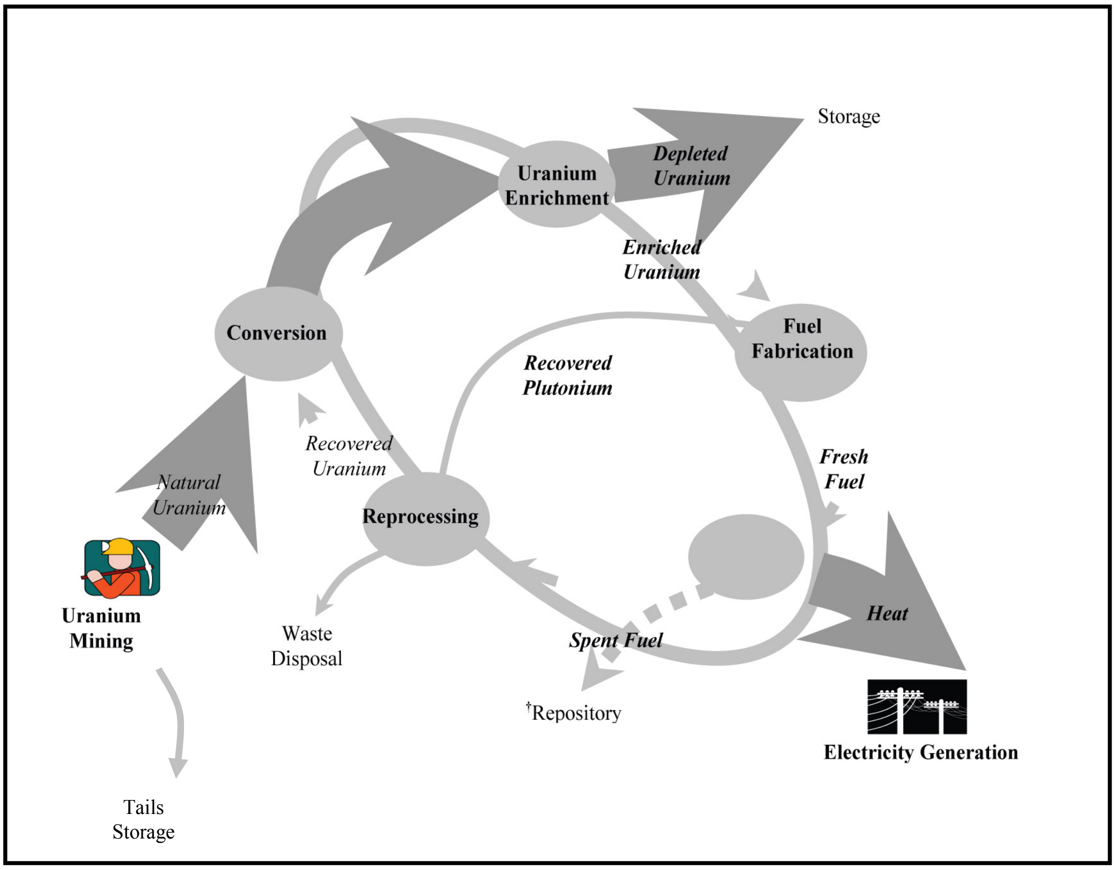

Figure 1: Nuclear Fuel Cycle

[1] Source: ASNO (2004)

The global extent of the existing NFC is greater than is often understood. For example, as at October 2008, there were 439 nuclear power plants in operation in 30 countries providing approximately 16% of global electricity supply. A further 36 nuclear reactors are currently being built in 12 different countries, whilst 99 reactors are planned or ordered and an additional 232 reactors are proposed, which would bring the total number of countries relying on nuclear energy to 40 by around the middle of this century. There are also commercial scale reprocessing plants in 4 countries, conversion plants in 6 countries and enrichment plants in 8 countries. The majority of these facilities are in EU countries, North America, the Russian Federation and North Asia (China, Japan, and the Republic of Korea).

Around the world, scientists in more than 50 countries use nearly 300 research reactors to investigate nuclear technologies and to produce radioisotopes for medical diagnosis and cancer therapy. Meanwhile, on the world's ocean, nuclear reactors have powered over 400 ships.

2.2 The Stages of the Nuclear Fuel Cycle (NFC)

Set out below is a more detailed description of the various stages of the NFC shown in Figure 1. Understanding the various stages is important in providing context to the way Australian uranium produced from Olympic Dam, may be used in the NFC.

(a) Mining and Processing

The first stage of the NFC is mining and processing. There are three primary methods used to mine uranium:

(i) open-pit mining

(ii) underground mining

(iii) in-situ leach processing where minerals are dissolved underground and the solution containing the minerals is pumped to the surface for mineral recovery.

At Olympic Dam, the uranium is currently mined underground and will expand to an open pit operation as part of the expansion project. The ore is recovered through mechanical (milling) and chemical processing. Olympic Dam is proposing to export its uranium in two forms, as a uranium oxide (uranium ore concentrate, UOC), which is the current practice, and in its copper concentrate. The concentrate to be exported would contain up to 2000 ppm uranium. The Olympic Dam ore body contains around 400–800 parts per million (ppm) uranium and the uranium oxide exported is about 99% uranium oxide (U_3O_8).

(b) Conversion

The next stage of the NFC is conversion. At a conversion plant, uranium is first refined to uranium dioxide, which can be used as fuel for reactor types using natural (non-enriched) uranium fuel. However, most uranium for power reactor fuel is converted into uranium hexafluoride (UF_6) in preparation for enrichment. Conversion is a chemical process by which the uranium oxide—otherwise known as U_3O_8—is converted into UF_6, which is a solid at atmospheric pressure below a temperature of 57 ºC and gaseous above this temperature. As a highly corrosive and chemically toxic substance, UF_6 is transported as a solid in purpose-built secure cylinders. Consequently, conversion plants are subject to strict regulation covering the environment, safety and security.

(c) Uranium Enrichment

Following conversion, the next stage of the NFC is the enrichment of uranium. Uranium found in nature consists largely of two isotopes, U_{235} and U_{238}. Energy is produced in the form of heat in nuclear reactors from the “fission” or splitting of the U_{235} atoms. Natural uranium contains 0.7% of the U_{235} isotope. The remaining 99.3% is mostly the U_{238} isotope which does not generally contribute directly to the fission process in power reactors.

Most common types of nuclear power reactors require fuel with higher than natural levels of the fissile isotope U_{235}. To achieve this, natural uranium must be enriched (using UF_6 feedstock). The enrichment process yields a higher concentration, typically between 3.5% and 5% U_{235}, by removing over 85% of the U_{238}.

There are two enrichment processes in large scale commercial use; gaseous diffusion and gas centrifuge. These processes use the physical properties of molecules of U_{235} and U_{238} to separate the isotopes. The product at this stage of the NFC is enriched uranium hexafluoride. This is re-converted to enriched uranium dioxide (UO_2) before being fabricated into fuel elements.

(d) Fuel Fabrication

Following enrichment the uranium is ready for fuel fabrication. Reactor fuel is normally manufactured as ceramic pellets. These are formed from pressed UO_2 which is baked at high temperature. The pellets are encased in metal tubes to form fuel rods, which are arranged into a fuel assembly ready for loading into a reactor core.

The dimensions of fuel assemblies are controlled very tightly to ensure consistency in the performance of fuel bundles and reactor operations.

(e) Power Reactor

In a reactor, fission (splitting the atom) releases energy that, either directly or indirectly, produces steam to drive a turbine and generator and, in turn, produces electricity. This is comparable to the burning of coal, gas or oil in a fossil fuel power plant. Typically in a power reactor, fuel bundles or elements are replaced every 12–24 months, with usually one third of the core being replaced during each refuel. Spent fuel is normally stored in ponds on-site pending either reprocessing to recover uranium and plutonium, or long term disposal.

(f) Reprocessing

In a reprocessing plant, spent fuel is separated into uranium and plutonium (for possible reuse) and waste (containing highly radioactive fission products). Reprocessing allows the uranium and plutonium to be recycled into fresh fuel, and leads to greatly reduced volumes of waste.

(g) Spent Fuel Repository

Power reactors are usually able to hold spent fuel for well over 30 years. After 40 to 50 years of storage, the radioactivity level of the fuel falls to 0.1% of its original level. Given this and the fact that the volumes of waste are relatively small, final disposal facilities—as opposed to storage facilities—have not been established yet on a commercial scale, although the final disposal technology has been demonstrated at the trial plant stage. Furthermore, spent fuel offers a significant energy resource that could be reprocessed in the future; hence there has been a reluctance to permanently dispose of it.

Current thinking on best practice management of spent fuel and nuclear waste from reprocessing is placement in deep geological repositories. By way of example, the USA is now building a national repository at Yucca Mountain in Nevada while Sweden and Finland have proposed deep geological repositories for final disposal.

The proposed method in Sweden for the repository of high level waste will see the spent nuclear fuel encapsulated in copper. The copper canisters will then be deposited in geologically stable bedrock, embedded in clay, at a depth of about 300 metres. When deposition is finished the tunnels and rock caverns will be sealed.

The tunnels will be about 250 metres long and spaced at a distance of about 40 metres from each other. Deposition holes will be spaced at intervals of about six metres on the floor of the tunnels. The copper canisters will be placed in the deposition holes and surrounded by a buffer of bentonite. When deposition is finished, the tunnels and shafts will be filled with a mixture of crushed rock and bentonite.

2.3 Australian Government Policy

Under current Federal Government policy, Australia's direct involvement in the NFC is restricted to its early stages. That is, the mining of uranium, the production of uranium oxide and concentrate, and the safe handling and transport of both products to certain countries for conversion, enrichment and fabrication into fuel for nuclear power generation. South Australian and the Northern Territory Government policies also limit activities within their jurisdiction to the early stages of the NFC.

The Olympic Dam expansion project would not require any change to the scope of current Federal or State Government policies regarding nuclear activities in Australia. BHP Billiton is proposing to export concentrate (as well as currently approved uranium oxide) with China as the preferred destination for this concentrate. Under such circumstances, China would produce uranium oxide from that concentrate for subsequent use in the civil NFC.

Export of concentrate would require a specific export permit from the Australian Government through the Department of Resources Energy and Tourism. Furthermore, before concentrate exports to China could commence, the Australian Government would also need to have in place a new nuclear safeguards agreement with China to ensure that any uranium extracted in China would remain exclusively in peaceful use and be subject to the current bilateral Nuclear Materials Transfer Agreement once in the form of uranium oxide.

2.4 Australian Obligated Nuclear Material (AONM)

As a prelude to discussing safety, security and safeguards controls across the NFC, it is important to understand the concept of "Australian Obligated Nuclear Material" management (AONM).

The international nature of nuclear material management means that uranium from many sources is routinely mixed during processes such as conversion and enrichment. Uranium is termed a "fungible" commodity, that is, at these processing stages uranium from any source is identical to uranium from any other source. Accordingly, it is not possible to physically differentiate the origin of the uranium. This characteristic also applies a number of other commodities, such as oil. The fungibility of uranium has led to the establishment of conventions used universally in the industry.

The obligations under Australia's various bilateral safeguards agreements are applied to AONM. AONM is a shorthand way of describing the nuclear material which is subject to the provisions of the Australian bilateral safeguards agreements discussed below.

Those other countries that apply bilateral safeguards comparable to Australia's, principally the U.S. and Canada, also use this approach. These countries attach a safeguards "obligation" to the nuclear material they upgrade (process, enrich, fabricate), which results in "multi-labelling". For example, AONM enriched in the U.S. will also become U.S. obligated nuclear material (USONM), and its subsequent use will have to meet the requirements of both Australian and U.S agreements. This is a common situation and, a significant proportion of AONM is also characterised as USONM and is accounted for both to the Australian Safeguards and Non-Proliferation Office (ASNO) and its U.S. counterpart, the U.S. Department of Energy.

3 SAFETY, SECURITY AND SAFEGUARDS CONTROLS ACROSS THE NFC

Although Australia's direct role in the NFC is restricted to uranium mining, Australia and BHP Billiton would have some control over the use of concentrate sourced from Olympic Dam. The export and use of the concentrate from the Olympic Dam expansion would be subject to a range of international, domestic and contractual controls relating to nuclear safety, nuclear security and nuclear safeguards which are currently applied to all AONM in the international nuclear fuel cycle.

Nuclear safety focuses on minimising the possibility and consequences of the accidental release of hazardous materials, while nuclear security focuses on the physical protection of nuclear material and installations, particularly in relation to threats such as terrorism. Nuclear safeguards are applied to ensure the peaceful use of, amongst other things, nuclear material such as AONM.

These safeguards or controls can be broadly broken into five elements:

(a) The first element of control is **international treaties and conventions** to which Australia and China are parties (Refer section 5.1).

(b) The second element consists of **Australian Government policy and legislative controls** on the production, export and use of uranium which seek to give domestic effect to the International Treaties and Conventions to which Australia is a party (Refer section 5.2).

(c) The third element consists of **bilateral safeguards agreements** that Australia has in place with a range of countries including China, to ensure that Australia's significant nuclear non-proliferation obligations under International treaties and conventions are met (Refer section 5.3). The Australian Government only agrees to the sale of Australian uranium to countries with which it has a bilateral safeguards agreement. Under these safeguards agreements Australia imposes conditions to ensure that Australian uranium is used exclusively for peaceful purposes, is accounted for in full and appropriate standards of physical protection are implemented. Australia has such a bilateral nuclear material transfer agreement with China (2007) that permits the sale of uranium oxide.

(d) The fourth element of control on the NFC consists of **export control regimes,** such as the Zangger Committee, through which participating governments apply consistent export controls covering strategic materials and equipment used in the NFC (Refer section 5.4).

(e) Lastly, controls are applied through **contractual conditions** with purchasers of controlled materials and items, and joint venture partners. In the case of the proposed sale of concentrate to China, BHP Billiton would have contractual controls in place, as well as the BHP Billiton Uranium Stewardship Program, to ensure the application of good international practice in nuclear safety and nuclear security at each stage of the NFC (refer section 7.7).

Each of these controls is discussed in more detail below in the context of the various stages that the concentrate will pass through in the NFC.

4 BHP BILLITON'S MINING EXPERTISE

The controls relating to the beginning of the NFC, namely at the stage where the uranium would be mined and milled at Olympic Dam and transported to a port as uranium oxide and concentrate, have been discussed in detail in the main body of the draft EIS (see Chapter 6) and, therefore, are not repeated in this Appendix. In terms of its expertise, through an ongoing philosophy of continuously improving its uranium logistics processes over the past 20 years, BHP Billiton has extensive experience in the safe, secure, efficient and effective transport of drummed uranium oxide throughout the world.

This is reflected through the movement of over 2,800 ISO shipping containers involving over 52,000 tonnes of uranium oxide without incident from the Olympic Dam mine site to overseas conversion facilities.

BHP Billiton has developed improved methods of packaging, securing and stowing uranium oxide, and has promoted and set associated national and international standards through external bodies such as the Australian Uranium Industry Framework and the World Nuclear Transport Institute.

5 SAFETY, SECURITY AND SAFEGUARDS CONTROLS ON THE EXPORT OF CONCENTRATE

5.1 International Treaties and Conventions

Australia has entered into a range of international treaties and conventions (under international law) designed to facilitate the peaceful use of nuclear energy while minimising the potential for proliferation. Further, this international legal framework seeks to ensure that the nuclear fuel cycle is managed safely and that appropriate security is applied at each stage. In the case of the Olympic Dam expansion project, this regime is applied to ensure the application of safeguards and the safe and secure export of concentrate.

Essentially, the fundamental objective of all safeguards measures under these treaties is to ensure that nuclear energy remains exclusively in peaceful use and is not diverted for the production of nuclear weapons or other nuclear explosive devices.

The *Treaty on the Non-Proliferation of Nuclear Weapons* (NPT) is the centrepiece of the nuclear non-proliferation regime. Under this treaty, ratified by Australia 35 years ago, non-nuclear weapon states (NNWS), such as Australia, have accepted comprehensive nuclear safeguards to verify compliance with their commitment not to manufacture or produce nuclear weapons in exchange for undertakings on facilitating access to nuclear energy for peaceful purposes. China is also a signatory to a number of international non-proliferation, safety and security treaties and conventions, including the NPT as a nuclear weapon state.

Australia has agreed to accept safeguards on "all source or special fissionable material" in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

Australia's obligations under the NPT also include an agreement to apply the safeguards set out in the agreement between Australia and the International Atomic Energy Agency (IAEA) for the Application of Safeguards (Safeguards Agreement). The requirements under the Safeguards Agreement are then effected into Australian domestic law through the *Nuclear Non-Proliferation (Safeguards) Act 1987,* which is discussed below.

Australia's reporting obligations are set out in Article 93 of the IAEA Safeguards Agreement. Australia is required to report to the IAEA on the nuclear materials it holds and their location, and to accept visits by IAEA auditors and inspectors to independently verify Australia's material reports and to physically inspect the nuclear materials concerned to confirm their physical inventories.

Of particular relevance to the Olympic Dam expansion is Article 92 of the IAEA Safeguards Agreement. This article provides that in the case of export out of Australia, nuclear material subject to safeguards is regarded as Australia's responsibility up until the time at which the recipient State assumes responsibility and no later than the time at which the material reaches its destination. The point at which the transfer of responsibility takes place is determined in accordance with suitable arrangements to be made by the States concerned. In the context of the Olympic Dam expansion, this would be addressed in the administrative arrangements pursuant to a new nuclear transfer agreement and contract arrangements between BHP Billiton and its joint venture partners. This is discussed further in section 7.7 below.

In 1997, in an effort to strengthen the safeguards system, the IAEA Board of Governors approved a *Model Additional Protocol* (AP). The new measures provide increased access for inspectors to information about current and planned nuclear programs and to more locations on the ground.

The second major treaty under international law, which will control the concentrate exported from Olympic Dam, is the *Convention on the Physical Protection of Nuclear Material* (Physical Protection Convention). That Convention requires signatories (which include Australia and China) not to undertake, or authorise the undertaking of any international export of nuclear material unless assurances are provided that the nuclear material will be protected to the levels required by the Convention.

While the Physical Protection Convention focuses primarily on nuclear material being shipped in international commerce, it also contains other important requirements related to domestic security measures. As a party to the Physical Protection Convention, Australia is obliged to make the following legal provisions:

(a) to make certain physical protection arrangements and ensure specific defined levels of physical protection for international transport of nuclear material

(b) to cooperate in the recovery and subsequent protection of stolen nuclear material

(c) to make specific acts (for example, theft of nuclear materials and threats or attempts to use nuclear material to harm the public) punishable offences under Australian law

(d) to prosecute or extradite those accused of committing such acts.

In 2005, a diplomatic conference agreed on amendments to strengthen the Physical Protection Convention. Key amendments included new express requirements for domestic use, storage and transport, a new offence of sabotage and requirements on State Parties to establish robust and comprehensive domestic security regimes for nuclear material and nuclear facilities. Australia ratified the amended Convention in 2008. China was supportive of the amendments but had not yet completed its ratification process at the time of writing.

In addition to the NPT and the Physical Protection Convention, Australia must also give consideration to non-binding but authoritative recommendations developed by the IAEA on the Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC 225). These recommendations provide much greater technical detail than the general requirements set out in the Physical Protection Convention.

In summary, there is a range of control measures applicable to Australia and China under international law including the NPT, the Physical Protection Convention and the IAEA recommendations to ensure that the concentrate exported from Olympic Dam expansion project (and the uranium oxide extracted from it) would be subject to comprehensive safety and security controls and used exclusively for peaceful, non-military purposes.

Set out below is the next element of control that covers how Australia as a State party to these international law conventions introduces those treaty and convention obligations into Australian domestic law.

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5.2 Australian Government Uranium Export Policy and legislation

5.2.1 Overview

In accordance with Australian Government policy, any concentrate produced from the proposed Olympic Dam expansion project would be exported on the basis that any uranium extracted from it would be used exclusively for peaceful purposes, that is, for electrical power generation. Government policy on the peaceful use of Australian uranium has always imposed this peaceful use stipulation.

After Australia ratified the NPT in 1973, an inquiry with the powers of a Royal Commission was conducted into whether Australia should mine its uranium and if so, under what conditions. As a result of what became known as the Fox inquiry, in 1977 the Australian Government determined it would only supply uranium to Non Nuclear Weapon States (NNWS) that were a party to the NPT. While this policy did not state that nuclear weapon states (NWS) had to be parties to the NPT, it did specify that exports to NWS would require an assurance of peaceful use and that any Australian uranium exported would be covered by IAEA safeguards.

In accordance with this policy, the Australian Government will only allow Australian uranium to be used in countries which have:

(a) signed the Nuclear Non-Proliferation Treaty (NPT)

(b) implemented a Bilateral Safeguards Agreement with Australia (see details below)

(c) for exports to NNWS, which does not include China, they must also have an International Atomic Energy Agency (IAEA) safeguards Additional Protocol in force.

As part of its ratification process for international treaties and conventions, Australia enacts implementing legislation to introduce its international commitments under those treaties and conventions into domestic Australian law. In the case of uranium and nuclear exports two pieces of Federal legislation are relevant.

5.2.2 Nuclear Non-Proliferation (Safeguards) Act 1987 (Cth)

The first is the *Nuclear Non-Proliferation (Safeguards) Act 1987* (Safeguards Act). The Safeguards Act forms the legislative basis for nuclear safeguards activities and gives effect to Australia's safeguards obligations under:

(a) The NPT

(b) Australia's NPT safeguards agreement and the Additional Protocol with the IAEA

(c) Agreements between Australia and various countries (and Euratom) concerning transfers of nuclear items, and cooperation in peaceful uses of nuclear energy

(d) the Convention on the Physical Protection of Nuclear Material (Physical Protection Convention or CPPNM).

Control over nuclear material and associated items in Australia is exercised under the Safeguards Act by issuing permits for their possession and transport while the communication of information contained in sensitive nuclear technology is controlled through the grant of authorities. BHP Billiton currently holds a section 13 permit to possess nuclear material or associated items for the purpose of transporting the material or item, and a section 16A permit to establish a facility.

The Safeguards Act also establishes a statutory office of Director of Safeguards which, since 2004 has been formally known as the Director-General of ASNO. The Director-General's functions include ensuring the effective operation of Australia's safeguards system, and of Australia's system of bilateral safeguards agreements (see earlier discussion above).

The Safeguards Act also empowers the Minister:

- to grant, vary or revoke permits or authorities
- to make declarations or orders in relation to material, equipment or technology covered by the Safeguards Act
- to appoint inspectors to assess compliance with the Safeguards Act and with Australia's NPT safeguards agreement with the IAEA.

The Minister has delegated most of these powers (with certain exceptions such as granting of permits to uranium mines and for nuclear activities) to the Director-General of ASNO.

5.2.3 Recent amendments

In 2003 and 2007, the Safeguards Act was amended to strengthen arrangements for the application of non-proliferation safeguards to, and the protection of, nuclear material, facilities and associated information. Specifically, the amendments:

(a) broadened the class of material which may be declared as associated material, to ensure effective controls on the full range of materials which are specially suited for use in NFC activities or prohibited activities such as the production of nuclear weapons

(b) introduced a permit requirement for establishing any new nuclear or related facility in Australia

(c) introduced offences for conduct which breaches procedures set as a permit condition and intended to protect proliferation sensitive information, and for unauthorised communication of information which could prejudice the physical security of nuclear material

(d) provided that a permit under the Safeguards Act may prescribe an area to which the permit holder must restrict access

(e) updated penalty provisions

(f) implemented amendments to the Physical Protection Convention

(g) provided a framework for the application of non-proliferation safeguards to a nuclear facility that has been shut down

(h) updated penalties for serious offences in the Safeguards Act

(i) extended the geographical jurisdiction for non-proliferation offences.

The second key legislative instrument is the *Customs (Prohibited Exports) Regulations 1958* which are made under the *Customs Act 1901*. Under those regulations an export licence is necessary to export radioactive material, (including refined uranium, plutonium and thorium). Regulation 9 gives the Minister for Resources, Energy and Tourism the responsibility to approve permits for the export of nuclear material. Before making any such approval, the Minister will consult with the Minister for Foreign Affairs to ensure that Australia's nuclear non-proliferation obligations (security and safeguards etc) and policy requirements will be met.

Regulation 13E is also relevant to the NFC although not to the export of concentrate from Olympic Dam expansion project. It is the responsibility of the Minister for Defence and states that any item contained within the Defence and Strategic Goods List (DSGL), requires authorisation prior to export. The DSGL includes a range of defence and dual-use goods that could be used in a military program, such as materials, equipment, assemblies, software, technologies, and associated test, inspection and production equipment. Specifically, Regulation 13E and the DSGL implement the Zangger and NSG control lists which are discussed later.

5.3 Bilateral Safeguards Agreements

At present, Australia has 22 nuclear safeguards agreements in force covering 39 countries plus Taiwan. These treaty-level Bilateral Safeguards Agreements are concluded between Australia and the recipient country of nuclear items, and serve as a mechanism for applying conditions in addition to IAEA safeguards. These conditions may include for example, restrictions on retransfers, high enrichment and reprocessing. See ASNO 2007-08 Annual Report pages 18-20 and 64 (http://www.asno.dfat.gov.au/annual-report-0708/ASNO_2007_08_ar.pdf).

The key point is that Australia's safeguard's requirements are based on IAEA safeguards. IAEA safeguards provide the basic assurance that nuclear material is not being diverted from peaceful to non-peaceful purposes. It should be noted that IAEA safeguards are generally not concerned with origin attribution, that is, the 'flag' and conditions attached by suppliers (for the IAEA there are limited exceptions, e.g. under certain non-NPT safeguards agreements). Rather, this is the purpose of bilateral safeguards agreements.

The application of Australia's requirements starts with a careful selection of those countries eligible to receive nuclear material. It is generally a minimum requirement that, in the case of NNWS, countries must meet the NPT full scope safeguards standard. That is, IAEA safeguards must apply to all existing and future nuclear activities. Since 2005, for supply to NNWS, the IAEA safeguards Additional Protocol has been added as a prerequisite.

In the case of NWS, such as China, there must be a treaty-level assurance that nuclear material will be used only for peaceful purposes and will not be diverted to military or explosive purposes, and that IAEA safeguards will apply to that nuclear material.

In addition, other principal conditions in Australia's bilateral safeguards agreements for the use of AONM including the following:

(a) First, none of the following actions can take place without Australia's prior consent:

   (i) transfers of the AONM to third parties

   (ii) enrichment to 20% or more in the isotope uranium-235

   (iii) reprocessing.

(b) Provision for fallback safeguards or contingency arrangements in case NPT or IAEA safeguards cease to apply in the country concerned.

(c) An assurance that internationally agreed standards of physical security will be applied to nuclear material in the country concerned.

(d) Detailed 'administrative arrangements' between ASNO and its counterpart organisation, setting out the procedures to apply in accounting for AONM.

(e) Regular consultation regarding the operation of the agreement.

(f) Provision for the removal of AONM in the event of a breach of the agreement.

A further control included in agreements with China, Russia, and Japan is that AONM can be used only at predetermined facilities agreed between the parties. The list of such facilities is known as the Delineated Nuclear Fuel Cycle or Eligible Facilities List. For nuclear weapon states, such as China, facilities which process, use or store AONM must also be subject to the safeguards agreement which that state has with the IAEA. The specific agreements that Australia has in place with China for AONM are discussed in section 7 below.

5.4 Export Control Regimes

Further international controls are the two export control regimes known as the Zangger Committee and the Nuclear Suppliers Group.

(a) The Zangger Committee

The Zangger Committee comprises major nuclear suppliers that have developed a common approach to implementing the NPT and supplying nuclear material to states outside of the NPT based on certain safeguards and assurances. The Committee was formed in 1971 and comprises 35 member states.

(b) The Nuclear Suppliers Group

The NSG aims to prevent civilian nuclear trade from contributing to nuclear weapons programs in NNWS. NSG guidelines deal with the transfer of nuclear-related items to all NNWS regardless of their NPT status. The NSG includes all the major suppliers of nuclear technology.

NSG guidelines also require recipient governments to provide assurances that transferred items will not be diverted to unsafeguarded nuclear facilities or nuclear explosive activities. The guidelines set out re-transfer provisions and requirements for the physical protection of nuclear material and facilities. They also require particular restraint with respect to trade in facilities, technology or equipment that may be used for uranium enrichment or plutonium reprocessing.

While these export control regimes do not have the same legal status in international law as the NPT, participating governments—which include Australia and China—implement the control lists in domestic law, thus aligning export controls and strengthening the international nuclear non-proliferation regime.

Membership of these two regimes has increased significantly in recent years and NSG participating governments have become generally more transparent about their export arrangements for nuclear material and engaged in outreach with non-members. Other countries have harmonised their export control systems with these regimes.

Australia is an active participant in international dialogue on sensitive nuclear technology issues. In the NSG, Australia is working towards adopting agreed criteria, including strict non-proliferation measures which recipient states would need to meet before any supplier would transfer sensitive nuclear technology. Australia supports NSG endorsement of the IAEA Additional Protocol as a condition of nuclear supply.

6 SAFETY AND SECURITY CONTROLS ON INTERNATIONAL NUCLEAR TRANSPORT

In addition to the Physical Protection Convention and other treaties discussed earlier, the physical transport of radioactive material in international waters is regulated by specific international instruments:

(a) For maritime transport, which is relevant to the export of uranium oxide and concentrate, the International Maritime Dangerous Goods Code is the key document. This has been made mandatory through incorporation into the text of chapter VII of the *International Convention for the Safety of Life at Sea* (SOLAS Convention).

(b) The SOLAS Convention specifies minimum standards for construction, equipment and operations of merchant ships carrying dangerous goods such as nuclear material. Flag states are responsible for ensuring that ships under their flag comply with the requirements of the SOLAS Convention.

(c) Also relevant are the IAEA Regulations for the Safe Transport of Radioactive Material (IAEA Transport Regulations) which are incorporated by the above two conventions. The IAEA Transport Regulations address all categories of radioactive material, ranging from very low activity material, such as ores and ore concentrates, to very high activity material, such as spent fuel and high level waste. They establish requirements for the marking, labelling and placarding of conveyances, documentation, external radiation limits, operational controls, quality assurance, notification and the approval of certain shipments and package types.

There are also a number of other international instruments which address the transport of nuclear material:

(a) Articles 22 and 23 of the United Nations *Convention on the Law of the Sea* prescribe certain conditions for the carriage of “nuclear substances” through sea lanes or territorial seas.

(b) The *Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation* (SUA Convention), as amended by the 2005 SUA Protocol, allows for the transfer of nuclear material where the transfer is consistent with a state’s obligations under the NPT.

(c) The 1994 *Convention on Nuclear Safety* imposes certain obligations with regard to trans-boundary emergency planning. As a party to the Convention, Australia is obliged to take appropriate steps to ensure that it has in place on-site and off-site emergency plans that cover the actions to be taken in the event of an emergency. The plans need to be tested before the nuclear installation goes into operation and subsequently be subjected to tests on a routine basis. However, the Convention only applies to the operation of nuclear power reactors and therefore imposes no practical obligations on Australia at present.

(d) The Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) cover situations in which an accident involving activities or facilities in one State has resulted or may result in a trans-boundary release that could be of radiological safety significance for other States. The Assistance Convention and the Early Notification Convention were both signed by Australia on 26 September 1986.

(e) The Early Notification Convention requires State Parties, in the event of an accident at a nuclear reactor, at a NFC facility, or at a radioactive waste management facility (among others), to notify those States which may be physically affected by the accident. Parties are obliged to provide exact information in order to facilitate the organisation of counter-measures.

(f) The Assistance Convention is a framework agreement designed to establish a general basis for mutual assistance in the event of a nuclear accident or radiological emergency. Under the Convention, State Parties are required to cooperate among themselves and the IAEA must provide prompt assistance in the event of a nuclear accident or radiological emergency in order to minimise its consequences and to protect life, property and the environment from the effects of radiological release.

All of these conventions and the controls they introduce ensure that the concentrate exported from the Olympic Dam expansion project will be subject to a range of international requirements and standards focused on minimising the risk of environmental harm in addition to the secure and safe transport and handling of the AONM.

7 SAFETY, SECURITY AND SAFEGUARDS CONTROLS FOR AONM IN CHINA

7.1 Management of AONM in China

As noted above, the Australian Government strictly controls the export and use of AONM and only allows uranium exports to countries which are parties to the NPT and which are covered by a Bilateral Safeguards Agreement.

Furthermore, in the case of exports of nuclear material to nuclear weapons states such as China, the Australian Government requires an additional treaty level assurance that IAEA safeguards will apply to that nuclear material and that any nuclear material supplied (which would include that in the concentrate) will be used only for peaceful purposes and will not be diverted to military or explosive purposes.

The Australian Government obtains that assurance from Bilateral Safeguards Agreements with China, which are discussed below. The range of safety, security and safeguards controls that will apply to the AONM as it passes through the NFC in China is also summarised below.

In the case of exporting concentrate to China (as opposed to exports of uranium oxide) where China would extract uranium solely for nuclear energy production, an additional Australia-China bilateral safeguards agreement would have to be developed.

A new agreement would ensure peaceful use obligations apply to any uranium extracted, that uranium oxide produced by this means would be subject to the current bilateral Nuclear Materials Transfer Agreement and that contained uranium would be accounted for in full (whether in the form of concentrate, uranium oxide or waste).

7.2 Bilateral Safeguards Agreements with China

There are two specific bilateral arrangements which are already in force between Australia and China:

(a) *"The Agreement Between the Government of Australia and the Government of the People's Republic of China for Cooperation in the Peaceful Uses of Nuclear Energy"*

(b) *"The Agreement Between the Government of Australia and the Government of the People's Republic of China on the Transfer of Nuclear Material".*

These two bilateral safeguards agreements impose a comprehensive set of controls on the export and use of AONM, which will apply equally to concentrate from the proposed Olympic Dam expansion project. Those controls will include:

(a) the application of IAEA safeguards to any AONM exported to, processed, used and stored in China

(b) strict accounting and control measures and physical protection requirements for the AONM (discussed below)

(c) that AONM can only be used at facilities listed in the Delineated Chinese Nuclear Fuel Cycle Program which is an annexure to the Bilateral Safeguards Agreement. Safety standards and a good operating record are some of the factors which are taken into account when agreeing this facilities list

(d) restrictions on the ability of China to transfer the AONM it purchases to a third party (at a minimum that third party must be a country which is also covered by a bilateral safeguards agreement with Australia).

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7.3 Accounting and Control of AONM

As noted above, the Australian Government would impose strict accounting and control measures on the export and use of the concentrate. Once the concentrate left Australian waters the Australian Government and BHP Billiton would continue to monitor the uranium component of the concentrate (as AONM) through a series of accounting and reporting systems which are summarised below.

(a) Nuclear Material Accountancy Regime

Australia has a safeguards agreement with the IAEA that requires Australia to "*establish and maintain a system of accounting for and control of all nuclear material subject to safeguards under the Agreement*".

This system is known as the State System of Accounting and Control of Nuclear Material (SSAC). In Australia, the Safeguards Act implements this specific obligation of SSAC through ASNO.

Since Australia exports uranium only to NPT parties, which have in force a safeguards agreement with the IAEA[2], each recipient of AONM, including China, will also operate equivalent state arrangements.

The SSAC has two primary objectives covering domestic and international obligations. The domestic objective is to account for and control AONM in the State and to contribute to the detection of possible losses, or unauthorised use or removal of AONM. The international objective is to provide the essential basis for the application of IAEA safeguards pursuant to the provisions of an Agreement between the State and the IAEA, and to ensure the full implementation of peaceful use commitments by bilateral partners processing, storing and using AONM.

ASNO is also charged to ensure that the peaceful use commitments and other treaty commitments are met in each country which uses, processes or stores AONM. The results of this work are presented in the ASNO annual report tabled in the Australian Federal Parliament each year.

Australia's bilateral partners (such as China) which are holding AONM are required by ASNO to maintain detailed records of transactions involving the AONM, and ASNO's counterpart organisations in those bilateral partner countries are required to submit to ASNO regular reports, consent requests, transfer and receipt documentation.

[2] In the case of NNWS an AP is required as well

The IAEA also receives reports covering the use and shipment of uranium in the international NFC. ASNO accounts for AONM on the basis of information and knowledge from multiple sources, including the IAEA, as well as:

- reports from each bilateral partner
- shipping and transfer documentation
- calculations of process losses and nuclear consumption, and nuclear production
- knowledge of the fuel cycle in each country
- regular liaison with counterpart organisations and with industry
- reconciliation of any discrepancies with counterparts.

Although the above measures are essentially designed to track Australian nuclear product, adherence to these measures provides a means of monitoring the risk of unintended environmental impact as the nuclear product progresses through the NFC.

7.4 Safety Systems at nuclear installations

The future of nuclear energy depends upon the nuclear industry achieving and demonstrating an acceptable, consistent and competent safety record in all applications. Safety of operations and the protection of the workers and public remain fundamental to the industry. The nuclear industry is one of the most highly regulated and controlled, with national regulation based on international requirements where systems of constant review and transparent auditing lead to ongoing improvements. Despite this, the industry understands the challenges and importance of safety and continues to strive for improvements.

A broad overview of the systems of safety and actual performance is presented here.

Within the nuclear industry, safety audits and reviews are conducted routinely and rigorously. At an international level, the IAEA undertakes detailed annual industry wide reviews, which are submitted to the Board of Governors and the results used to strengthen worldwide efforts on nuclear, radiation, transport and radioactive waste safety, and emergency preparedness. The latest review, (Nuclear Safety Review for the Year 2007 GC(52)INF/2 (IAEA 2007)) was published in 2008 and provides an overview of safety of the industry, identifying areas for improvement.

IAEA 2007 reinforces the dual responsibilities for nuclear safety with National governments being responsible for establishing and maintaining effective legal and governmental framework for safety, and facility operators being ultimate responsibility for implementing safety requirements and demonstrating improvements in safety. IAEA 2007, also notes that during the reporting period, the nuclear industry continued to show a strong safety performance.

The IAEA also seeks annual external independent recommendations and opinions on current and emerging nuclear safety issues from the International Nuclear Safety Group (INSAG). This group consists of experts in safety working in regulatory, research, academic and industry organizations. In its most recent report (letter to Director General IAEA, dated 25 August 2008), INSAG noted that;

> "The safety performance of nuclear power plants has improved significantly in recent decades, at least as revealed by objective indicators – e.g., capacity factors, unplanned shutdowns, radiation exposure to workers, radiation releases to the environment – albeit with some leveling off in performance in recent years."

In addition to these broader industry wide reviews, nuclear power programs in individual countries, regulatory systems and facility operations undergo regular reviews. Recently, the IAEA commenced a program of reviews of regulatory agencies in member states and it is known as the Integrated Regulatory Review Service (IRSS)).

While the IAEA does not have direct responsibility for nuclear safety within a member state, it is a credible authority on nuclear matters and maintains a continuous focus on safety. State jurisdictions have established their own regulatory frameworks. For example, in the US, the regulator is the Nuclear Regulatory Commission which routinely reports on safety performance (i.e. Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other facilities 2006).

The actual safety performance of the industry can be judged by considering a number of performance indicators, including, radiation doses to employees, and traditional safety statistics such as accident rates and also the number of nuclear related incidents, a summary of which is presented below.

Occupational Radiation Exposures

The unqualified authoritative organization on radiation doses and impacts is the United Nations Standing Committee on the Effects of Atomic Radiation (UNSCEAR). This body reviews radiation related research from across the world and collates the findings. A summary of occupational exposure within the nuclear industry can be seen in Figure 2 and is from the most recent publication (UNSCEAR 2000). These figures show improvements (i.e. a reduction) in doses in the industry between 1975 and 1995, but later results have yet to be collated.

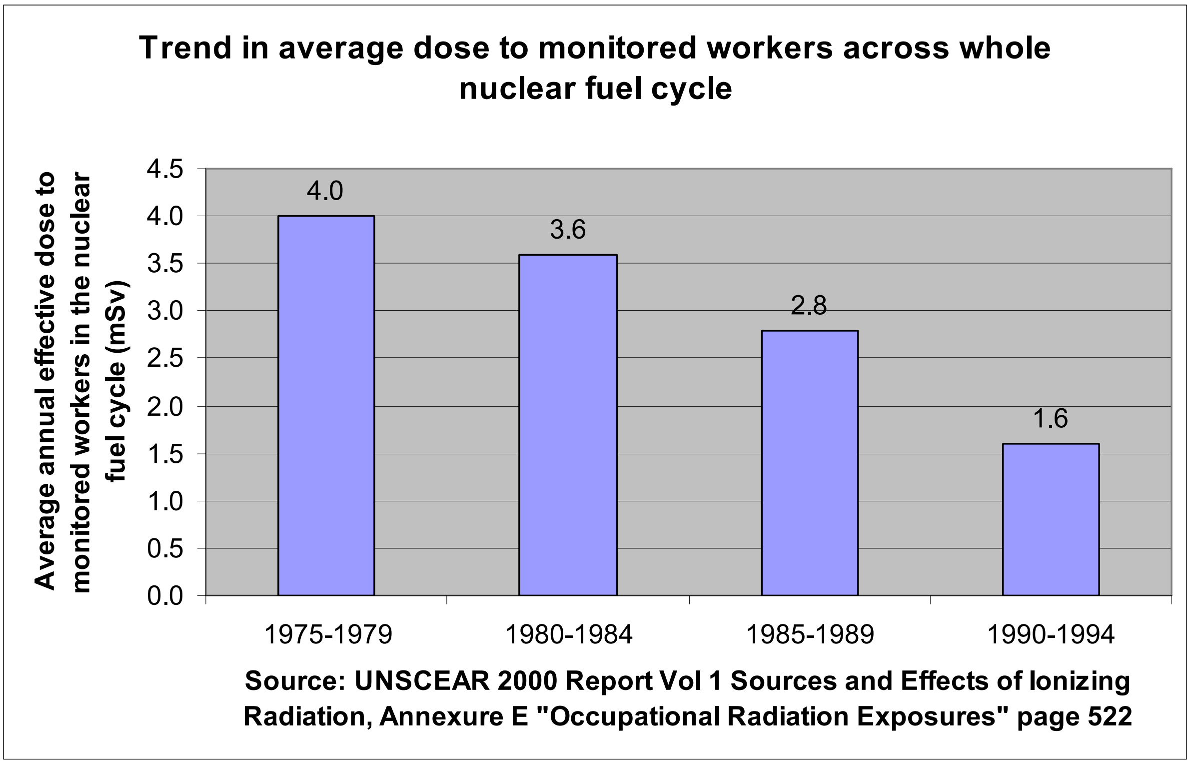

Figure 2: Trends in average doses to monitored workers across the whole of the nuclear fuel cycle

Other sources of information can be referred to for later dose results, for example, the European Study on Occupational Radiation Exposures (http://www.esorex.eu/) and the US Department of Energy Occupational Radiation Exposure Report 2005. In Europe, reported average worker doses in the nuclear fuel cycle fell from 2.2 mSv/y in 1996 to 1.3 mSv/y in 2004. In the US, averages doses fell from 1.4 mSv/y in 1997 to 1.0 in 2006.

The more recent exposure information confirms the continuous improvement in radiation exposure noted in the long term by UNSCEAR.

Industrial Safety

Industrial safety refers to the broader occupational and health issues and is usually measured by the number of reportable incidents or workplace accidents and incidents that occur which result in time off work. There is some discrepancy in how these statistics are defined in different countries, so comparisons should be used with care. However, within countries it is possible to identify the key trends.

Operating experience in the UK (Safety Overview of the Major UK Nuclear Licensees Annual Update – Jan 2007), indicates an improvement in reportable incident rate over the period 1990 to 2005/06, with employee and contractor injury rates averaging at approximately 1.2 injuries per million hours worked by 2005/2006. This compared to a whole of workforce average of 2004/5 of 3 (HSC – Health and safety statistics, national statistics, UK).

In the US, the indicator for general safety is the number of accidents resulting in lost work, restricted work or fatalities and this has improved from 1.9 per million hours worked in 1997 to 0.6 per million hours worked in 2007. This compares to 11 for the US mining industry and 10 for US private industry as a whole in 2007 (US department of Labour statistics).

The general safety of the nuclear industry is better than that for other industries, providing an indication of the robust safety culture that generally exists.

Nuclear Incidents

Safety within the nuclear industry depends upon the detailed analysis of any and all incidents and the rapid sharing of information of findings in order to prevent recurrences elsewhere. The sharing of safety advances and improvements is not bound by business confidentiality restraints. As an example of this, the OECD/NEA with the IAEA, co-ordinates the International Incident Reporting System (IRS) and the IAEA operates and incident and emergency centre which quickly disseminates information on any incidents or event.

The number of reported incidents can be seen in Figure 3 (from Nuclear Power Plant Operating Experiences from the IAEA/NEA Incident Reporting System 2002-2005 NEA no.6150). The main aim of the reporting system is to share learnings and operating experience, however, the system also shows improvements over time.

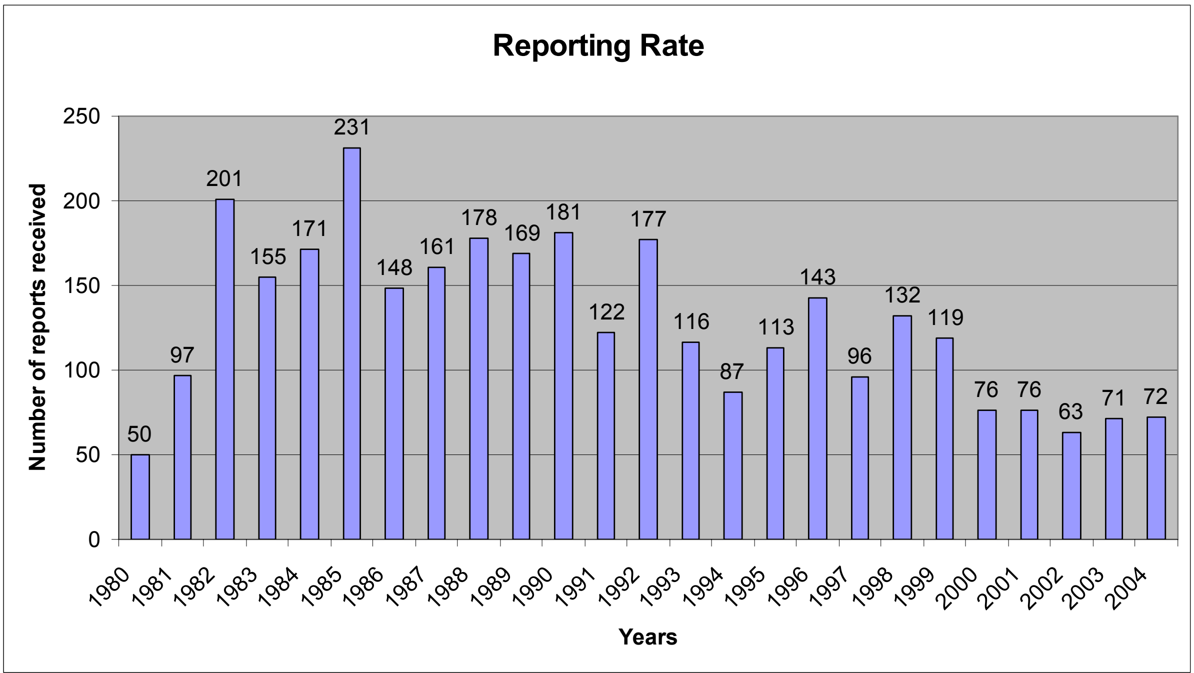

Figure 3: Number of Incidents Reported to IRS

Transport Safety

Nuclear materials have been transported safely and routinely for over 45 years. During this period there has not been a transport incident that has caused significant radiological damage to people or the environment (http://www.wnti.co.uk/nuclear-transport-facts/facts-and-figures/key-facts).

While these are facts about nuclear safety, the industry does not rest on these facts and aims for continuous improvement in all areas of safety (Strengthening the Global Nuclear Safety Regime (INSAG Series)).

Set out below is a summary of some of the typical systems that are in place at nuclear installations in support of nuclear safety.

(a) Defence-in-depth

A technique widely adopted to ensure nuclear safety involves applying a series of complementary and overlapping measures known as "defence-in-depth".

The objective of defence-in-depth is to ensure that no single human error or equipment failure at one level of defence, or a combination of failures at more than one level of defence, can lead to harm to the public or the environment. Defence-in-depth involves:

(i) Care in selecting sites

(ii) Robust design, including passive safety features, secondary containment, independent heat removal and reactor shut down systems

(iii) High quality construction

(iv) Multi-channel reactor protection systems

(v) Fault prevention and appropriate containment building

(vi) Fostering a culture of safety-awareness which supports a consultative approach to health and safety management among all staff

(vii) Inspection by an independent regulatory authority.

(b) Operational safety

Operational safety of nuclear facilities is achieved by:

(i) The use of remote handling equipment for many operations in the core of the reactor

(ii) The use of physical shielding

(iii) Time limits on work in areas with significant radiation levels.

These measures are supported by continuous monitoring of individual doses to ensure very low radiation exposure as shown in Figure 4 and Figure 5.

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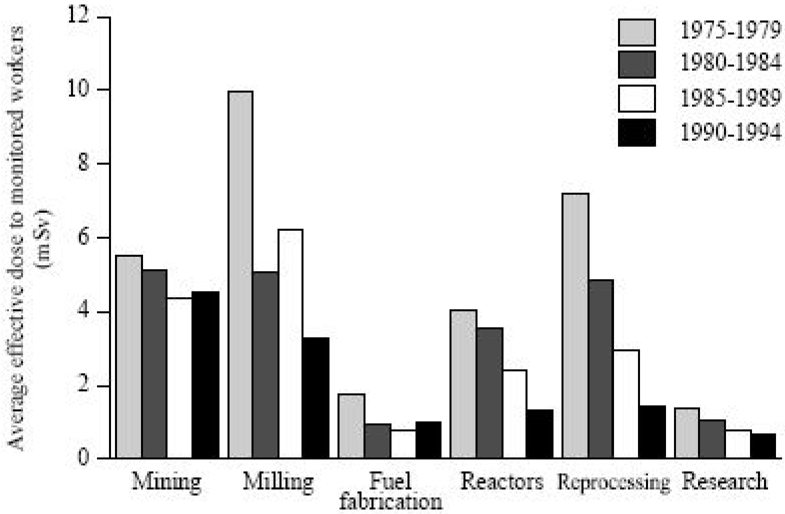
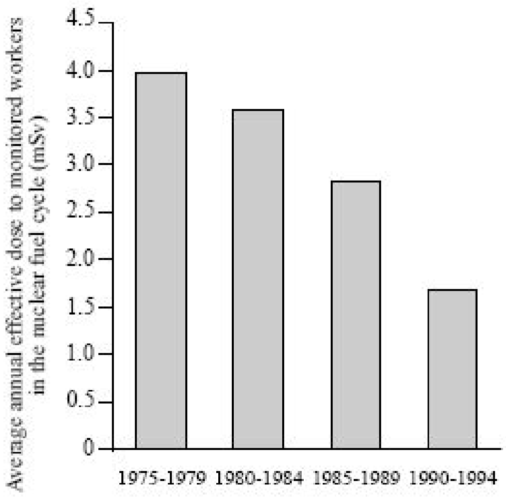


Source: **UNSCEAR 2000 Report Vol 1** ***Sources and Effects of Ionizing Radiation*****, Annexure E "Occupational Radiation Exposures" page 522**

Figure 4: Trends in average dose to monitored workers in the nuclear fuel cycle (by sector)



Source: **UNSCEAR 2000 Report Vol 1** ***Sources and Effects of Ionizing Radiation*****, Annexure E "Occupational Radiation Exposures" page 522**

Figure 5: Trend in average dose to monitored workers across the whole nuclear fuel cycle

(c) Importance of containment structures

The experiences at Three Mile Island and Chernobyl highlight the critical importance of containment structures in the event of an accident.

Containment structures can be defined as:

Structural features of a facility, containers or equipment which are used to establish the physical integrity of an area or items (including safeguards equipment or data) and to maintain the continuity of knowledge of the area or items by preventing undetected access to, or movement of, nuclear or other material, or interference with the items. Examples are the walls of a storage room or of a storage poll, transport flasks and storage containers. The continuing integrity of the containment itself is usually assured by seals or surveillance measures (especially for containment penetrations such as doors, vessel lids and water surfaces) and by periodic examination of the containment during inspection.

The ultimate barrier is the containment building, which is typically a large reinforced concrete structure designed to both retain any radioactive release and to protect the internal structures from external hazards such as missiles, fires or explosions. The walls of this structure are typically at least one metre thick.

(d) Passive safety features

Increasingly, generators now reflect not only the defence-in-depth approach, but also include "passive safety" features, that is systems that close down the reactor using natural processes that require no external intervention or power supply. These are referred to as failsafe systems.

The main passive safety features are a negative temperature coefficient and a negative void coefficient, which means that beyond an optimal level, as the temperature increases the efficiency of the reaction decreases and that if any steam has formed in the cooling water there is a decrease in moderating effect so that fewer neutrons are able to cause fission and the reaction slows down automatically.

(e) Nuclear security

In the last several years, a body of research into nuclear security has shown that, in the event of an accident, radioactive material is not readily mobilized beyond the immediate internal structure. The containment structure would still be highly effective in preventing release, even if ruptured. In its report “Safety of Nuclear Power Reactors” (June 2008—see http://www.world-nuclear.org/info/info06.html), the World Nuclear Association states, ‘The risks from western nuclear power plants, in terms of the consequences of an accident or terrorist attack, are minimal compared with other commonly accepted risks. Nuclear power plants are very robust.’

7.5 Significant Incidents at Nuclear Facilities

The most serious *accidents* in the nuclear industry have occurred at Chernobyl in 1986 and Three Mile Island in 1979.

While there is no question that the events at Three Mile Island and Chernobyl were significant, it is important to put them in context. At Three Mile Island, the reactor pressure vessel and the containment building prevented all but a very minor release of radioactive gas that had no physical effect on the neighbouring population even though serious core damage had occurred releasing both intense heat and radioactivity. In fact, the experience at Three Mile Island demonstrated the strength of the design of the reactor, as well as the importance of containment structures. At Chernobyl, a meltdown of the nuclear fuel combined with a steam explosion resulted in large amounts of radioactive materials being released. However, in contrast to Three Mile Island, a number of factors at Chernobyl (Russian RBMK type reactor) contributed to and exacerbated the impacts of the accident:

(a) the design of the reactor was intrinsically unstable

(b) there was no containment structure (unlike Western power reactors)

(c) the experiment that the operators were conducting involved them overriding safety systems which is completely contrary to the operating procedures.

In both cases, there was poor emergency response planning and poor communication between government officials and the community, which exacerbated the impact. Since 1986, technical and operating standards have been improved at Russian built reactors, and a recurrence of Chernobyl is most unlikely. Nonetheless, the enduring emotional impacts on the community of these accidents cannot be underestimated.

A further example of the robustness of modern nuclear power plants is the earthquake in July 2007 in the vicinity of Japan's Kashiwazaki-Kariwa nuclear power plants. Although the earthquake far exceeded the design factors of the reactors, the reactors were safely shutdown and all safety equipment was maintained, demonstrating that designs had ample safety margins. Minimal quantities of radioactivity were released.

In addition to these other incidents at facilities have occurred and have resulted in minor environmental and safety impacts. An overview of reporting systems can be seen at: http://www-ns.iaea.org/databases/.

7.6 Contractual controls

In addition to the controls and safeguards outlined above, there are a number of provisions under the proposed Joint Venture (JV) contract and the supplementary concentrate supply agreement which would have a support role in ensuring the safe management, transport, handling, use and storage of concentrate in China.

For example, under the draft terms of the proposed agreements, BHP Billiton may suspend the delivery of concentrate produced at Olympic Dam to China if the Chinese JV company failed to comply with relevant Chinese or Australian regulations and relevant uranium handling standards.

It would be a condition precedent under the supply agreement that all inter-governmental agreements relating to nuclear safeguards to which Australia is a party, must be in force between Australia and the country receiving the concentrate (in this case, China) prior to the export of concentrate. In other words, no concentrate would be supplied until such bilateral agreements are signed and are in force.

There will also be an independent metallurgical auditor on-site at the combined copper-uranium production plant in China who will ensure that no product has been diverted and that all material is accounted for and remains exclusively in peaceful use.

Finally, the proposed JV Company would have to ensure the design and construction of the facility complied with international practice including all appropriate environmental and uranium safeguards and that the facility will be suitable for leaching and refining uranium oxides as well as smelting and refining copper concentrate that has been pre-leached for uranium oxide.

There would be requirements for the management systems of the facility including that the general manager had high professional qualifications and experience and must report to and be responsible to the board of directors.

Extensive IAEA safeguards reinforced by the Australian bilateral safeguards regime, supported by the JV and concentrate supply agreements give BHP Billiton significant confidence that the concentrate would be handled and produced safely in China during the lifetime of Olympic Dam.

7.7 Waste streams and controls

In broad terms there are potentially four waste streams arising from the processing in China of concentrate from the Olympic Dam expansion, namely:

(a) smelter dust and off-gases from the smelter

(b) tailings from the uranium oxide production plant (the raw material here would be the concentrate) and radioactive slag from the copper smelter

(c) tailings from the enrichment of AONM

(d) waste from any reprocessing of AONM. However, this activity is expressly prohibited by Australia under the Bilateral Safeguards Agreement with China.[3]

Spent reactor fuel is not a waste as such. It is a source of energy given that reprocessing allows for the recovery of uranium and plutonium for recycling. However, spent fuel could eventually be categorised as waste by China when it is placed irrecoverably in long-term repositories.

[3] Agreement Between the Government of Australia and the Government of the People's Republic of China on the Transfer of Nuclear Material (Annex C).

There are a range of controls which apply to ensure the safe management of these waste streams including the following:

(a) Uranium Accounting Report and Waste Management Plan

The Australian Government has required BHP Billiton to develop a detailed Uranium Accounting Report to track the waste streams containing AONM as part of the process for considering export approval. Under that regime Olympic Dam will develop a waste management plan to ensure the waste containing AONM is properly accounted for and controlled.

(b) BHP Billiton experience will assist JV Partners

While there would be some process differences between the current Olympic Dam operations and the proposed China JV operations, as noted in section 4 of this appendix, BHP Billiton has had considerable experience over many years in managing these wastes safely and securely. This experience would be brought to bear in its JV arrangements.

(c) Contractual Controls

Under the JV arrangements with its Chinese customers (discussed above), the customer's operation will apply international standards in relation to security, safety, nuclear material accounting and the environment.

(d) International Standards

The first binding legal instrument to directly address radioactive waste management on a global scale was the 1997 *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,* which came into force in June 2001 (Joint Convention).

The Joint Convention establishes an international legal framework for harmonising national waste management practices and standards, and imposes obligations on Contracting Parties in relation to the trans-boundary movement of spent fuel and radioactive waste. These obligations would be mainly based on the concepts contained in the IAEA Code of Practice. The obligations imposed by the Joint Convention include a requirement to establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and manage radioactive waste.

Further, the Joint Convention creates an obligation to ensure that individuals, society and the environment are adequately protected against radiological and other hazards through appropriate siting, design and construction of facilities and by making provisions for ensuring the safety of facilities both during their operation and after their closure.

There are also strict controls on the movement of radioactive waste to prevent one country disposing of it in another. One such control is the IAEA Code of Practice on the International Trans-boundary Movement of Radioactive Waste (IAEA Code of Practice), which was adopted by consensus at the IAEA General Conference in 1990. The code recognises the sovereign right of every state to prohibit the movement of radioactive waste into, from or through its territory.

The code also calls on states to ensure that trans-boundary movements are undertaken in a manner consistent with international safety standards, and only take place with the prior notification and consent of the sending, receiving and transit states, and in accordance with each states' respective laws and regulations.

7.8 ESD and Product Stewardship

BHP Billiton is committed to the principles of Ecologically Sustainable Development (ESD), intergenerational equity and other long-term environmental considerations which are fundamental tenets of sustainability. Part of this commitment involves promoting and implementing stewardship principles on a whole of life cycle basis for the raw materials that it produces, including concentrate.

BHP Billiton's Stewardship Program aims to ensure that its activities, and those of the purchasers and users of its products, are technically appropriate, environmentally sound, financially profitable and socially responsible.

Those stewardship principles and their application to the export and use of concentrate in China, including the wastes mentioned above, are discussed in more detail in the paragraphs below.

(a) What are stewardship principles?

Stewardship principles are a set of formal principles that engages all players in the life cycle of a commodity where the responsibility of using a certain commodity such as uranium oxide is shared by all players in every sector in the NFC – from exploration and mining to spent fuel recycling and management, from the production of medical resources to the operation of nuclear power.

(b) Involvement in the Australian Uranium Association

BHP Billiton was a founding member, and currently chairs the Board of Directors, of the Australian Uranium Association (AUA) whose members include the country's leading uranium exploration, mining and exporting businesses.

The AUA was established in 2006 for the following purposes:

- to enable businesses involved in the exploration, mining and exporting of uranium oxide to contribute to emerging policy debates about the expansion of the industry
- to enable the safe, efficient and productive development of the uranium industry
- to obtain a better understanding of the global context in which the uranium industry operates
- to ensure stakeholder and public confidence in the industry.

(c) The Uranium Stewardship Principles

In September 2006, the AUA established a Uranium Stewardship Working Group (chaired by BHP Billiton) (Working Group).

The Working Group established a programme aimed at ensuring that all uranium oxide and its by-products are managed in a safe, environmentally responsible, economically and socially acceptable manner. At present, the Working Group is developing the Uranium Stewardship Principles (Principles) which are supplementary to the broader Australian Minerals Industry's commitment to sustainable development[4] and to the AUA's Charter and Code of Practice.

In developing the Principles and the Uranium Stewardship Program, a number of other authorities were consulted including:

- Australian Government – to promote stewardship principles both in Australia and recently through APEC economies
- intergovernmental agencies who work closely with the IAEA
- non-government organisations (NGOs) – BHP Billiton hosts regular stakeholder conferences and has sought feedback from NGOs on what would constitute uranium stewardship; and
- investment organisations – both BHP Billiton and the World Nuclear Association have conducted dialogues in Australia and in London with the aim of seeking feedback on what would constitute uranium stewardship. It is proposed to hold another dialogue at the Global Nuclear Fuel Cycle Conference in Sydney in April 2009.

The Working Group has developed and BHP Billiton has committed to the following Stewardship Principles, with the goal of reducing as far as practicable any residual risk for harm to people and the environment:

- support the safe and peaceful use of nuclear technology
- act responsibly in the areas that we manage and control
- operate ethically with sound corporate governance
- uphold and promote fundamental human rights
- contribute to social and economic development of the regions in which we operate
- provide responsible sourcing, use and disposition of uranium oxide and its by-products
- encourage best practice and responsible behaviour throughout the NFC
- improve continually in all areas of our performance
- communicate regularly on progress
- review and update as necessary.

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[4] As outlined in Enduring Value - The Australian Minerals Industry Framework for Sustainable Development

(d) Consistency with the World Nuclear Association Principles

It is important to note, in the context of the NFC, that the Principles being developed by the AUA also reflect the global principles being developed under the auspices of the World Nuclear Association (WNA).

The WNA is a global private-sector organization that seeks to promote the peaceful worldwide use of nuclear power as a sustainable energy resource for the coming centuries. Specifically, the WNA is concerned with nuclear power generation and all aspects of the NFC, including mining, conversion, enrichment, fuel fabrication, plant manufacture, transport, and the safe disposition of spent fuel.

The WNA has the following specific functions:

- to facilitate members interacting on technical, commercial and policy matters and promoting wider public understanding of nuclear technology
- to serve as the pre-eminent global forum and commercial meeting place for those engaged in providing the world's largest source of safe, economic and environmentally friendly energy
- to provide a respected information service on nuclear energy and to speak pro-actively on behalf of nuclear energy amongst policymakers, opinion leaders, the media and the public.

In April 2006 the WNA established a Uranium Stewardship Working Group (chaired by BHP Billiton). The Working Group comprises over 80 members from all sectors and services of the uranium life cycle.

The WNA has agreed to the same Stewardship principles as outlined above and has developed a Code of Practice to support those principles which has recently been finalised (see attached supplement).

(e) Application of the Stewardship Principles to concentrate export

When applied to the export of concentrate, the Uranium Stewardship Program and the adoption of the Principles, means that BHP Billiton would have a direct responsibility in the areas and functions that it controls and operates, and a shared concern in those areas and functions where others have a direct responsibility.

BHP Billiton will continue to work with all other entities in all sectors of the life cycle of uranium and its by-products to reduce opportunities for harm to people and the environment. Since entering the nuclear industry in 2005, BHP Billiton has supported leadership in the development of national and international Uranium Stewardship Working Groups that assist global players in the life cycle of uranium to work together to provide assurance that no harm comes to people and the environment as a result of using uranium as a fuel source.

While the verifiable standards for uranium stewardship are still being developed, several interim measures are currently in place that either reflect national and international regulation, or company (eg BHP Billiton HSEC Standards) or industry values (eg ICMM's Sustainable Development Principles and Minerals Council of Australia's Enduring Value).

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The performance criteria associated with the BHP Billiton HSEC standards are verified in a triennial audit and also verified by some of the company's customers (eg Vattenfall's ESD questionnaire and site audit). The development of the Stewardship Principles and performance criteria will reflect the shared responsibility and shared concern by all players in the uranium life cycle. These performance criteria will cover not only the primary sectors in the NFC (mining, conversion, enrichment, fuel fabrication, power generation and waste disposal) but also the links between the sectors (eg the transport connections).

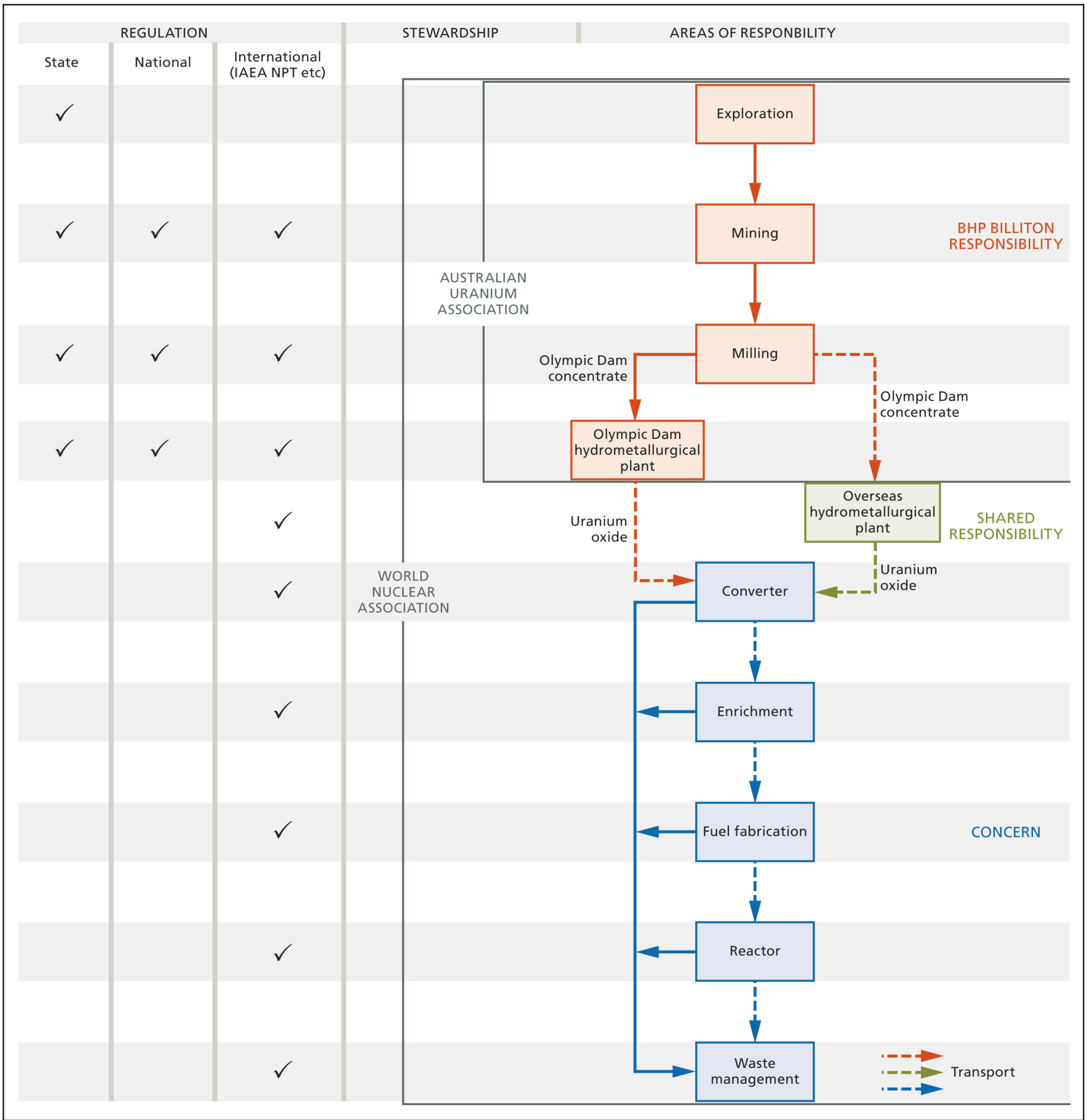

Figure 6: Stewardship and the Nuclear Fuel Cycle[5]

[5] The Australian Uranium Association (AUA) and the World Nuclear Association (WNA) are recognised non-government organisations which, with the full participation of the Australian and international nuclear industries respectively, set benchmarks and coordinate industry standards and stewardship programs. These organisations do not implement such standards: that responsibility lies with industry and Governments

7.9 No Wastes to be returned to Australia

There is no intention on the part of BHP Billiton or the Australian Government that any of the waste streams from the NFC discussed in section 7.8 above would be returned to Australia.

The return of the waste to Australia would be contrary to long standing Australian Government policy as well as being contrary to international practice which dictates that the country which produces the nuclear waste is also responsible for its management and long term disposal. In accordance with that approach, all of the waste streams would be managed in China in accordance with domestic and international regulatory requirements. Accordingly, the proposed Olympic Dam expansion would not require a long-term nuclear waste facility in Australia.