APPENDIX I

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APPENDIX I1

Draft radioactive material transport management plan (interim draft)

OLYMPIC DAM EXPANSION
SUPPLEMENTARY EIS

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Draft Radioactive Material Transport Management Plan (interim draft)

April 2011

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NOTE:

This draft Radioactive Material Transport Management Plan (interim draft) has been prepared as information to support the Environmental Impact Statement for the proposed Olympic Dam Expansion Project, and is not to be relied on as final or definitive. It will continue to be developed and will be subject to change.

CONTENTS

1 PURPOSE

The purpose of the Radioactive Material Transport Management Plan (RMTMP) is to ensure Olympic Dam radioactive material is transported safely and efficiently by either rail or road through the application of consistent systems and procedures.

This document establishes the framework for the operational requirements of the RMTMP and will form the basis of a management program that will comply with regulations set down by the relevant Australian, state and territory governments.

2 SCOPE

2.1 Scope of the RMTMP

The scope of this management plan is to provide a high level of protection for the environment, community and workers against radiation, contamination and other hazards associated with transporting radioactive materials between Olympic Dam and nominated export ports, namely Port Adelaide in South Australia and the East Arm facilities at the Port of Darwin in the Northern Territory.

The RMTMP complies with the requirements of relevant regulatory agencies and provides a management system that covers radiation protection practices and the safe and efficient transport of radioactive materials from Olympic Dam. It will form the basis for the issuing of formal long-term licences and/or approvals that would permit BHP Billiton to transport Class 7 LSA-1 radioactive material in Australia.

The plan applies to the following radioactive material that leaves Australian Safeguards and Non-Proliferation Office (ASNO) approved storage areas at Olympic Dam for transport, either by road or rail:

- uranium oxide concentrate (hereafter uranium oxide) packed in 205 litre drums in 20 ft General Purpose containers
- copper concentrate containing uranium (hereafter concentrate) loaded bulk into covered bulk rail wagons.

Both uranium oxide and concentrate are classified as dangerous goods and will be transported as UN29192, Class 7 – Radioactive Substances, LSA-1.

Construction of any infrastructure associated with the transport of radioactive materials is not included in the scope of this document, and this plan assumes that all port infrastructure required has been provided prior to enactment of the Transport Plan.

2.2 Definitions

An element is ***radioactive*** if it is one of the natural or man-made elements that are unstable. Elements (and materials) cannot become radioactive (except under very specials conditions). Radioactivity is a natural way for an atom to achieve a lower energy state.

Under the South Australian *Radiation Protection and Control Act 1982* ***radioactive substance*** means ‘a substance occurring naturally or artificially produced (whether solid, liquid or gaseous), which consists of or contains any radioactive element or compound whether natural or artificial and includes any device or thing that contains such a substance.’

Under the South Australian *Dangerous Substances Act 1979* ***dangerous substance*** means ‘dangerous goods; or any other substance or article that is toxic, corrosive, flammable or otherwise dangerous and declared by the regulations to be a dangerous substance’.

Under the Northern Territory *Radioactive Ores and Concentrates (Packaging and Transport) Act* ***radioactive material*** is defined as ‘uranium ores and concentrates, uranium oxide (U_3 0_8) and any other prescribed radioactive ore or concentrate with a specific activity greater than 0.002 microcuries

per gram'. Under ARPANSA, *Safe Transport of Radioactive Material (2008), Radiation Protection Series No. 21* ***radioactive material*** is anything greater than 1bq/g (approx 80 ppm uranium).

Under the Northern Territory *Darwin Port Corporation Act* ***dangerous goods*** means goods listed as dangerous goods in the International Maritime Dangerous Goods Code, published by the International Maritime Organization, London, in 1965 or that Code as amended to the date, if any, specified under subsection (2) by the Minister.

Low Specific Activity (**LSA**) material means radioactive material, which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material must not be considered in determining the estimated average specific activity.

3 LEGISLATION: TRANSPORT OF RADIOACTIVE MATERIAL

3.1 Introduction

Australia has operated a comprehensive uranium export policy for over 30 years in line, and consistent, with all relevant international conventions and obligations.

This section provides and overview of the uranium oxide regulated activities across the international, national, state and territory government departments and agencies associated with the transport and export shipment of radioactive material (uranium oxide and concentrate).

3.2 International Atomic Energy Agency (IAEA)

As an independent international organisation related to the United Nations system, the IAEA was established in 1957 by member states for the safe, secure and peaceful use of nuclear science and technology. The IAEA reports annually to the UN General Assembly. The IAEA's three main areas of focus are:

- safety and security
- science and technology
- safeguards and verification.

The IAEA also advises the Security Council regarding non-compliance to safeguards obligations and matters relating to international peace and security.

The IAEA produces international transport regulations for transporting radioactive substances, known as TS-R-1 or the *Regulations for the Safe Transport of Radioactive Material*, as part of the IAEA safety standards. The current version is the 2009 edition. The regulations address all categories of radioactive material, ranging from very low activity material, such as ores and ore concentrate, to very high activity material, such as used fuel and high level waste. The regulations cover marking, labelling and placarding, documentation, external radiation limits, operational controls, quality assurance, and notification of radioactive substances across land, marine and air transport.

A full suite of supporting publications are downloadable in pdf format from the IAEA website <http://www-ns.iaea.org/standards/documents/default.asp?sub=200>.

3.3 Legal requirements

Table 1 lists the primary legislation relevant to transporting radioactive material together with a summary of the key requirements.

Table 1: Applicable legislation

Applicable site	Source	Summary of key requirement/obligation
All	*Australian Radiation Protection and Nuclear Safety Act 1998*	Creates the ARPANSA body, which regulates radiological matters in Australia. ARPANSA has developed the radiation protection codes, one of which is the Code of Practice for the Safe Transport of Radioactive Materials 2008 (summary below).
	Nuclear Non-Proliferation (Safeguards) Act 1987	Prohibits the export of radioactive material without approval by the appropriate Minister, (currently the Energy and Resources Minister).
	Customs Act 1901 *Customs (Prohibited Exports) Regulations 1958*	The Regulations require the Minister for Resources to manage the issuing of permits to export radioactive material.
	Code of Practice for the Safe Transport of Radioactive Materials 2008[1]	Schedule A adopts the IAEA 'Regulations for the Safe Transport of Radioactive Material 2005 Edition (No. TS-R-1)' Key requirements are: ▪ all movements are to be fully contained in a sealed package, container, ship's hold or like, that prevents leakage or spill when being handled by routine transport solutions. ▪ external surfaces must be measured and free of any traces of the material so that the radiation level averaged over 300 cm^2 does not exceed 4Bq/$cm^{2\ for}$ beta and alpha emitters and low toxicity alpha emitters. ▪ Class 7 labelling and placards must be placed at all entrances to storage and handling locations, on road and rail transport equipment and supporting documentation (i.e. SDS, Consignor's Declaration for Dangerous Goods Class 7 Radioactive Material etc). ▪ any bulk rail wagon, conveyor and material handling system or ships hold that has been used to carry radioactive material is retained for exclusive use until the bulk rail wagon, conveyor and material handling system or ships hold has been fully decontaminated.
	Australian Dangerous Goods (ADG) Code	Establishes the detailed technical and procedural requirements for a range of activities associated with the preparation and transport of hazardous and dangerous goods by road or rail. The ADG specifies requirements for separating, segregating, labelling and documenting dangerous and hazardous materials. For Class 7 – Radioactive Material, the ADG references the ARPANSA Code of Practice for the Safe Transport of Radioactive Materials 2008.
South Australia (Olympic Dam, road transport route to Outer Harbor, rail transport route to SA/NT border)	*Environment Protection Act 1993*	**Section 25:** General environmental duty: A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm. **Section 83:** Notification where serious or material environmental harm is caused or threatened.

[1] Referred to as the 'Transport Code' under the South Australian Radiation and Protection and Control Act Regulations

Applicable site	Source	Summary of key requirement/obligation
	Radiation Protection and Control Act 1982	**Section 42**: (1) If the Minister considers that a dangerous or potentially dangerous situation exists involving actual or threatened exposure of a person to excessive radiation or contamination of a person or place by radioactive substances— (a) the person responsible for the danger or potential danger or a person affected by it may be directed to take, or refrain from taking, specified action; or (b) the radiation apparatus or radioactive substances giving rise to the danger or potential danger or anything contaminated or affected thereby may be seized, removed, disposed of, treated or otherwise dealt with; or (c) any other direction may be given, or action taken, to avoid, remove or alleviate the danger or potential danger.
	Radiation Protection and Control (Transport of Radioactive Substances) Regulations 2008	**Section 5**: A consignor must, in relation to the consignment of radioactive material, comply with the requirements of the International Regulations specified in Clause 2.8 of the Transport Code. **Section 6**: (1) A carrier must, in relation to the transport of radioactive material, comply with the requirements of the International Regulations specified in Clause 2.9 of the Transport Code. (2) A carrier must ensure that, at all times during the course of the carriage of packages of radioactive material in a freight container or in or on a vehicle, each package is stowed and secured in such a manner that— (a) the package will remain in position despite movements of starting, stopping, jolting or swaying to which the container or vehicle may be subject; and (b) the package is kept away from heavy articles or goods likely to cause damage to it in the ordinary course of transport or in the event of accident; and (c) if carried on a vehicle—the package does not project beyond the periphery of the vehicle. **Section 7**: (1) If, while a package of radioactive material is being transported— (a) the package is lost, wrongfully interfered with or damaged; or (b) radioactive material leaks from the package; or (c) the vehicle used to transport the package is involved in an accident that results in, or is likely to result in— (i) damage to the package; or (ii) a leak of radioactive material from the package, the driver of the vehicle being used to transport the package must— (d) forthwith report the matter to all relevant persons, giving details of the package and the circumstances of the loss, interference, damage, leak or accident and such other details as are reasonably required by the relevant person to whom the report is being made; and (e) prevent, as far as practicable, access to the package by anyone other than a person authorised by a relevant person; and (f) obey any directions given by the Minister in respect of the package. Maximum penalty: $10,000. (2) If, while a package of radioactive material is being stored in the course of transit— (a) the package is lost, wrongfully interfered with or damaged; or

Applicable site	Source	Summary of key requirement/obligation
		(b) radioactive material leaks from the package, the person in charge of the place of storage of the package must— (c) forthwith report the matter to all relevant persons, giving details of the package and the circumstances of the loss, interference, damage, leak or accident and such other details as are reasonably required by the relevant person to whom the report is being made; and (d) prevent, as far as practicable, access to the package by anyone other than a person authorised by a relevant person; and (e) obey any directions given by the Minister in respect of the package. **Section 8**: (1) A person must not, without the approval of a relevant person, interfere with— (a) the contents of a consignment of radioactive material; or (b) any label or marking required by the International Regulations in relation to a package of radioactive material; or (c) a document relating to a consignment of radioactive material, except in the course of transporting the radioactive material in accordance with the Act and these regulations.
	Dangerous Substances Act 1979	**Section 2**: Interpretation: Definitions of dangerous substances and dangerous goods. **Section 11**: General duty: A person must, in keeping, handling, conveying, using or disposing of a dangerous substance, or in transporting dangerous goods, take such precautions and exercise such care as is reasonable in the circumstances in order to— (a) avoid endangering the health or safety of any person (including himself or herself), or the safety of property; and (b) prevent the risk of environmental harm. **Section 12**: Duty in relation to plant. **Division 2**: (Requirements for) Licences to keep dangerous substances. **Division 3**: (Requirements for) Licences to convey dangerous substances. **Division 4**: (Requirements for) Licences generally. **Part 4:** Dangerous Goods – Special Provisions.
	Dangerous Substances (Dangerous Goods Transport) Regulations 2008	**Regulation 3:** (2) Part 4 of the Act and these regulations do not apply to the transport of the following dangerous goods except when they are being transported with other dangerous goods: (c) dangerous goods of UN Class 7 (radioactive material); **Part 3:** Licences. **Regulation 17:** Circumstances in which a licence is required. **Regulation 19**: Application for licence or renewal of licence (for driver transporting dangerous goods). **Division 3:** Dangerous goods vehicle licences. **Regulation 25**: Application for licence or renewal of licence. **Regulation 42**: Drivers licence to be carried. **Regulation 43**: Vehicle licence label must be attached to the vehicle in a conspicuous place. **Part 4**: General Industry Requirements. **Regulation 46**: Vehicles must be covered by insurance for a sum that includes at least $5,000,000 for each load-bearing vehicle comprising the vehicle for purposes described in the regulation.

Applicable site	Source	Summary of key requirement/obligation
		Regulation 48: Training: A person who is responsible for management, control or supervision of a task must not employ, engage or permit another person to perform the task if the other person— (a) has not received appropriate instruction and training to ensure that he or she is able to perform the task safely and in accordance with these regulations; or (b) is not appropriately supervised in performing the task to ensure that he or she is able to perform the task safely and in accordance with these regulations. A person must not manage, control or supervise a task unless the person has received instruction and training to enable him or her to manage, control or supervise (respectively) another person to perform the task safely and in accordance with these regulations. **Part 5**: Packaging. **Part 6:** Signage: ▪ **Division 1**: Marking and labelling of packages ▪ **Division 2**: Placarding of loads. **Part 7:** Vehicles and equipment ▪ **Division 1**: Standards ▪ **Division 2**: Safety equipment. **Part 9:** Stowage and restraint. **Part 10:** Segregation. **Part 11**: Special requirements for transport in tank vehicles and bulk transfer. **Part 12:** Documentation ▪ **Division 1**: Transport documentation ▪ **Division 2**: Emergency information. **Part 13:** Procedures during transport ▪ **Division 1**: Road vehicles – driver's duties ▪ **Division 2**: Routes, times etc ▪ **Division 3**: Immobilised and stopped vehicles ▪ **Division 4**: Emergencies generally ▪ **Division 5**: Emergencies involving placard loads.
	Road Traffic Act 1961	**Part 3:** Duties of drivers, passengers and pedestrians. **Part 3AA**: Provisions related to the management of heavy vehicles. **Part 4**: Vehicle standards, mass and loading requirements and safety provisions.
Northern Territory (Rail transport route from SA/NT border, East Arm Concentrate Storage Facility, Port of Darwin)	*Waste Management and Pollution Control Act*	**Section 12:** General environmental duty: (1) A person who – (a) conducts an activity that causes or is likely to cause pollution resulting in environmental harm or that generates or is likely to generate waste; or (b) performs an action that causes or is likely to cause pollution resulting in environmental harm or that generates or is likely to generate waste, must take all measures that are reasonable and practicable to – (c) prevent or minimise the pollution or environmental harm; and (d) reduce the amount of the waste. **Section 14:** Duty to notify of incidents causing or threatening to cause pollution.

Applicable site	Source	Summary of key requirement/obligation
	Radioactive Ores and Concentrates (Packaging and Transport) Act	**Section 9**: (1) A person shall not transport radioactive material of which he is the owner, or cause or allow that material to be transported, unless he has as an agent for the purpose of this Act a natural person resident in the Territory and employed by the owner. **Section 12**: (1) An owner of radioactive material, who intends to transport radioactive material, or an agent of such an owner, may apply, in the prescribed form, for a grant of a licence under section 13(a). (2) A person who intends to use premises occupied by him for the storage of radioactive material may apply, in the prescribed form, for a grant of a licence under section 13(b). **Section 16**: Person not to possess radioactive material without a licence. **Section 17**: Person not to store radioactive material without a licence. **Section 18**: A person shall not package, store or transport radioactive material unless it is packaged, stored or transported in compliance with a code, rule, specification or regulation adopted under section 25(1). **Section 20**: (1) Where radioactive material is being transported by a vehicle and: (a) the vehicle is involved in an accident or is subject to unusual delay; or (b) contamination of the environment or danger to any person has occurred or, in the opinion of the person in control of the vehicle may result from, a leakage or spillage of that material from a container or package, the person in control of the vehicle shall: (c) forthwith notify an inspector of that fact; (d) obey such instructions as an inspector may give; and (e) take all reasonable steps to prevent access to the vehicle or the vicinity of the material by any person unless authorized by an inspector to have such access. **Section 21**: Where, a licensee becomes aware that damage has occurred to a package or container containing radioactive material on his licensed premises, he shall: (a) forthwith notify an inspector of that fact; (b) obey such instructions as an inspector may give; and (c) take all reasonable steps to prevent access to the package, container and material or the vicinity of the package, container and material by any person unless that person is authorized by an inspector to have such access.
	Radioactive Ores and Concentrates (Packaging and Transport) Regulations	**Regulation 4**: Prescribes types of records for transport of radioactive material that licensees must keep. **Regulation 5**: Prescribes types of records persons licensed to store radioactive material shall keep.
	Darwin Port Corporation Act	**Section 38**: (1) A person may apply to the Port Corporation for a licence for the purposes of the carrying on the business of a stevedore within the Port. **Section 48**: By-laws (1) The Port Corporation may make by-laws, not inconsistent with this Act, prescribing all matters that are required or permitted by this Act to be prescribed by by-laws or are necessary or convenient to be so prescribed, for the control, regulation and management of the Port and (then details particulars...) (2) Where there is an inconsistency between a by-law made under this section, or continued under section 50(1) to apply, and a provision of or under the *Dangerous Goods Act*, the provision of or under the *Dangerous Goods Act* shall, to the extent of the inconsistency, cease to apply.

Applicable site	Source	Summary of key requirement/obligation
	Darwin Port (Handling and Transport of Dangerous Cargoes) By-laws.	**By-law 3:** These By-laws adopt the provisions of Australian Standard AS 3846-1998 as by-laws of the Port Corporation in relation to the Port of Darwin.
	Australian Standard AS 3846-1998 "The handling and transport of dangerous cargoes in port areas".	

4 RELATIONSHIP AND RESPONSIBILITIES OF PARTIES

4.1 Introduction

This section sets out the relationships with service providers as detailed in the RMTMP. These are limited to covering activities associated with the transportation of radioactive material (uranium oxide or concentrate) from Olympic Dam to the ports of Adelaide or Darwin.

In addition, the roles and responsibilities of personnel within the organisations supplying services relating to the plan are detailed in this section.

4.2 Relationship of parties

A ‘top down’ hierarchical contractual relationship shall be established between BHP Billiton and all parties involved in transporting radioactive materials (uranium oxide or concentrate) from Olympic Dam.

All commercial contracts between BHP Billiton and transport service providers for handling, storage and transportation will stipulate the provider’s obligations to ensure appropriate permits and approvals are in place with relevant Australian, state and territory regulatory authorities.

4.3 Roles and responsibilities

4.3.1 President BHP Billiton Olympic Dam

- The President of BHP Billiton Olympic Dam has responsibility for the implementing and, maintaining this Transport Plan.
- Aspects of the plan will be delegated to suitably qualified personnel within BHP Billiton.

4.3.2 BHP Billiton (Olympic Dam) Corporation

BHP Billiton (Olympic Dam) Corporation will:

- manage, operate, conduct and supervise the activities at the Olympic Dam site in South Australia
- hold the ultimate responsibility for collecting, packaging, labelling, certifying, documenting and delivering the radioactive materials (uranium oxide or concentrate) from the Olympic Dam site to the ASNO approved facilities in either Port Adelaide or the Port of Darwin along an approved transport route, as described in this RMTMP
- use contractors, at its discretion, for part or all of the operations described in this RMTMP, but nothing shall absolve BHP Billiton or the contractors of the ultimate responsibility defined in this plan under Contract conditions

- maintain relationships with Australian, state and territory government agencies and authorities associated with the road or rail transport of radioactive materials (uranium oxide or concentrate) from the Olympic Dam site
- be responsible for all aspects associated with the approvals, implementation and management of the RMTMP.

4.3.3 Transport freight service provider(s)

Transport freight service provider(s) (TSP) contracted directly to BHP Billiton to provide rail or road transport services, have the responsibility to:

- maintain valid permits and approvals from Australian, state and territory regulators to carry radioactive materials (uranium oxide or concentrate)
- complete appropriate training and licensing of TSP personnel in the handling of radioactive materials (uranium oxide or concentrate)
- provide all services associated with the safe handling and transportation of the radioactive materials (uranium oxide or concentrate) by road or rail
- comply with the procedures described in this RMTMP and any other Australian, state or territory government code(s) or regulation(s) that apply to deliveries from Olympic Dam, South Australia by road or rail
- comply with all Australian, state and territory road and rail regulations, regulated procedures (i.e. chain of responsibility, fatigue management) and codes of practice applicable at the time of the task of transporting radioactive materials (uranium oxide or concentrate)
- maintain, review and regularly test emergency response procedures related to transporting radioactive materials (uranium oxide or concentrate)
- place appropriate documentation and an emergency response folder in the cabin of each locomotive or road truck.

5 BASIS OF THE TRANSPORT SOLUTION

The transport of radioactive materials (uranium oxide and concentrate) on public roads and rail systems from Olympic Dam will comply with the legislation outlined in Section 4 – Legislation: Transport of Radioactive Material.

The ARPANSA ‘Code of Practice: Safe Transport of Radioactive Material’ Edition 2008 establishes specific requirements for radioactive substances such as uranium oxide and concentrate which are outlined in this section.

5.1 Community perception

The community perceives any exposure to radioactive substances is dangerous. As the Olympic Dam concentrate is rated as LSA-I, BHP Billiton will communicate openly with stakeholders and involve them in education and dealing with community concerns.

The BHP Billiton strategy is to establish clear procedures to minimize the risk of radiation exposure and provide protection during the transport of radioactive material (uranium oxide or concentrate).

5.2 The ALARA principle

The ALARA principle is defined as[2]:

> 'the source related process to keep the likelihood of incurring exposures (where these are not certain to be received), the number of people exposed, and the magnitude of individual does as low as reasonably achievable, taking economic and societal factors into account'.

ALARA focuses on protecting people and the environment from the harmful effects of ionizing radiation, which includes both particle radiation and high-energy electromagnetic radiation.

The objective across the transport solution is to maintain the minimum exposure levels of employees and the community to well below the annual public dose limits set by Australian legislation of 1 mSv/y.

There are four principal ways to reduce radiation exposure to workers or to the community:

- shielding – use proper barriers to block or reduce ionizing radiation
- time – spend less time in radiation fields
- distance – increase the distance between radioactive sources and workers or population
- amount – reduce the quantity of radioactive material being held in storage.

These four ways have been incorporated into the overall design of the transport solution for Olympic Dam material and are aligned with achieving the ALARA principle.

5.3 Separation distances

Consistent with the ADG requirements, separation distances for radioactive material including uranium oxide and concentrate during transport will comply with the following requirements:

- 24 m from Class 1 or 2.1
- 12 m from Class 3, 4, 5 or 8.

5.4 Controls for surface contamination

Under routine transport conditions, the non-fixed surface contamination (i.e. dust particles or similar than can be wiped or washed off) on the external surfaces of either the bulk rail wagon or the 20 ft container shall not exceed the following:

- 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters
- 0.4 Bq/cm^2 for all other alpha emitters.

Before departing from Olympic Dam, Port Adelaide and/or the Port of Darwin, the external surfaces of the bulk rail wagon and 20 ft container(s) will be checked by nominated Safety Officer(s) to ensure surface contamination is below these limits.

In the case of bulk rail wagon(s), the external surfaces will be checked after wash down has occurred at Olympic Dam and the Port of Darwin.

[2] The 2007 Recommendations of the International Committee on Radiological Protection (ICRP), ICRP Publication 103, Annals of ICRP Vol. 37 (2–4).

5.5 Marking, labelling and placarding

5.5.1 Marking

The outside of the package (i.e. bulk rail wagon or the individual drums of uranium oxide in each container) shall be clearly marked with the gross mass and net mass. The marking must be legible and durable.

5.5.2 Labelling and placarding

Correct labels must be attached to each bulk rail wagon or the 20 ft container as required under the ADG Code, (namely UN2912, II-Yellow) when loaded with export material from Olympic Dam. The labels will be removed or covered when the contents of the bulk rail wagon or the 20 ft container are not present (i.e. when being moved empty).

5.6 Approved routes

The transport of radioactive material (uranium oxide or concentrate) from Olympic Dam to Port Adelaide and the Port of Darwin will be undertaken using an approved ASNO transport route and will use the public transport infrastructure shown in Figure 1.

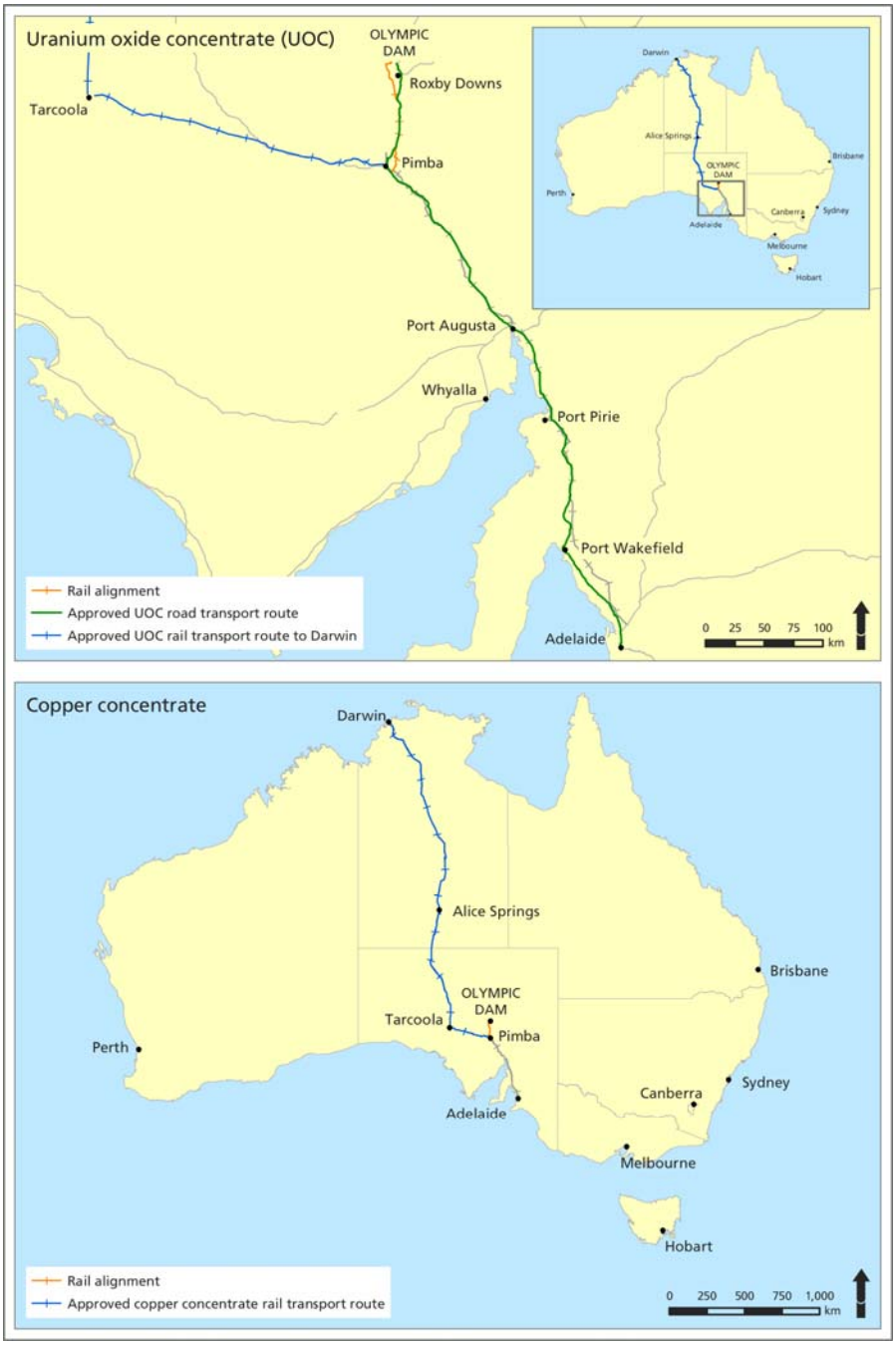

Figure 1: Proposed transport routes for uranium oxide concentrate and copper concentrate

Under instructions from the respective state police officer(s), emergency services and/or approved regulatory officer(s), alternate routes may be requested or required from time to time to complete the delivery of the consignment to the approved destinations of Port Adelaide and the Port of Darwin.

If such event(s) take place once a consignment has left Olympic Dam, the TSP and their representative will asses the impact of the required changes to the approved transport route with BHP Billiton to ensure that safety and compliance regulations are not compromised. If an alternative route is approved for transporting radioactive material (uranium oxide or concentrate), BHP Billiton will advise the relevant state or territory authorities of the change in the approved route.

5.7 Storage during transport

Radioactive material will be stored in designated secure areas that have been approved and licensed by ASNO and/or the relevant state or territory regulator.

These designated secure areas are:

- uranium oxide in 20 ft GP container(s):
  - Dubai Ports, Port Adelaide Terminal
  - Tolls Terminal, Berrimah Industrial Estate, Darwin
- concentrate:
  - storage facilities, East Arm, Port of Darwin (subject to EIS approvals and construction).

5.8 Materials handling at the Port of Darwin: copper concentrate

5.8.1 Closed system

The concentrate storage facilities, product handling, loading and unloading operations will be entirely enclosed to prevent product spills or losses from occurring throughout the transport chain and thereby separate the radioactive material from the community and the environment. The closed system would begin at Olympic Dam, where the rail wagons would be covered with a secure lid and include storage at the Port of Darwin in secure negative pressure warehouses, and the use of enclosed conveyors for the ship loading activities before ocean transit to the designated destination.

The closed storage approach also enables BHP Billiton to comply with the regulatory requirement to ensure that metal accounting practices can account for the movement of material through the entire handling system.

5.8.2 Access and security

All office facilities such as storage locations would have appropriate security measures including remote controlled gates to control the movement of all vehicles, and CCTV and other such measures to restrict and prevent unauthorised access. Continuous monitoring (i.e. 24 hours a day, seven days a week) would also be in place.

Access to the port area at the Port of Darwin is controlled under the Maritime Security Legislation and would be coordinated with the Darwin Port Corporation.

All employees, contractors and visitors will be inducted and undertake the appropriate training in the key requirements of the site management system covering access, use of personal protective equipment (PPE) and other specific requirements.

A site security pass that includes vehicle access to the storage facilities, conveyor system and ship loader will only be issued to approved personnel.

Visitors will be allowed to enter the site once formal documentation and authorisation has been provided to the site gatehouse. Visitors will be issued with a temporary site security pass (to be returned on exit) and will be escorted at all times while within the facility.

5.8.3 Dust

Olympic Dam concentrate will be transported in a dry form at a moisture level of 8-11%. While being handled in the transport chain, the concentrate may generate airborne dust. This is likely to occur at the product handing points, which are the transfer activities between:

- bulk rail wagons to storage at the Port of Darwin, East Arm facilities

- reclamation from the Port of Darwin storage shed to ship load then ship hold
- conveyor transfer points.

Employees in the storage location will use machinery that has fully enclosed cabins with dedicated dust air management and dust filtering systems in place.

These activities will take place within a closed system as described in Section 5.8.1 to prevent loss of containment to the environment or community.

5.8.4 Radon

Radon is a naturally occurring inert gas that is released when radium 226 undergoes alpha decay. Radon exists naturally in air and the average worldwide concentration is between 1 Bq/m^3 and 10 Bq/m^3.

On an ongoing basis, the potential locations where radon can accumulate will be identified and strict procedures will apply when workers are required to enter such locations.

In addition, concentrations of radon will be maintained at acceptable levels through the use of adequate ventilation.

5.8.5 Facilities control and separation

To avoid the transfer of concentrate outside contained areas at both Olympic Dam and the Port of Darwin, the storage area of concentrate will be separate from other activities such as office space, general storage and maintenance areas.

Theses facilities are designated ‘supervised’ areas and within designated areas will be ‘controlled’ areas to prevent the transfer of material outside contained areas. The separate areas will be clearly sign posted with clear rules and protocols to transfer between the areas.

Within the ‘controlled’ area, minimum requirements for personal protective equipment (PPE) will apply for employee’s and visitors alike at all times, which includes:

- work overalls
- suitable footwear (i.e. steel capped boots)
- safety helmet, glasses and gloves
- ear protection (when required)
- face mask (when required).

Any machinery entering into or used in the ‘controlled’ area will be washed down and radiation clearance will be required before it is transferred outside the ‘controlled’ area. All personnel leaving the ‘controlled’ area will be required to wash/shower and change from PPE to normal work clothes.

House keeping procedures such as continual clean up of storage area floors, roads and access ways will occur in the ‘supervised’ area to prevent dusting and transfer of concentrate.

6 INCIDENT MANAGEMENT

6.1 Damaged or leaking bulk rail wagon or 20 ft container

If it is evident during the movement between secure facilities that a bulk rail wagon or a 20 ft container is damaged or leaking, or may have been damaged or leaking, then access to the bulk rail wagon or the 20 ft container will be restricted. Qualified person(s) designated by BHP Billiton will, as soon as possible, be sent to assess the extent of contamination and the resultant radiation levels.

Temporary repairs to the bulk rail wagon or the 20 ft container will be undertaken after the assessment has been completed, and in conjunction with the rail service provider, to enable the movement to secure facilities where more permanent repairs may be required. Neither the bulk rail wagon nor the 20 ft

container will be allowed to continue on the proposed transport trip until it has been repaired and certified as safe.

In the event of loss of containment resulting from a transport accident, the main exposure pathway for personnel in attendance is likely to be via inhalation of suspended material (dust). The affected area should be suitably controlled and segregated, and access to enter or remain within the area should be restricted. Qualified persons such as emergency services representatives will take control of the incident and supervise the response operation, including the salvage operation.

6.2 Emergency management and response

IMPORTANT NOTE: The loss of containment and the presence of radioactive material should not prevent qualified persons such as emergency services personnel from undertaking rescue operations such as attending injured person(s) or fighting fires.

Historically, there have been no reported transport accidents involving radioactive material from BHP Billiton's Olympic Dam operation that have resulted in serious radiological consequences to the environment or communities along approved transport routes.

Emergency planning and preparedness for responding to a transport incident involving radioactive material (uranium oxide or concentrate) is similar to that required when responding to transport incidents involving other types of dangerous goods such as flammables, explosives, poisonous gases, corrosives and toxic chemicals.

As the Police, Fire Brigade and/or local emergency services (i.e. State Emergency Service, South Australian Country Fire Service, Northern Territory Country Fire Service) are the first line of response, they will already have emergency plans dealing with other dangerous goods as defined in the ADG code. The emergency plan for dealing with radioactive material will conform and integrate as closely as possible with procedures for dealing with other transport incidents involving other classes of dangerous goods.

The emergency response plans for TSP involved in transporting radioactive material (uranium oxide or concentrate) are integrated with those of emergency service providers to ensure a consistent approach to transport accidents where other dangerous goods are involved. This will include provisions for notifying local, state/territory and national authorities.

A separate BHP Billiton Emergency Response Plan (ERP) for Transport of Radioactive Materials (see Appendix I2 of the Olympic Dam Expansion Supplementary EIS for the plan) has been developed in the event of a transport accident involving:

- damage to rail wagon(s) of concentrate or container(s) of uranium oxide
- loss of containment of Olympic Dam radioactive material.

The plan covers:

- purpose and scope of the ERP
- roles and responsibilities under the plan
- incident classification, notification and incident response escalation procedure
- preparedness requirements
- initial response, containment and recovery procedures.

Any incident in which a loss of containment or damage to a container of Olympic Dam uranium oxide or a rail wagon loaded with Olympic Dam concentrate will be reported to competent Australian Government and state authorities as soon as practicable after the incident. BHP Billiton will provide qualified designated representatives to provide specific expertise to on-site incident controller(s) on radiation, contamination issues, and recovery and rehabilitation matters associated with the transport accident.

In general, when responding to transport incidents involving radioactive material, the main steps are to:

- use respiratory protection, protective clothing and eyewear as outlined in Safety Data Sheets for uranium oxide or copper concentrate containing uranium to reduce the possibility of inhaling radioactive material
- rescue injured personnel and provide any emergency first aid/medical attention required
- evacuate non-essential personnel and members of the community
- control fires and other common consequences of transport accidents

- identify the hazards of the material (other dangerous goods such as fuel spills, electrical sources etc.) and establish a controlled cordoned-off area
- control and prevent any additional spread of radioactive contamination
- recover the radioactive material, packaging and transport equipment
- quarantine person(s) who may have come in contact with the material, decontaminate personnel and recover contaminated material (i.e. PPE, clothing) for correct disposal
- decontaminate equipment in preparation for rail and/or road transport
- decontaminate and restore the surrounding environment to a safe state.

6.3 Training

A training program will be established by BHP Billiton and coordinated across all relevant organisations likely to be involved in a transport incident involving radioactive material. Regular refresher programs will be conducted to maintain the proficiency of all personnel, especially emergency services organisations.

This document supports and supplements individual training aimed at specific target groups, which includes training presentations on:

- radiation training and awareness for transport workers involved in transporting, handling, storing or loading uranium oxide and concentrate onto road, rail or shipping vessels
- radiation training and awareness for State Emergency Service, South Australian Country Fire Service, Northern Territory Country Fire Service or other agency personnel involved in the initial response to an incident involving uranium oxide or concentrate.
- emergency response and cleanup of Class 7 uranium oxide and concentrate material for SA and NT Emergency services personnel.

The training focuses on providing participants with awareness about:

- the requirements relating to the safe handling, storage and transportation of Class 7 radioactive material
- the characteristics of uranium oxide and concentrate
- radiation safety protection requirements, first aid and personal safety.

7 MANAGEMENT SYSTEM

7.1 Procedures

7.1.1 Uranium oxide transport

The procedures that apply to the transport of uranium oxide by road from Olympic Dam to Port Adelaide and/or rail to the Port of Darwin will address the following requirements:

- documentation and prior approval of each shipment
- procedures for packing uranium oxide for transport
- training requirements for drivers
- the allocation of trucks and drivers
- the process for sealing and washing the containers prior to loading uranium oxide
- uranium oxide loading procedure
- the marking, labelling and placarding requirements for containers
- processes for pre-departure checks

- documentation handover to the contractor drivers
- departure-from-site notification processes
- transportation procedure
- the incident management process
- unloading procedure in Port Adelaide for transport either by ship or onto rail to Port of Darwin
- a procedure for emergency storage if required
- record-keeping requirements for transport documentation.

7.1.2 Concentrate transport

As part of the Olympic Dam expansion, a procedure shall be developed to meet the requirements of this plan. The following requirements will be addressed:

- the documentation requirements for each rail movement to the Port of Darwin in accordance with the legal requirements (see Section 3 for more detail)
- procedures for loading and unloading concentrate to and from rail wagons
- pre-departure checks, including checks for radiation surface contamination on rail wagons
- the process for sealing and washing rail wagons prior to loading concentrate and following unloading
- documentation handover to rail transport contractor
- training requirements for rail transport drivers
- a procedure for emergency storage if required
- record keeping requirements for shipment documentation.

7.2 Security during transport

The objective of transport security is to prevent unauthorized personnel from acquiring radioactive material while it is in transport.

The IAEA has created a Code of Conduct for the security of radioactive material. The IAEA code addresses three topics: Prudent Management Practices, and Basic and Enhanced security levels.

The Security in the Transport of Radioactive Material code, (IAEA Nuclear Security Series No. 9, 2008) defines security levels based of the radioactivity levels of the contents of a single package of the radioactive material being transported. Uranium oxide and concentrate is classified as LSA-I and requires prudent security management practices to be implemented.

The transport of radioactive material including the transfers between transport modes from Olympic Dam to the nominated export ports of Adelaide and Darwin occurs in the public domain. While in transit, delays such as modal transfers and waiting times will be kept to a minimum and no longer than absolutely necessary to minimise unauthorised access, unexplained loss or theft or other malicious acts.

The objectives of the security plan are:

- to deter, detect and delay unauthorised access to the material while it is being transported or stored outside Olympic Dam
- to prevent any attempted theft or malicious acts while the material is being transported or stored
- to enable an appropriate response and allow recovery or contingencies to commence promptly.

A security plan that complies with Australian regulatory requirements and achieves the above objectives will be developed, implemented, periodically reviewed and communicated to all relevant parties associated with transporting Olympic Dam radioactive material. The security plan will:

- allocate responsibilities for security
- specify measures to provide advanced transport notification (where required), monitor shipments and maintain records of material transported
- include a review of operations and an assessment of vulnerability

- specify measures used to reduce security risks
- include procedures for reporting and dealing with security threats, breaches and incidents
- provide threat information on an ongoing basis and actions to be taken in the event of a change in threat level (this is and would continue to be provided by ASNO)
- include provisions for evaluating, testing, reviewing and updating the security plan
- outline measures to secure information and limit distribution of sensitive information
- ensure appropriate emergency response and security contingency plans are in place for accidents, breakdowns or any other delays along the approved transport route.

7.3 Residual risks

A risk assessment was completed for the proposed transport of radioactive material from Olympic Dam for the Draft EIS and the residual risks identified are summarised in Table 2.

Table 2: Residual transport risks

Risk issue	Description	Mitigation and controls
Injury to personnel during loading and unloading	Injury to personnel during loading and unloading	▪ Administrative and contractual controls (only trained, competent, accredited operators) ▪ Sealed drains/controlled areas (restricted and secure) for loading/unloading ▪ Plant and equipment safety and design to be fit for purpose, inspection and preventative maintenance systems ▪ Packaging to be designed for the proposed transport route ▪ Emergency response/Incident management ▪ Training for securing loads
Road and rail transport safety	Rail Incidents: ▪ Collision ▪ Derailment due roll-over /hitting infrastructure	▪ Compliance with rail procedures and safety systems ▪ Compliance with national Chain of Responsibility/Fatigue Management regulations ▪ Audit management within contract management ▪ Competent drivers/training
	Road incidents: ▪ Collision ▪ Roll-over/hitting infrastructure ▪ Leaving road	▪ Compliance with road safety ▪ Compliance with national Chain of Responsibility/Fatigue Management ▪ Audit management within contract management ▪ Traffic management plan for paved roads ▪ BHP Billiton procedures ▪ Competent drivers/training
Loss of containment	During road or rail transport due to: ▪ Collision ▪ Fatigue ▪ Over loading ▪ Road or rail conditions ▪ Weather conditions ▪ Failure to follow systems or procedures	▪ Preferred contractor, audits, licensing compliance ▪ Safety and Incident Management Plan, emergency response ▪ Chain of Responsibility/Fatigue Management Program ▪ Background checks prior awarding of contract (i.e. contractual arrangements, roadworthiness, health risk assessment, fitness for work)

Risk issue	Description	Mitigation and controls
	▪ Inappropriate packaging ▪ Poor load restraint ▪ Mechanical/equipment failure	
Malicious act, tampering or security breach (i.e. theft)	Unauthorised access to consignment, loss of containment and/or potential theft of commodity	▪ Transport Security Plan ▪ Use of in electronic monitoring, tracking, control and communications procedures

7.4 Monitoring systems: objectives and assessment criteria

The impact of the transport solution for moving Olympic Dam uranium oxide and concentrate in ensuring effective radiation protection for workers and community will be assessed on an ongoing basis.

Table 3 sets out the objectives and assessment criteria associated with the transport of BHP Billiton's radioactive materials from Olympic Dam.

Table 3: Assessment criteria

	Objective	Assessment criteria
Transport of radioactive material	No adverse impacts to health of employees or the public from exposure to radiation as a result of BHP Billiton's expansion activities	Radiation doses to members of the public less than 1 mSv/y above natural background and maintaining doses at less than 50% of the internationally acceptable limit of 20 mSv/y above natural background for radiation designated workers.
Radioactive process material spillage	No adverse impacts to health of employees or the public from exposure to radiation from BHP Billiton's expansion	Radiation doses to members of the public less than 1 mSv/y above natural background and maintaining doses at less than 50% of the internationally acceptable limit of 20 mSv/y above natural background for radiation designated workers.

Monitoring systems will be established to determine the concentrations of radionuclides in the workplace, community and environment where the materials area being handled. The monitoring programs will:

- establish a base line assessment prior to the movement of material
- once operational:
  - check the efficiency of control/mitigation measures
  - provide data for ongoing risk/dose assessments
  - demonstrate compliance with licence requirements.

Monitoring programs would be continually reviewed to ensure the information being collected is relevant and identify areas of concern that may need additional or increased control/mitigation strategies.

7.5 Continuity of permits and licences

In order to ensure ongoing business continuity BHP Billiton requires long-term transport permits and licensing arrangements, which have common expiry dates wherever practical. This will ensure that BHP Billiton cannot find itself in the position whereby it is in breach of lawful requirements relating to the transportation of its Class 7 LSA-1 radioactive material such as uranium oxide in 20 ft GP containers or concentrate in bulk rail wagons.

In this regard, BHP Billiton will work collaboratively with stakeholders including but not limited to:

- government regulators (national, state and territory governments)
- transport service providers
- emergency service providers
- communities through which the consignments pass.

7.6 Responsibilities

The responsibilities identified in this plan are included in the position description of relevant BHP Billiton personnel and will be monitored through the regular performance review processes.

7.7 Flexibility relating to process changes

The RMTMP will be a live document that is reviewed and updated as necessary. As the transport task becomes routine, it is anticipated that improvements to the RMTMP will occur. Table 4 sets out a change management process.

Table 4: Change management

Change to	Example	Approval by	Notification list
Radioactive Material Transport Management Plan (RMTMP)	Any process change to the RMTMP significantly effecting procedure, responsibilities and accountabilities	Relevant regulators for review and comment as to any additional requirements	Relevant service providers and personnel
	RMTMP section reviewed or document added to it as a periodical update or as an additional reference	RMTMP owner and associated TSP, with copies to regulators for their information	Relevant TSP and personnel
Any supporting procedure within the RMTMP	A major change to a process, procedure or document provided by an external party that has a significant influence on the transportation	All regulators for review and comment as to any additional requirements	Relevant TSP and personnel
	A minor change to a process or procedure that has no significant influence on the transportation	Procedure owner only	Update procedure

7.8 Inconsistencies

Where any inconsistencies arise between the procedures or policies stipulated in this RMTMP and the procedures of government regulators or other relevant parties to the RMTMP, such inconsistencies will be identified, addressed, resolved and corrected by BHP Billiton as soon as possible.

7.9 Review of the transport plan

As part of the BHP Billiton Olympic Dam quality system, a comprehensive review and update of the plan will take place regularly. The plan will be modified as appropriate to take account of changes in procedures, organisation and personnel changes and to ensure the accuracy and relevance of the plan to both the operational and regulatory environment.

8 REFERENCES

ARPANSA 2008, *Code of Practice for the Safe Transport of Radioactive Material 2008*, Radiation Protection Series No. 2, Canberra.

Australian Dangerous Goods (ADG) Code 2008, 7th Edition, Canberra.

BHP Billiton 2009, *Draft Environmental Impact Statement for the Olympic Dam Expansion 2009*, BHP Billiton, Adelaide.

International Atomic Energy Agency 2008, *Security in the Transport of Radioactive Materials*, IAEA Nuclear Security Series No. 9, Implementing Guide.

International Atomic Energy Agency 2002, *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material*, IAEA Safety Standard Series, No. TS-G-1.2 (ST3), 2002.

Environment Protection Authority (EPA) 2008, *Emergency Response to a Leakage or Spillage of a Hazardous Material during Transport, Storage or Handling,* EPA, Adelaide.

South Australian State Emergency Management Plan 2010, Version 2.4, 23 June 2010.

APPENDIX I2

Draft transport of Class 7 radioactive material emergency response plan (interim draft)

OLYMPIC DAM EXPANSION
SUPPLEMENTARY EIS

bhpbilliton
resourcing the future

Transport of Class 7 Radioactive Material Emergency Response Plan (interim draft)

April 2011

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NOTE:

This draft Transport of Class 7 Radioactive Material Emergency Response Plan has been prepared as information to support the Environmental Impact Statement for the proposed Olympic Dam Expansion Project, and is not to be relied on as final or definitive. It will continue to be developed and will be subject to change.

CONTENTS

1 INTRODUCTION

1.1 Statement of intent

An incident or emergency situation involving BHP Billiton radioactive materials may occur without warning. BHP Billiton believe it is of critical importance that we are prepared to positively and strategically manage these situations as efficiently as possible with minimal impact to people, the environment, our operations and reputation.

1.2 Purpose

The draft Transport of Class 7 Radioactive Material Emergency Response Plan (ERP) provides a framework aimed specifically at transport events involving radioactive substances from the South Australian Olympic Dam operation. The ERP fits within the broader BHP Billiton Crisis and Emergency Management (CEM) policy.

The ERP outlines a consistent approach for emergency response actions to address an incident involving Olympic Dam Class 7 radioactive material during transport activities for the expanded Olympic Dam operation, namely:

- transportation by rail between Olympic Dam, the Port of Adelaide (SA) and the Port of Darwin (NT)
- handling and storage (transit only) at the Port of Darwin
- shipping from the Port of Darwin, East Arm wharf into international waters.

It is important to note that the nature and characteristics of the Olympic Dam radioactive material will not in itself create or place either the BHP Billiton personnel or anyone else present at the incident scene in any immediate or imminent danger. The first priority at any incident involving Olympic Dam radioactive material would be to attend to any injured personnel.

1.3 Document scope

The scope of this document covers all activities and services that BHP Billiton and its contractors undertake in relation to the transportation process of the following Class 7 radioactive material from Olympic Dam:

- drums of uranium oxide concentrate (hereafter uranium oxide) containerised in 20 ft General Purpose container(s).
- Bulk rail wagons of copper concentrate containing uranium (hereafter termed concentrate).

All BHP Billiton personnel and the appointed organisations involved in the transport and handling of Olympic Dam radioactive material are responsible for following and complying with the BHP Billiton Policies and Procedures with respect to this plan.

1.4 Document overview

This document consists of the following sections:

- Introduction – this section
- Abbreviations and definitions – useful terms used throughout the document
- Reference standards – relevant standards and reference material to support this ERP
- Parties involved in an emergency response – description of the parties and roles in dealing with an emergency response situation
- Classification of an incident – provides a description of incident types for the transportation of radioactive material

- Preparedness – outlines roles, responsibilities and arrangements for the planning and associated activities of the parties to deal with an emergency response
- Initial response, containment and recovery – an overview of the three phases and associated actions of an incident response.
- Additional information for this ERP – an overview of the BHP Billiton Crisis and Emergency Management (CEM), transportation of radioactive material and Olympic Dam procedures.

This plan recognises the importance of integration between Federal and State response agencies and those of the rail service provider. The format of this plan is at the discretion of BHP Billiton and the following is noted:

- this is an operational document for use in the event of an emergency situation. Instructions are therefore easily located and clearly stated
- this document does not re-state procedural and administrative information that is located in BHP Billiton Crisis and Emergency Response plans.

1.5 Abbreviations and definitions

The abbreviations and definitions listed in Table 1 are used throughout this document.

Table 1: Definitions and abbreviations

Term/Abbreviation	Definition
ADGC	Australian Dangerous Goods Code
AMSA	Australian Maritime Safety Authority
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASNO	Australian Safeguards and Non-Proliferation Office
ATSB	Australian Transport Safety Bureau
CEM	Crisis and Emergency Management
CMT	Crisis Management Team
Concentrate	Olympic Dam copper concentrate containing uranium
CSG	Customer Sector Group
DPA	Darwin Port Authority
EMT	BHP Billiton Emergency Management Team (CSG Level)
ERAP	Emergency Response Action Plan
ERP	Emergency Response Plan
GP	20 ft General Purpose ISO container
IMT	BHP Billiton Incident Management Team (Asset Level)
ISO	International Standards Organisation
RSP	Rail service provider
SA	South Australia
SES	State or Territory Emergency Services

Term/Abbreviation	Definition
SDS	Safety data sheet (Previously referred to as MSDS – Material safety data sheet)
Radioactive material	Generic reference consisting of either uranium oxide concentrate (UOC) or copper concentrate containing uranium (copper concentrate) as classified by the ADG code that are packaged in either drums, 20 ft General Purpose container(s) and bulk rail wagons.
Uranium oxide	Olympic Dam uranium oxide concentrate

1.6 Reference standards

The following list references Legislative Acts and Regulations across Australian, South Australian and Northern Territory governments along with BHP Billiton internal procedures relevant to the transportation of radioactive material from Olympic Dam.

The plan adopts the position that the latest versions of Legislative Acts and Regulations will apply to all transport activities of radioactive materials at the time of shipment.

1.6.1 BHP Billiton

- BHP Billiton, GLD.006 Asset Protection Standard
- BHP Billiton, Uranium Australia:
  - Incident Management (IMT) Team Plan
  - Emergency Management Team (EMT) Plan
  - Crisis and Emergency Management Framework
  - Media Policy

1.6.2 Commonwealth of Australia

- Australian Dangerous Goods Code, 7th edition
- Code of Practice for the Safe Transport of Radioactive Material, 2008
- Code of Practice, Security of Radioactive Sources, Radiation Protection Series 11
- Permit to Possess Nuclear Material – issued by ASNO
- Safe Transport of Radioactive Material, Safety Guide

1.6.3 South Australia

- Fire and Emergency Services Act
- *Emergency Management Act 2004*
- *Dangerous Substances Act 1979*
- Dangerous Substances (Dangerous Goods Transport) Regulations 2008
- *Radiation Protection and Control Act 1982*
- Radiation Protection and Control (Transport of Radioactive Substances) Regulations 2008
- Rail Safety Act
- Rail Safety (General) Regulations

1.6.4 Northern Territory

- Dangerous Goods Act
- Dangerous Goods Regulations
- Fire and Emergency Act
- Radioactive Ores and Concentrates (Packaging and Transport) Act
- Radioactive Ores and Concentrates (Packaging and Transport) Regulations
- Rail Safety (Northern Territory) Act

2 PARTIES INVOLVED IN AN EMERGENCY RESPONSE

2.1 Introduction

Any incident that occurs outside of BHP Billiton controlled areas (i.e. outside of the Olympic Dam Special Mining Lease and the proposed BHP Billiton storage and handling facilities at the Port of Darwin, East Arm) would be outside of the area of BHP Billiton's direct responsibility. BHP Billiton therefore recognises that control and coordination of the incident response will rest with the relevant State Emergency Services in which the incident occurred.

2.2 Emergency services

An incident would require the SA Police or NT Police as the coordinating authority to be in attendance. Similarly, a maritime related incident may require the Australian Maritime Safety Authority (AMSA), respective NT Government agencies and Darwin Port Authority.

In the case of a spill or leakage, depending on the location, will require the relevant Emergency Services either career or volunteer units would be in attendance such as:

- SA Police, SA Ambulance Service, SA SES, SA Country Fire Service (CFS) to assume the role of Combatant Authority
- NT Police, Fire and Emergency Services
- Australian Maritime Safety Authority (AMSA) for all shipping incidents.

Support from other relevant federal, state or territory government agencies would also be provided as necessary.

Table 2 summarises who will be involved in providing the emergency response.

Table 2: Summary of main responsibilities of parties involved

Organisation	Activities
Police	▪ Incident command
Fire brigade, ambulance, SES etc.	▪ Combatant authority lead to deal with hazardous materials, injured personnel at the incident site ▪ Render the situation 'safe for recovery' to enable recovery and clean up operations to commence which will be under taken by other parties
Rail service provider	▪ Isolate the incident site until arrival of Emergency Services ▪ Removal of rail rolling stock ▪ Provide rail transport assistance as requested or directed

Organisation	Activities
BHP Billiton	▪ Lead and coordinate any onsite incidents at Olympic Dam and Darwin ▪ Provide radiation management expertise ▪ Coordination of post incident clean up, recovery of spilt material
Darwin Port Authority	▪ Incident Command and control within the Port of Darwin jurisdiction
AMSA	▪ Incident Command and control of shipping incidents within Australian territorial waters

2.3 Rail service provider (RSP)

The appointed BHP Billiton RSP will undertake the transportation task of moving radioactive material between Olympic Dam, Port Adelaide and the Port of Darwin. The material will be packaged and transported as indicated in Section 6.2 of the ERP – Packaging and handling radioactive material.

The RSP must have its own Emergency Response Plan (which is a requirement of the respective State or Territory Rail Safety Act and Rail Infrastructure owner) and procedures. The RSP may have contracted to a recognised Emergency Response provider to provide first response action after initial notification of an incident along with provision of assistance and some control at the scene.

Direction and guidance in response to an incident must be in accordance with RSP organisational requirements linked to this ERP.

2.4 Port Authority of Darwin

While vessels are within the port area, all shipping activities will be under the control, co-ordination and direction of the Darwin Port Authority (DPA). Outside of the Darwin Port Authority controlled area, and within Australian coastal waters, the Australian Maritime Safety Authority (AMSA) is responsible for management of vessel safety.

On advice of a shipping related incident involving BHP Billiton export consignments, the Darwin Port Authority (DPA) will assume operational control of all emergency response activities which will be co-ordinated as part of the Port's emergency response plan and procedures.

2.5 BHP Billiton

BHP Billiton has avoided and/or reduced the potential for an incident during the transportation of radioactive material by:

- designing a 'closed system' for the transport, storage and handling of radioactive material from Olympic Dam to the ship hold (refer Appendix E4 of the Olympic Dam Expansion Draft EIS 2009 for details)
- enclosing uranium oxide within sealed drums that are transported within locked 20ft General Purpose containers
- enclosing concentrate within rail wagons fitted with air and water tight lids and loading and unloading these wagons within purpose-built negative pressure storage sheds
- implementing operating procedures for all transport and associated operations, including handling and storage of hazardous material, in accordance with BHP Billiton's strict safety specifications and requirements.

BHP Billiton is committed to achieving excellence in every aspect of its operations as outlined in the BHP Billiton Charter. This includes responding to company incidents that threaten people, environment and property.

Included in the RSP actions plans is the requirement to contact BHP Billiton in the event of an incident. On being advised of an incident, BHP Billiton will:

- provide product specific advice and technical support related to the material. This includes mobilising appropriate BHP Billiton personnel to assist onsite Emergency Services personnel in attendance at the incident.
- manage, provide relevant information and inform external stakeholders on all aspects of radiation management associated with the incident.
- assess the extent of damage and integrity of container(s) and rail wagon(s), including the integrity of the packaging to complete the planned journey.
- manage and coordinate the recovery of leaking or spilt material
- Ensure washdown and decontamination procedures are in place and properly completed.

In addition, and if required, BHP Billiton will also access support and resources from other organisations (such as Heathgate Resources and ERA) that are part of the Mutual Aid Agreements outlined in Section 4.5.

2.6 External stakeholders

External stakeholders include, but are not limited to, members of parliament (federal, state and/or territory), members of the general public, federal, state and local government authorities, interest groups, and media organisations.

Any enquiries made by external stakeholders would be managed in accordance with the BHP Billiton Uranium Australia External Affairs Policy, which seeks to ensure that all enquiries are managed professionally and efficiently, assisting BHP Billiton in building and maintaining positive relationships at all times. All incoming enquiries are to be directed to the authorised contact:

<Contact Details to be inserted>

BHP Billiton requires that the issue of any statement(s) regarding an incident to external stakeholders is to be made by BHP Billiton External Affairs.

Any enquiries received by the RSP relating to an incident involving Olympic Dam radioactive material must be directed to BHP Billiton External Affairs for a response. The RSP would coordinate with BHP Billiton External Affairs, follow their own relevant policies, and limit information about an incident to their own response efforts in dealing with the incident.

At the incident site, if approached by any external stakeholder(s) for information relating to the incident, all personnel would direct the stakeholder to BHP Billiton External Affairs and/or to the Emergency Services Incident Controller in attendance.

Appendix 1 provides is a list of useful contact numbers in the event of an incident.

3 INCIDENT CLASSIFICATION AND RESPONSE

This section provides a classification level for the types of incidents that may occur during the rail movement, storage and shipping of radioactive material from Olympic Dam and the appropriate response to that incident.

A response to an unlawful act would be managed in the same manner as the other types of incidents outlined in *Section 3.2 – Emergency Classification and Response Level*. If the incident is, or appears to be, associated with a terrorist act (e.g. unexplained explosion, hostage situation) then Emergency Services incident management arrangements outlined in the National Counter-terrorism Plan would apply.

3.1 Definition of an emergency response

An **incident** is any event that has the potential to impact on BHP Billiton's people, its neighbours, the environment or the business and, which if not controlled, can escalate into an emergency.

An **emergency** is defined as any abnormal, dangerous or threatening situation needing a prompt and coordinated action to prevent or minimise the impact, including:

- critical injury or loss of life
- explosions
- significant fire
- significant asset damage
- situations involving malicious intent
- structural failure requiring the evacuation of personnel
- spills or leaks likely to cause harm to the environment or community
- collision, derailment of the locomotive and/or rolling stock.

3.2 Emergency classification and response level

It is important to note that the nature and characteristics of the Olympic Dam radioactive material will not in itself create or place either the BHP Billiton personnel or anyone else present at the incident scene in any immediate or imminent danger. The first priority at any incident involving Olympic Dam radioactive material would be to attend to any injured personnel.

Table 3 provides three incident classification levels and delineates responsibilities for activation and mobilisation of the BHP Billiton Uranium Australia Incident Management Plan (IMT) and/or Emergency Management Plan (EMT).

Table 3: Incident classification levels

Incident type	Event type	Description	IMT activation	EMT activation
Type 1	Minor	Incidents that do not involve leakage or spillage of radioactive material	Monitor situation and escalate if required	No – activate if incident escalates
Type 2	Serious/Crisis	Incidents involving fatalities and/or loss of containment (leakage or spillage) of radioactive material during transportation or storage activities	Yes	Yes
Type 3	Serious/Crisis	Incidents involving any unlawful interruption to the free passage, or movement or transportation of radioactive material	Yes	Yes

The decision making process outlined in Figure 1 is to be used by BHP Billiton personnel as a guide to assist in an emergency situation.

Appendix 2 provides a summary of incident types and will assist the assessment and development of an action plan for each incident type. The Emergency Response Action Plan (ERAP) card provided in this appendix would also be available:

- in the BHP Billiton Emergency Response Folder at their East Arm facilities at the Port of Darwin
- would be carried by each RSP driver(s)

- in the locomotive cabin Emergency Response Folder of the lead locomotive and the crew rest cabin transporting Olympic Dam radioactive material.

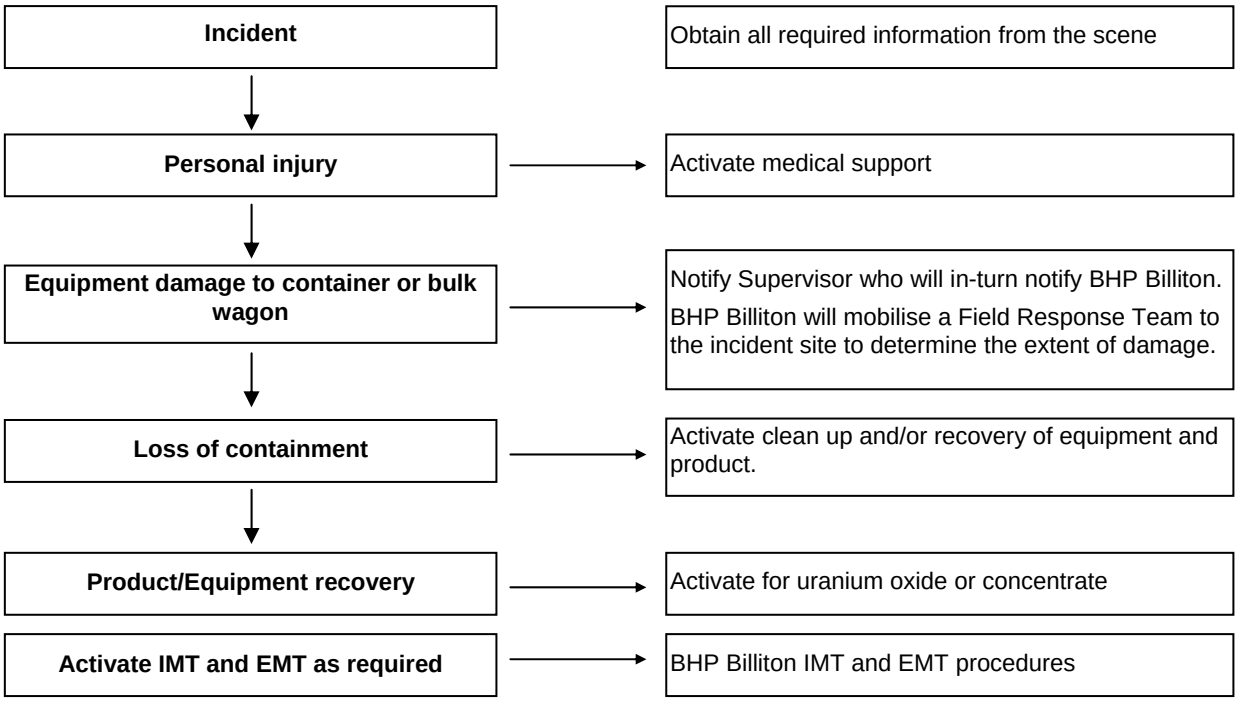


Figure 1: Emergency response decision-making process

3.3 Response activation

Table 4 sets out the likely events of notification, activation and escalation associated with a transportation incident for the movement of radioactive material.

Table 4: Incident notification, activation and escalation

Event	Actions	Triggers
Notification	Notification of an incident requiring a response could occur in a number of ways, including: ▪ RSP train driver initiating their own ERP ▪ direct contact by BHP Billiton with Emergency Services ▪ call to "000" by: – BHP Billiton – the RSP train driver – other motorist(s) and member of the public – Emergency Service personnel near by the incident.	Notification occurs when: ▪ A collision with: – single or multiple vehicle(s) – infrastructure (includes damage) ▪ fatalities or injuries ▪ derailment ▪ spill or potential for spill of radioactive material ▪ unlawful interruption of the transport task.
Activation	Based on the initial information received, the respective state/territory Emergency Management Plan at a local and district level would: ▪ determine the scope of the incident	Based on the initial incident information, a typical response would be: ▪ police: law enforcement, evacuation, traffic and crowd control, investigation ▪ fire: spill of hazardous material including

Event	Actions	Triggers
	▪ identify hazards to be addressed. As an incident may involve or impact on the general public, the SA or NT Police is the nominated Incident Controller and in co-operation with local, district emergency response co-ordinator would manage a response to the notification. The SA CFS or NT Fire and Emergency Service would assume the role of Lead Combatant for most incidents.	fuel and/or fire. ▪ ambulance: injured personnel ▪ health department: advice on public health ▪ EPA/NRETAS: environmental impacts ▪ BHP Billiton: technical advice on the product ▪ SA/NT Worksafe.
Escalation	The nature of the incident could be such that significant coordination of agencies is required.	Triggers for escalating a response include: ▪ loss of life ▪ significant damage to critical infrastructure ▪ evacuation of surrounding community ▪ resources may be required beyond the local or district capabilities.

4 PREPAREDNESS

4.1 Introduction

In the event of an incident involving BHP Billiton radioactive material, incident response plans that will be developed in collaboration with SA and NT Emergency Services and national agencies, will be initiated to ensure an effective and appropriate response is undertaken.

4.2 Responsibility for preparedness

Relevant state and territory emergency service organisations and BHP Billiton appointed service providers are responsible for preparedness in the event of a rail incident between Olympic Dam, Port Adelaide and the Port of Darwin.

Preparedness by respective emergency service organisations and BHP Billiton appointed service providers will be achieved by ensuring that:

- appropriate plans are in place for local, regional and state levels to facilitate an effective response to a rail incident
- operational capability to respond is maintained by:
  - Developing and maintaining systems, tools and processes for effective command, control and co-ordination of an emergency response
  - Conducting suitable training in emergency response operations.

BHP Billiton has a robust Crisis and Emergency Management framework. The framework provides a means for BHP Billiton to escalate response and recovery protocols across all levels of the organisation. An outline of the framework is provided in *Section 6.1 – BHP Billiton Crisis and Emergency Management Overview.*

BHP Billiton preparedness is achieved by ensuring:

- strong relationships are developed with respective federal, state and territory emergency services organisations.
- appropriate support and technical information on the radioactive material potentially involved in an incident is provided to emergency service organisations, site commanders etcetera prior to its transport

- reliable and credible information concerning the radiation issues associated with a rail incident is available to the response organisations, media, community and government officials
- all relevant personnel are trained as outlined in *Section 4.5 – Readiness and training* in the appropriate emergency responses procedures prior to the transport of BHP Billiton radioactive material.

4.3 Coordination of plans

Each of the parties involved in the transport of radioactive material as outlined in Chapter 2 will have individual plans and will coordinate their respective plans in the areas of:

- initial response
- situation assessment
- declaration of emergency activation levels
- deployment of resources
- liaison and assistance provided to or from external companies and emergency authorities.

Individual plans will contain sufficient detail to enable those involved, either individually or a coordinated response, to effectively carry out their respective responsibilities and duties in response to a rail incident. All plans will be distributed to staff that have responsibilities within the plan to ensure their understanding of the individual as well as organisational responsibilities and roles within the plan.

Each of the parties involved in the transport of radioactive material will be responsible for updating their respective plans on a regular basis and informing others of any alterations accordingly.

4.4 Resources

In the event of an incident involving Olympic Dam radioactive material it is critical that resources can be located and deployed quickly to manage the incident.

After assisting with personnel and/or environmental impacts, the focus of BHP Billiton efforts will be the recovery of spilt radioactive material. BHP Billiton will work with relevant emergency service organisations to establish appropriate preparedness, response and recovery resources to assist in such instances. Resources will include, as required:

- specialist personnel (e.g. radiation advisor, environmental and transport specialists as required)
- incident management centres
- communication equipment
- in-field materials and equipment
- recovery plant and equipment.

Where appropriate, equipment pools will be established with other uranium producers and emergency service organisations and located at appropriate locations between Olympic Dam, Port Adelaide and the Port of Darwin. Appendix 3 provides an indicative list of the types of equipment that may be required.

4.5 Mutual Aid Agreements

In the event of an incident escalating into a major or prolonged emergency response, additional resources may be required beyond what BHP Billiton might initially be able to supply.

The intent of Mutual Aid Agreements is to maximise support between BHP Billiton and external organisations in the event of an emergency. The aim of such agreements is to ensure that sufficient support can be provided through BHP Billiton business units, local emergency service organisations and external organisations nearby the incident site.

BHP Billiton would enter into suitable agreements (e.g. a Memoranda of Understanding or similar) to provide a range of support activities such as:

- access to emergency response teams and associated equipment from other mining entities in South Australia and the Northern Territory
- personnel or equipment to assist in the incident response
- specialist support (e.g. radiation officers, rail engineers)
- office facilities, administrative support, staging locations for response teams and equipment.

Such agreements would be planned in advance and support agreements would be put in place with relevant entities such as:

- Australian Government authorities and agencies
- state and territory emergency services
- other uranium producers
- external organisations and service providers.

Such agreements will ensure that a minimum response capability is available at all times. Regular review of Mutual Aid Agreements will be undertaken.

4.6 Readiness and training

Individual organisations involved with the carriage of radioactive material from Olympic Dam would maintain readiness and undertake regular training activities.

BHP Billiton maintains a layered approach to readiness and training:

- **Individual** – understand emergency procedures, their roles and responsibilities and how to activate them in an emergency situation
- **Team** – response teams have a detailed understanding of their roles, how to support each other, mobilise and work together to resolve the emergency situation
- **Organisational** – response procedures are common and understood by the organisation to ensure a clear understanding of the importance of emergency response and recovery procedures.

All personnel who have an active role in the Plan for an incident response would be trained in key aspects of the response plan. This could include participation in internal and/or multi-agency training activities such as:

- mock call-outs
- desktop simulations and coaching sessions
- in-field training scenarios and mobilisation to remote locations to simulate complexity and realism.

Such participation will ensure that personnel maintain skill levels in undertaking their roles and responsibilities should an incident occur.

BHP Billiton will undertake regular training exercises and information sessions with service providers, emergency service organisations, federal and state regulators. All agencies would be trained in the specific requirements relating to radioactive material (including radiation safety and transportation emergency response). This will be an ongoing requirement and will provide advice as to the best way to contain spilt radioactive material, safety procedures, use of specialised methodologies/equipment where appropriate, to protect the immediate environment and community.

BHP Billiton will undertake a minimum of one emergency drill, incorporating an environmental component, each year and a full scale training exercise every three to five years with all parties involved.

4.7 Investigation

Following an environmental or emergency response associated with radioactive material a full investigation would be conducted.

4.8 Community information

The BHP Billiton Manager External Affairs has overall responsibility for the liaison with, and release of information to, external parties relating to an incident involving Olympic Dam radioactive material. This will be done in close cooperation with state and territory emergency management services.

5 EMERGENCY PROCEDURES

5.1 Introduction

The response actions to an incident involving the transportation of radioactive material can be divided into three phases:

- the initial response phase
- the containment phase
- the recovery phase.

An overview of each of these phases is provided below.

5.2 Initial response phase

The first responder at the incident should determine the type of incident. In most instances, this is likely to be the train driver of the RSP. Personnel at the scene will then make an initial assessment prior to calling for emergency services assistance. The initial assessment of the incident scene will determine the emergency actions that should be directed towards:

- savings lives
- attending to injured person(s) – this could involve enlisting help or assistance from other persons not directly involved in the incident in order to gain some form of control of the situation
- isolating the location of the incident
- preventing or extinguishing fires
- identifying additional hazards
- determining the actions necessary to prevent further threat to human life, property or the environment
- calling for the appropriate help.

The first responder must prioritise and identify the important issues so that emergency services, BHP Billiton personnel and/or RSP can gain a clear understanding of the situation. This will be most important when emergency services, BHP Billiton personnel or RSP relay information onto persons who will be arranging for external help and assistance.

The training associated with the initial response phase will reinforce the need to stay calm and take the time to regain composure so as to better assess the incident and pass on important information.

Appendix 3 provides a summary of the information that should be provided in an initial call to emergency services, nominated contacts at RSP and BHP Billiton. It is important to note that the call should not be delayed in order to collect all of the information listed in Appendix 3.

5.3 Containment phase

5.3.1 Prior to the arrival of emergency services

Having completed the initial assessment of the incident and prior to the arrival of emergency services, additional resources and actions should be directed towards:

- continuing to provide first aid assistance to injured person(s)
- where possible, placing warning indicators (i.e. flashing lights, breakdown triangles) to warn approaching vehicles on nearby roads of the impending incident site. Again, this may involve enlisting help or assistance from other persons not directly involved in the incident
- restricting access to the incident site by maintaining a safe distance for all person(s) including members of the general public
- if required, and where safe to do so, initiate actions to prevent further threat to human life, property or the environment
- collecting details of other person(s) involved, timeline logging of incident details and other related information in readiness for the arrival of emergency services.

Most importantly:

- do not panic – there is no need to rush
- unless there is an immediate hazard situation, there is no need to handle or move any leaking or spilt radioactive material.

5.3.2 Emergency services response

Once emergency services arrive they will assume responsibility for the management of the incident, including command and control responsibilities.

In some instances, the capability of local emergency services for handling an incident involving radioactive material may be limited to recognising the radioactive material placarding and being familiar with the basic initial precautions to be taken. Regardless of their level of experience and training, the initial emergency services response will be the same as when handling other ADG classed material. In those instances, emergency services have procedures and methods for handling Hazardous Material (HAZMAT) spills and have emergency services centres (such as the Darwin and Alice Springs centres in the NT) that can be mobilised accordingly.

BHP Billiton staff and/or appointed service providers would fully co-operate with emergency services by providing:

- an initial briefing of the events up to their arrival
- relevant documentation from the Emergency Response Folder (i.e. SDS, Consignor's Declaration for Dangerous Goods Class 7 Radioactive Material; see Appendix 4 for copies of the SDS and an example of a Consignor's declaration).

This will assist emergency services to:

- assess the situation
- identify hazard(s) that exist at the incident site
- formulate an initial response plan to the incident by identifying what resources or specialised assistance is required
- contact and coordinate mobilisation of additional resources to respond to the incident. This may also include contacting BHP Billiton directly.

Once command and control responsibilities have been assumed by the emergency services, all personnel including BHP Billiton and RSP will follow and adhere to directions and instructions issued by the appointed emergency services Incident Controller.

5.3.3 BHP Billiton containment response

During the containment phase, BHP Billiton will undertake as required:

- liaison and open lines of communication with emergency services
- support, mobilisation and activation of resources, security, environmental (includes radiation management) or other specialist skills and assistance to the incident site
- coordination with other BHP Billiton CSGs to support the incident response requirements
- maintenance of effective communications with:
  - local community in the vicinity of the incident site
  - Australian, state and local government authorities and agencies
  - BHP Billiton media response
- facilitating or assisting with the recovery phase.

5.3.4 Recovery phase

Under the direction of emergency services, and where appropriate as instructed by either the Australian, state or territory government authority or agency, BHP Billiton is most likely to assume responsibility to coordinate the recovery activities of any leaked or spilt radioactive material.

In the event of a rail or maritime incident, the RSP and ship owners will have their own plans and procedures to deal with the recovery of damaged wagons, trailers and/or containers along with the clean up associated with hazardous materials such as diesel, oils and lubricants at the incident site. It is envisaged that BHP Billiton, the RSP and ship owner will work closely in the recovery phase to minimise delays or inconvenience to the community resulting from the incident.

It is important to restrict access to the incident site by members of the public or unauthorised personnel until the recovery activities have been completed to an acceptable level.

5.3.5 Recovery phase activities

The recovery phase activities are focused on:

- re-establishing normal activities in the vicinity of the incident site
- collecting, for return to BHP Billiton:
  - leaked or spilt radioactive material/damaged packing equipment
  - contaminated items (e.g. personal protective equipment (PPE) such as clothing, dust masks, gloves).

ADG procedures for handling dangerous goods (i.e. labelling, placarding and documentation) will apply for any vehicle involved in the return of radioactive material, PPE and associated equipment to BHP Billiton.

5.3.6 Integrity of transport equipment

In the initial and containment response phases, it may only be possible to undertake a visual inspection to determine whether there has been any uranium oxide container(s) damage or concentrate rail wagon(s) damage. Other activities as outlined in Sections 6.2 and 6.3 take priority before any detailed assessment of either the container(s) or rail wagon(s) integrity can or should take place.

External damage does not mean that the integrity of the unit has been breached such that it is unable to complete the planned journey. However, external damage is an indication that a detailed examination should be undertaken to determine the appropriate action.

5.3.7 Spill recovery activities

As the Olympic Dam material will have relatively low concentrations of radioactivity, clean up of the incident site is relatively straight-forward. As the radioactive material is dry, any leaked or spilt material can be collected by conventional methods such as scraping, sweeping and vacuuming. As these activities may create dust, PPE as outlined in the SDS, will be used by recovery personnel at all times.

As required and depending on the extent of the incident, arrangements will be made to deliver suitable equipment as outlined in Appendix 5 to the incident site to enable collection, repacking of material and drums will be supplied for the collection of PPE used in the spill recovery activities.

Under the direction of the relevant State or Territory agencies, all recovered radioactive material including damaged equipment, drums of PPE and related clean up equipment will be returned to BHP Billiton for either decontamination or disposal as per BHP Billiton requirements.

Where machinery has been used to complete the clean up activities, and depending on the location of the incident, an assessment will be made in consultation with State or Territory government authorities and associated agencies at the time as to whether the equipment will need to be returned to BHP Billiton or other appropriate facilities for decontamination in line with BHP Billiton procedures.

6 ADDITIONAL INFORMATION FOR THIS ERP

6.1 BHP Billiton crisis and emergency management overview

The BHP Billiton Crisis and Emergency Management (CEM) organisation consists of a Crisis Management Team (CMT), Emergency Management Teams (EMT's), Incident Management Teams (IMT's) and Field Response Teams. In addition there are also Rapid Deployment Teams and other specialist teams established to augment the CEM organisation as required.

Within BHP Billiton Uranium Australia, the lower two levels of CEM process as shown in Figure 2 are handled at Olympic Dam with a local Incident Management Team and various Field Response teams.

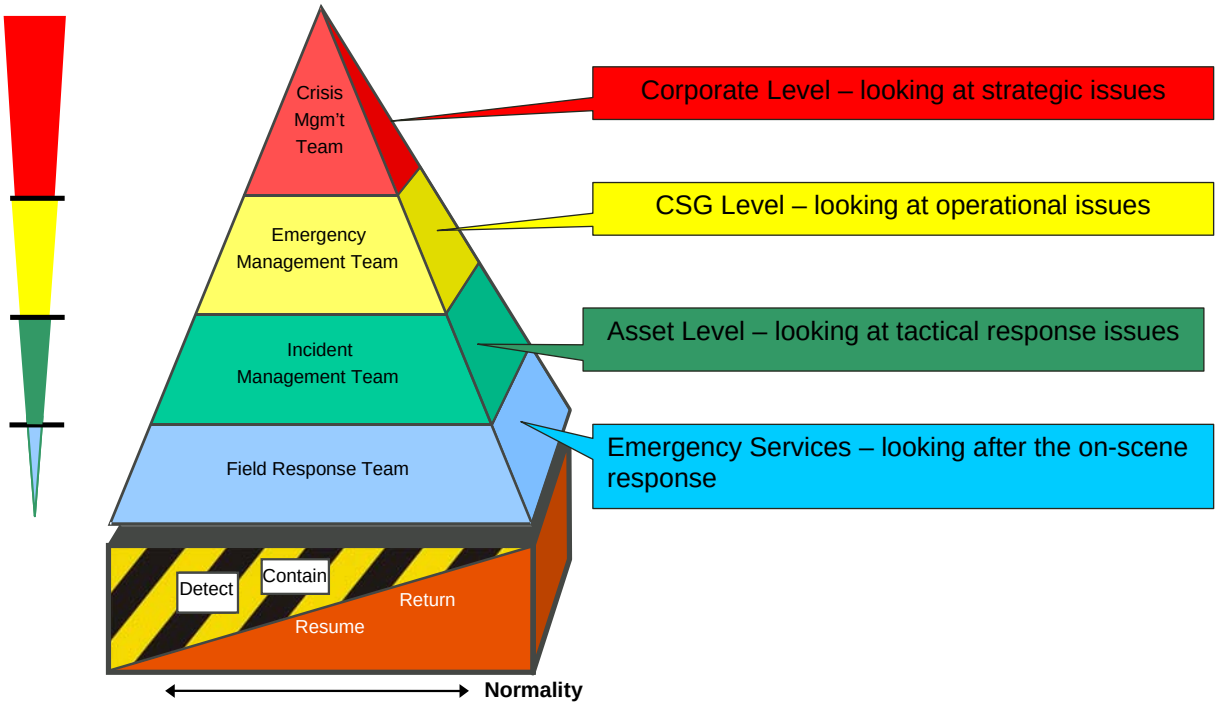


Figure 2: BHP Billiton CEM model

As required, the Emergency Management Team at Olympic Dam would be activated to support an incident involving radioactive material being transported from Olympic Dam to Port Adelaide or the Port of Darwin.

6.2 Packaging and handling radioactive material

6.2.1 Copper concentrate containing uranium

The rail wagon selected for the carriage of Olympic Dam concentrate is a relatively simple, but specialised, open-topped tipper wagon designed to be emptied by being rotated by specialised equipment through 170 degrees. The tipping process involves the wagon lid being removed as the wagons are moved into the tippler mechanism and rotated while the train remains coupled.

The rail wagon would be a traditional construction of fabricated steel with suitable epoxy lining/protective coating or stainless steel lining to maximise corrosion protection and with large radius internal corners to minimise build up of concentrate product. Externally, there would be few ledges or external corners to maximise the effectiveness of the external surface wash down procedure. This occurs when the rail wagon leaves the loading and unloading facilities and aims to remove any concentrate material that may have landed on the external surface.

The construction of the wagon will be robust and the wagon will be fitted with a purpose built secure lid that is removed during loading/unloading operations and swivel couplings allowing for up to 180 degrees of rotation. To ensure compliance and certification for operations on the rail system, the wagon will need to comply with the relevant rail standards for safe operation.

6.2.2 Packaging of uranium oxide consignments

The proposed design for uranium oxide consignments provides three levels of containment and encapsulation:

- packed in 205 litre steel drums
- secured with Corex strapping (Cordlash CC105) that has been approved by AMSA[1] as an acceptable packing design
- loaded and locked in a 20 ft General Purpose container lined with plastic sheeting.

The photographs below show examples of typical packing methods employed by Olympic Dam for uranium oxide exports, and a placarded container being loaded onto a rail wagon.

[1] The Australian Maritime Safety Authority (AMSA) is the Australian Competent Authority responsible for all safety aspects associated with the carriage of radioactive substances on land and at sea.

6.3 Overview of transporting radioactive material

Under the ADG code, BHP Billiton Olympic Dam radioactive materials are classified as Class 7 – Radioactive Material (UN2912 – Radioactive Material, Low Specific Activity (LSA-1), non-fissile excepted). The ARPANSA Code of Practice for the Safe Transport of Radioactive Material, 2008 (note that the latest edition is 2008: this may not yet been adopted by relevant state and territory jurisdictions, but it is discussed here in anticipation of such adoption) establishes international standards for the safe transport of radioactive materials with the purpose of providing acceptable levels of control of radiation and thermal hazards for the community and environment.

The key requirements under the transport code for the transport system covering the safe carriage of Olympic Dam radioactive material are:

- all movements are fully contained in a sealed package, container, ships hold or the like to prevent leakage or spill when being handled by routine transport solutions
- external surfaces must be measured and free of any traces of the material so that the radiation level averaged over 300 cm^2 does not exceed 4Bq/cm^2 for beta and alpha emitters and low toxicity alpha emitters
- Class 7 labelling and placards must be placed:
  - at all entrances to storage and handling locations
  - on road and rail transport equipment
  - on supporting documentation (i.e. SDS, Consignor's Declaration for Dangerous Goods Class 7 – Radioactive Material)
- any bulk rail wagon, conveyor and material handling system or ships hold that has been used for the carriage for radioactive material is retained for exclusive use until the bulk rail wagon, conveyor and material handling system or ships hold has been fully decontaminated.

6.4 Review and maintenance of this plan

This plan is subject to regular review and revision that should occur annually, and/or when:

- enhancements have been identified during the normal course of business
- desktop training, real-time exercises have been completed to incorporate lessons learnt
- independent review and audit has identified areas for improvement
- in-house review and updating has taken place
- organisational restructure has occurred whereby an employee that had a significant role in ERP has changed and affected the emergency response capability
- details on stakeholder contact lists change
- legislative or regulatory changes (See Section 1.6) or industry standards occur.

The plan will be up dated to reflect the appropriate changes in all transport activities of radioactive materials.

7 APPENDICES

Appendix 1: Contact directory

Note:

- **Do not** make any statements.
- **Contact with Emergency Services** - Include information from initial notification and what response procedures have been put in place.

EMERGENCY 000

EMERGENCY SERVICES					
EMERGENCY CONTACTS	**Location**	**Position**	**B/H Phone Numbers**	**Mobile Number**	**A/H Phone Number**
Police		Officer in Charge Officer in Charge Officer in Charge			
Fire		Officer in Charge Officer in Charge			
Ambulance		Officer in Charge			
Hospitals					
Royal Flying Doctor Service					
Rail Emergency					
State Emergency Services					

EMERGENCY SERVICES					
COMPANY CONTACTS					
EMERGENCY CONTACTS	**Name**	**Position**	**B/H Phone Numbers**	**Mobile Number**	**A/H Number**
Emergency Management					
EPA					
Australian Government Agencies					
BHP Billiton Service Providers					
Mutual Aid Organisations					
BHP Billiton Olympic Dam					

Appendix 2: Emergency Response Action Plan

INCIDENT ASSESSMENT
Remain calm, relax, take time to take control of the situation and assess the facts.
Check to see if there is any danger to yourself or others.
Has anyone been injured? Attend to injured persons and call “000” as required.
Contact the Olympic Dam Main Gate 08 86718222 (24 hour emergencies).
Provide BHP Billiton with the following information: Your name, your location and who you work for. Details pertaining to the location of the incident that will allow help to clearly identify where you are. Advise them of the type of incident (refer below for type). Provide basic details relating to any injured persons. Provide relevant details relating to conditions at the incident scene.

Do not hang up the phone until told to do so.

TYPE 1 INCIDENT – NOT INVOLVING LEAKAGE OR SPILLAGE
Making use of the safety equipment, discourage access by onlookers, passers by.
Do not open any packages to check their contents.
Wait for emergency services to arrive then follow instructions given by the Incident Controller.

TYPE 2 INCIDENT – INVOLVING A LEAKAGE OR SPILLAGE
Making use of the safety equipment, discourage access by onlookers, passers by.
Create or cordon off an exclusion zone ideally placed no closer than 25 metres from the source off the spillage. Clearly where circumstances permit, greater exclusion distances should be maintained.
Should you need to rescue persons who may be within the spillage area, remember your basic personal health safety requirements. Before commencing any rescue, wear disposable overalls, respiratory protection and gloves.
Avoid the inhalation of radioactive material by standing up wind of the incident area and by wearing a dust mask.
Do not eat, drink or smoke without first washing hands and face.
Care should be taken to avoid spreading radioactive materials via clothing and footwear.
Irrespective of the magnitude of the spillage or leakage, there is no need or requirement to attempt any cleanup.
Wait for emergency service personnel to arrive and follow all instructions given by the Incident Controller.
You and others involved in the rescue of person should not leave the incident scene until all persons have been checked for any possible radioactive contamination and given the ‘all clear’.

TYPE 3 INCIDENT – UNPLANNED DELAY
In the situation where movement is blocked unlawfully:
The safest most comfortable place is to remain within the vehicle. Contact Police and wait for the Police attend.
Follow all instructions given by the Incident Commander.
Once the Police Forward Commander has brought the situation under control advise your Transport Coordinator and continue the journey.
In all other cases:
Follow the instructions of your Transport Coordinator regarding the required action to repair equipment and continue the journey.

Appendix 3: Incident assessment checklist

Incident description

- What has happened?
- Where did it happen?
- When did it happen?
- How and why did it happen?
- What is at risk?
- Is everybody accounted for?
- Are there any casualties?

Incident status

- Contained or escalating? Is there potential to escalate?
- What is potentially at risk?
- What are your objectives?
- What are you trying to make happen or prevent from happening?
- What actions are being taken?
- Is the area secured from unauthorised access?
- Who is taking these actions?
- Who is responding?
- What resources (equipment/manpower) are being used?

Incident assessment

- What are the health and safety issues?
- What is the extent of environmental damage?
- Are there any social or cultural heritage issues?
- Is there any community damage?
- What contacts have been made with community, government and media?
- What are the legal implications?
- What is the operational impact – short, medium and long term?

Response required

- How effective is the response?
- Immediately, and in the longer term.

Appendix 4: Safety data sheet

Uranium oxide concentrate

SAFETY DATA SHEET **for OLYMPIC DAM DRUMMED URANIUM OXIDE CONCENTRATE (UOC)** Note: Radioactive material are outside the requirements of the Draft National Code of Practice for the preparation of Safety data sheets	

1. Identification of the material and supplier

Supplier Name	BHP BILLITON OLYMPIC DAM CORPORATION P/L
Address	PO Box 150, Roxby Downs, SA, AUSTRALIA, 5725
Telephone	+61 8 8671 8888
Fax	+61 8 8671 0506
24 hr Emergency	+61 8 8671 8222
Synonyms	MIXED OXIDES OF URANIUM, TRIURANIUM OCTAOXIDE, U_3O_8, URANIUM ORE CONCENTRATE, URANYL URANATE
Uses	FOR ENERGY PRODUCTION IN NUCLEAR FUEL REACTORS
SDS Date	30 March 2011

2. Hazards identification

INTERNATIONAL CLASSIFICATION	Class 7 Dangerous Good (Radioactive material)
GHS CLASSIFICATION	Not Applicable
HAZARD CLASSIFICATION	Radioactive
SIGNAL WORD	Harmful
HAZARD STATEMENT:	Toxic if inhaled or swallowed, causing damage to the liver and lungs through prolonged or repeated exposure.
PRECAUTIONARY STATEMENT	Obtain special instruction before use.

2. Hazards identification

HAZARD SYMBOL	Xn	Harmful
RISK PHRASES	R49	May cause cancer by inhalation
	R58	May cause long-term adverse effects in the environment
	R20/22	Harmful by inhalation and if swallowed
	R36/37/38	Irritating to eyes, respiratory system and skin
	R48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
SAFETY PHRASES	S22	Do not breathe dust
	S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
	S29	Do not empty into drains
	S62	If swallowed, do not induce vomiting: seek medical advice immediately

3. Composition/information on ingredients

Ingredient	EINECS	CAS No	Content	Classification
Uranium oxide	215-702-4	1344-59-8 or 1317-99-3	>99%	DG Class 7
Minor impurities including trace metals	Not Applicable	Not Applicable	<1%	Not Applicable

4. First aid measures

Eye If material gets into the eyes, hold the eyelids apart and flush the eye continuously with running water. Continue flushing for at least 15 minutes or until advised to stop by the Poisons Information Centre, or a doctor.

Inhalation If inhalation occurs, seek medical advice.

Skin Flush all effected areas with running water. Seek medical advice if irritation develops.

Ingestion Do not induce vomiting. For advice contact a Poison Information Centre

Medical Advice Treat symptomatically. (Assess and treat the identified symptoms)

5. Fire fighting measures

Flammability Non-flammable. No fire or explosion hazard exists

Fire and Explosion Treat as per requirements for surrounding fires:
If material is present in the fire, remain upwind and notify those downwind of hazard. Evacuate and control access to the area and contact emergency services. Wear full protective equipment including Self Contained Breathing Apparatus (SCBA) when combating fire. Use water fog to cool intact containers and nearby storage areas.

Extinguishing Non-flammable material. Prevent contamination of drains or water ways, absorb any runoff with sand or similar material

Hazchem Code 1XE, Wear full suit, provide containment, non-volatile.

6. Accidental release measures

Spillage

If spilt, wear personal protective equipment (PPE) as per 8. Exposure Controls/Personal Protection. Cover spillage with a tarpaulin or moist sand or similar material. For small spills, spray lightly with water to avoid creating dust, collecting and placing the material into suitable receptacles eg drums or container. For large spills, remove spilled material with mechanical equipment (eg. front end loader, etc). Do not flush residues into sewers, waterways or drainage systems.

7. Storage and handling

Storage

Storage should be undertaken in accordance with the relevant international and domestic, regional regulations.

Where regular storage occurs, it is good practice to utilise the same area within a shipping terminal to assist personnel to identify, familiarize and remember Class 7 storage locations.

In selecting storage locations select areas to store shipping containers of Class 7 materials away from office, accommodation, workshops, regular and highly trafficked areas.

Segregate from foodstuffs, oxidizing, corrosive, flammable, explosive or other DG materials.

Handling

205 litre steel drums must be secured inside of the twenty-foot shipping containers using a Kevlar polyester webbing strap. The strapping method has been approved by the Australian Maritime Safety Authority (AMSA), with the packaging processes being audited annually by Maritime Surveyors from AMSA.

AMSA are the Competent Authority approving authority for approving load restraints for the transport of Dangerous Goods and Hazardous Materials by road, rail or sea.

Normal operating procedures involving diligence and due care should be exercised when handling shipping containers of Class 7 UOC material.

As with any general purpose GP shipping container, visual observation and checking for evidence of material or moisture discharges from the shipping container should be reported and investigated.

8. Exposure controls/Personal protection

Exposure Standards

Ingredient	**Reference**	**TWA**		**STEL**	
		ppm	**mg/m3**	**ppm**	**mg/m3**
Uranium (natural), soluble and insoluble compounds	ASCC (AUS) and ACGIH TLV (US)		0.2		0.6

Biological limit values

3ug/g of kidney tissue (uranium)

Engineering controls

Multiple encapsulation through the utilisation of steel drums securely stowed inside locked and sealed steel shipping containers.

PPE

Personal Protective Equipment is not required under normal conditions of use. In the case of a spill, the following PPE may be required: a Class P2 (particulate) Respirator, dust-proof goggles, coveralls and PVC, rubber or cotton gloves.

The use of radiation badges to monitor exposure is not required for persons handling, storing and or transporting drummed UOC in shipping containers.

9. Physical and chemical properties

Appearance	Dark green to blackish powder	**Solubility (Water)**	Insoluble
Odour	Odourless	**Specific Gravity**	>7
pH	Not Applicable	**% Volatiles**	Not Available
Vapour Pressure	Nearly 0 @ 20 degrees C	**Flammability**	Non Flammable
Vapour Density	Not Applicable	**Flash Point**	Not Applicable
Boiling Point	Not Applicable	**Upper Explosion Limit**	Not Applicable
Melting Point	U3O8 decomposes to UO2 at 1300C, which then melts at 2878 degrees C	**Lower Explosion Limit**	Not Applicable
Evaporation Rate	Not Applicable	**Odour Threshold**	Not Applicable
Decomposition Temperature	1300 degrees C	**Viscosity**	Not Applicable
Partition Coefficient	63 to 63,000 ml/g @ pH 7	**Auto Ignition Temperature**	Non Flammable

10. Stability and reactivity

Stability	Stable under all conditions of storage, handling and transport
Conditions to avoid	No reported incompatibilities
Materials to avoid	Avoid storage or transporting adjacent to volatile, corrosive or oxidizing materials
Decomposition Products	Decomposes to UO_2 at 1300 degrees C
Hazardous reactions	Polymerization will not occur

11. Toxicological information

Summary

The health effects associated with ingestion and skin exposure to uranium appear to be solely chemical in nature, and not due to its radioactivity. There may be a slight radiological risk from inhalation.

Acute toxicity

Acute inhalation exposure could lead to fluid or bleeding in the lungs. Uranium is primarily a nephrotoxin (a kidney poison) and when ingested has a low order of chemical toxicity. Studies indicate that long-term exposure may result in kidney impairment. Tolerable intakes are limited by chemical toxicity for ingestion and radiological effects for inhalation.

Skin corrosion/irritation	No evidence of erythema or other effects on the skin.
Serious eye damage/irritation	Low to moderate irritant. Exposure may result in irritation, pain and redness.
Respiratory or skin sensitisation	There is no established data showing that skin cancer could occur. Absorption of material through skin abrasion and wounds can lead to effects similar to those applying to ingestion.
Germ cell mutagenicity	There is some evidence of genetic effects from radiation in animal studies, however there has been no evidence reported in human studies.
Carcinogenicity	Prolonged exposure (over many years) could lead to lung tissue damage from radiation exposure leading to lung cancer.
Reproductive toxicity	There is limited available data on the reproductive toxicity in humans.
STOST-single exposure	The IDLH for insoluble compounds of uranium is 10mg/m^3.
STOST-repeated exposure	Irreversible kidney damage from inhalation or ingestion. The radiological effect of insoluble compounds of uranium is due to lung irritation from inhaled particles.
Aspiration hazard	Material is insoluble and may be retained in the lungs and kidneys.

Carcinogenicity

The following components are reported to be carcinogenic:

Ingredient Name	CAS No	NTP	IARC	OSHA
Uranium Oxide	1344-59-8 or 1317-99-3	Not listed	Not listed	Not listed

12. Ecological information

Eco Toxicity	LD50 (oral - animals) 100 mg/kg/day (1 year).
Persistence/Degradability	Sediments act as sink for insoluble uranium compounds.
Bio accumulative potential	Bioaccumulation in aquatic species (fish) is low. No significant translocation of uranium from soils to above ground parts of plants observed.
Mobility	Mobility depends upon uranium being in a soluble form. Acidic conditions or an oxidizing environment enhance mobility.

13. Disposal considerations

Waste disposal	Do not dispose of material.
Legislation	Consult with the local Competent Authority.

14. Transport information

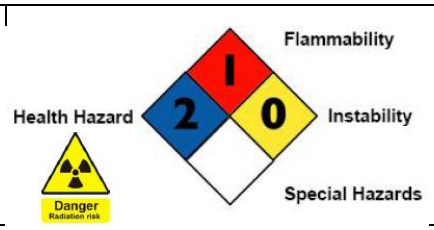
Road rail and sea (ADGR / RID / US DOT / TDG – IMDG / IMO)

Proper shipping name	UN2912 Class 7 Radioactive Material Low Specific Activity (LSA-I non fissile or fissile excepted)
Physical Form	Dry Powder (Uranium Oxide Concentrate as Uranium Oxide U3O8)
Chemical Form	Uranium Ore Concentrate as Uranium Oxide U308

Name of each radionuclide	Natural Uranium (LSA)
Category of Packages	III Yellow
Maximum Activity	440 Giga Bequerels
Transport Index:	4.5
Subsidiary risk(s)	None allocated
Packing Group	None allocated

15. Regulatory information

UNITED STATES

HMIS	Health	2	NFPA	
	Flammability	0		
	Physical Hazard	0		
	Personal Protection			
Reference: www.ilpi.com/msds/ref/hmis/html			Reference: www.ilpi.com/msds/ref/nfpa/html	

16. Other information

Additional information – Abbreviations	
UOC	Uranium Oxide Concentrates
GHS	Globally Harmonized System of classification and labelling of chemical materials
EINECS	European Inventory of Existing Chemical Material
CAS No.	Chemical Abstract Service number – used to uniquely identify chemical compounds
DG	Dangerous goods

Additional information – Abbreviations	
SCBA	Self-contained breathing apparatus
1XE	Wear full suit, provide containment, non-volatile
PPE	Personal protective equipment
AMSA	Australian Maritime Safety Authority
GP	General Purpose (twenty foot shipping container)
ASCC	Australian Safety and Compensation Council
ACGIH	American Conference of Governmental Industrial Hygienists
TLV	Threshold limit value
PVC	Poly vinyl chloride
TWA	Time Weighted Average (Exposure Standard)
STEL	Short-term exposure limit
ppm	Parts per million
mg/m^3	Milligrams per cubic metre
ml/g	Millilitres per gram
pH	Relates to hydrogen ion concentration using a scale of 0 (highly acidic) to 14 (highly alkaline)
IDLH	Immediately dangerous to life and health
NTP	National Toxicology Program (US) National Institute of Environmental Health Sciences
IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration
ADGR	Australian Dangerous Goods Regulations
RID	Regulations concerning the International Transport of Dangerous Goods by Rail (European law)
USDOT	United States Department of Transport
TDG	Transportation of Dangerous Goods Act (Canada)
IMDG	International Maritime Dangerous Goods (Code)
IMO	International Maritime Organisation
UN	United Nations
LSA-1	Low Specific Activity (rating of radiation risk)
HMIS	Hazardous Materials Identification System
NFPA	National Fire Protection Association (United States)

List of references used in this SDS	
National Toxicity Program <http://ntp.niehs.nih.gov/>	Toxicology Profile for Uranium – US Dept. of Health and Human Services September 1999)
International Agency for Research on Cancer <ww.iarc.fr>	Depleted Uranium – Technical Brief – USEPA December 2006
National Institute for Occupational Safety and health (NIOSH) – Pocket Guide to Chemical Hazards	Health Risk of Depleted Uranium – An Overview – Health Council of the Netherlands – May 2001

Report Status

This document has been compiled by RMT on behalf of the manufacturer of the product and serves as the manufacturer's material Safety Data Sheet (SDS).

It is based on information concerning the product which has been provided to RMT by the manufacturer or obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the manufacturer.

While RMT has taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, RMT accepts no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

The information contained in this SAFETY DATA SHEET (SDS) is provided by (BHP Billiton) to assist in evaluating the safety characteristics of the (product/mineral/substance) in question. The information is provided in good faith, but a risk assessment for the proposed use of the (product/mineral/substance) should be undertaken prior to that use. All persons coming into contact with the (product/mineral/ substance) should be made aware of the contents of this SDS.

Prepared by

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MSDS Date: Wednesday, 30 March 2011

End of Report

Bulk copper concentrate containing uranium – SDS

SAFETY DATA SHEET **for OLYMPIC DAM COPPER CONCENTRATE CONTAINING URANIUM (Copper Concentrate)** Note: Radioactive material are outside the requirements of the Draft National Code of Practice for the preparation of Safety Data Sheets	

IMPORTANT INFORMATION - RADIATION SAFETY OF MATERIAL

Olympic Dam bulk copper concentrate contains approximately 30% copper and may additionally contain up to 0.2% naturally occurring uranium. This is sufficient for the material to be classified as "radioactive", under the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material.

At these concentrations, the radiation exposure hazard is very low, although there could be a slight risk of radiation induced effects following any extended long term or continual periods of exposure. Significant ingestion or inhalation of the product material would create a far greater immediate medical and/or occupational health risk which would far outweighing any possible longer term radiation related effects arising from such ingestion or inhalation. Significant quantities of the product material would need to be ingested and or inhaled in order to trigger acute or chronic health issues.

Under normal transportation or operational warehousing conditions, personal protective equipment including gloves and respirators coupled with approved HSEC processes and policies will eliminate risks from inhalation and skin contact. Separating stockpiles of the material from personnel and from regular places of work will minimise the potential for exposure to gamma radiation and should not cause harm or injury to persons.

In the event of a spillage, radiation exposure will be minimised by reducing the spread of the spillage, by using personal protective equipment and by limiting and or restricting access into or through the area. Dusting should be avoided during any cleanup activities.

1. Identification of the material and supplier

Name	BHP Billiton Olympic Dam Corporation Pty Ltd
Address	PO Box 150, Roxby Downs, SA 5725, AUSTRALIA
Telephone	+618 86718 888 (general information)
Emergency	+618 86718 222 (24hours)
Product Name	Copper Concentrate • Concentrate in bulk
Synonym(s)	Copper sulfide ore concentrate up to 0.2 % contained uranium. Radioactive material, Low Specific Activity (LSA-1) non-fissile or fissile-excepted UN 2912 contained in METAL (COPPER) SULPHIDE ENTRATE
Recommend Use	The product material is primarily used as feed-stock for smelting purposes to produce blister and anode forms of copper. A further separate secondary process maybe undertaken to produce uranium oxide concentrate material.
MSDS Date	13 May 2008

2. Hazards identification

Australian Classification: Classified as hazardous according to ASCC criteria

OSHA: Hazardous by definition of hazard communication standard (29 CFR 1910.1200)
ECC Classification: Dangerous according to Directive 67/548/EEC
HAZARD CLASSIFICATION
Harmful by inhalation and or ingestion.
RISK PHASES
If inhaled or ingested can be harmful to the respiratory tract after prolonged exposure. Irritating to eyes.
SAFETY PHRASES
Do not breathe dust, wear respiratory mask.
Keep away from sources of ignition – No smoking, welding or similar activities
Do not eat, drink or smoke in proximity to product. Maintain good health and hygiene practices.

3. Composition/information on ingredients

Ingredient	Content	CAS No.	Classification
Copper	31 – 36%	7440-50-8	
Sulphur	26 – 28%	7440-34-9	
Silica	3.5%	14808-60-7	
Lead	<0.1%	7439-92-1	
Uranium as U308	<0.2%	7440-61-1	
Moisture	8 – 11%		

4. First aid measures

Eye	Flush gently with fresh running water.
Inhalation	Leave exposure area immediately. Encourage patient to blow nose to ensure clear passage of breathing. If assisting a victim, wear a Class P2 (Particulate) respirator where an inhalation risk exists.
Skin	Remove contaminated clothing and gently flush effected areas with water. Seek medical attention if irritation develops. Launder clothing prior to reuse.
Ingestion	For advice, refer to Poison Information Centre or seek medical advice.
Medical Advice	Treat symptomatically.

5. Fire fighting measures

Flammability	Combustible. Copper concentrates are liable to oxidation and may have a tendency to self-heat, with associated oxygen depletion and emission sulphur dioxide (SO2, SO3). Fumes of silica and copper when heated to decomposition. Dust explosion is possible if dust concentration in air rises and source of ignition is present combined with extremely low moisture levels.
Fire and Explosion	Combustible dust. Evacuate area and contact emergency services. Remain upwind and notify those downwind of hazard. Wear full protective equipment including Self Contained Breathing Apparatus (SCBA) when combating fire. Use waterfog to cool nearby storage areas.
Extinguishing	Combustible dust. Prevent contamination of drains or waterways, absorb runoff with sand or similar.
Vessel Information	NO WATER IS TO BE USED ON THIS MATERIAL WHEN CARRIED IN BULK IN THE HOLD OF A SHIP. Do not enter the hold of any vessel or ship unless the hold has been correctly ventilated in accordance with the vessels operating procedures. Respiratory equipment must always be worn whenever entering the hold of any vessel containing the product material or whilst working within any confined space containing the product material. Refer to Ships Safety and Emergency Management Plans for specific onboard vessel information.

6. Accidental release measures

Spillage

Always wear dust-proof goggles, dust mask, coveralls and PVC or rubber gloves. If spilt (small), material should be recovered, placed in containers and returned to process cycle. If spilt (bulk), contact emergency services where appropriate. Establish catchment system to capture any water run off by absorbing with moist sand or similar, collect without generating dust and place in sealable containers for disposal.

7. Storage and handling

Handling

This product may scavenge oxygen from the atmosphere, leading to oxygen depletion in poorly ventilated areas. Store in a cool, dry, well ventilated area away from foodstuffs, oxidising agents and acids. If stored in bulk, minimise unnecessary personal contact and dust generation. If stored in packages, ensure packages are adequately labelled and check regularly for leaks or spills.

This product may cause acid burns on skin, possibly as a result of the self heating nature evolving sulphur dioxide which mixes with sweat to form weak acid.

Storage

Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

Do not enter the hold of any vessel or ship unless the hold has been correctly ventilated in accordance with the vessels operating procedures. Respiratory equipment must always be worn whenever entering the hold of any vessel or whilst working within any confined space containing the product material. Refer to Ships safety and emergency management plans for specific onboard vessel information.

8. Exposure controls/personal protection

Exposure Standards

National Exposure Standards

Material	Source	TVL (TWA)	
		ppm	mg/m^3
Copper (copper dusts & mists as Cu)	ACGIH		1
Uranium (Uranium (natural), soluble & insoluble compounds (as H))	ACGIH		0.2
Nuisance Dust	ACGIH		10
Silica, crystalline – quartz (respirable)	NOSHC		0.1

Biological Limit Value	Source	Limit
Annual radiation exposure limit for radiation worker	ARPANSA	20 mSv
Annual radiation exposure for member of the public	ARPANSA	1 mSv

Biological Limit Values

No biological limit allocated.

Engineering Controls

Do not inhale dust or fume. Use in well ventilated areas. In poorly ventilated areas or when heated, use with local or extraction ventilation at source. Maintain dust levels below the recommended exposure standard.

PPE	Wear dust-proof goggles, rubber or PVC gloves, coveralls and a dust mask. At high dust levels, wear an air-line respirator. Where an inhalation risk exists, wear a Class P2 (Particulate) Respirator

9. Physical and chemical properties

Appearance	BLACK POWDER	**Solubility (water)**	INSOLUBLE
Odour	TBA	**Specific Gravity**	4.3
pH	NOT RELEVANT	**% Volatiles**	0 %
Vapour Pressure	NOT RELEVANT	**Flammability**	COMBUSTIBLE DUST
Vapour Density	NOT AVAILABLE	**Flash Point**	NOT AVAILABLE
Boiling Point	NOT AVAILABLE	**Upper Explosion Limit**	NOT AVAILABLE
Melting Point	NOT AVAILABLE	**Lower Explosion Limit**	NOT AVAILABLE
Evaporation Rate	NOT AVAILABLE		

10. Stability and reactivity

Stability	Material is stable under normal ambient, storage and handling conditions of temperature and pressure.
Conditions to Avoid	Avoid heat, sparks, open flames and other ignition sources. Do not enter the hold of any vessel or ship unless the hold has been correctly ventilated in accordance with the vessels operating procedures. Respiratory equipment must always be worn whenever entering the hold of any vessel or whilst working within any confined space containing the product material.
Material to Avoid	Incompatible with acids (forming toxic and flammable hydrogen sulphide gas) and oxidising agents (e.g. hypochlorites, peroxides).
Decomposition	May evolve toxic sulphur dioxide, hydrogen sulphide and silica, copper and lead oxides when heated to decomposition.
Hazardous Reactions	Polymerization is not expected to occur.

11. Toxicological information

Health Hazard Summary	Moderate toxicity – irritant. Use safe work practices to avoid direct eye-skin contact and dust inhalation. Chronic or high level exposure to copper may cause liver, kidney and blood damage. Crystalline silica is classified as carcinogenic to humans (IARC Group 1). No significant acute effects, and minimal chronic effect due to composition of mixture and difficultly in ingesting and inhaling significant quantities.
Eye	Low to moderate irritant. Exposure may result in irritation, pain and redness.
Inhalation	Irritant. Over exposure at high levels may result in irritation of the nose and throat with coughing. Prolonged and repeated exposure may result in pulmonary fibrosis (silicosis).
Skin	Irritant. Prolonged contact may result in irritation and rash. Although rare, over exposure to copper may cause allergic contact dermatitis.

Ingestion	Moderate toxicity. Ingestion may result in irritation, nausea and vomiting. Due to product form, ingestion is considered unlikely. Maintain good personal hygiene standards.
Toxicity Data	Silica, crystalline – quartz (14808-607-7), carcinogenic: classified as a human carcinogen (IARC1) Sulphur (7704-34-9), LD50 (oral - rat) >5,000 mg/kg LC50 (inhalation – mammal) >1660 mg/m^3

12. Ecological information

Environment	Solubility: Insoluble in water, soluble in acid. Copper and compounds occur naturally in the environment and is essential to animals and plants. Soluble copper compounds are potentially very toxic to aquatic organisms. Copper is expected to bio-accumulate in fish tissue. Copper in compounds and in complexes has reduced toxicity. No data are available on the short term and the long-term effects of copper to plants, birds or land animals. Insoluble copper compounds are significantly less environmentally hazardous. Uranium content of this substance presents a radiation hazard if ingested or inhaled.

13. Disposal considerations

Waste Disposal	Reuse or recycle where possible or return to manufacturer/supplier. Do not release to drains or waterways. Contact the product supplier for additional information.
Legislation	Dispose of in accordance with relevant local legislation.

14. Transport information

UN Number	2912	**UN Class**	7
UN Proper Shipping Name	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) non fissile or fissile-excepted	**Bulk Cargo Name**	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) non-fissile or fissile-excepted UN 2912 contained in METAL (COPPER) SULPHIDE CONCENTRATE
HazChem Code	Not Applicable	**Packaging Group**	Not Applicable
Bulk Cargo Group	Group A and B	**Segregation**	Cargo is to be carried in holds under 'exclusive use'. In respect to Class 7 classification the cargo is to be 'Separated from' foodstuffs and all Class 8 acids.

15. Regulatory information

Poisons Schedule	A poisons schedule number has not been allocated to this product.
Australian Regulatory requirements for transport and storage	ARPANSA Code of Practice for the Safe Transport of Radioactive Material (Cwlth) 2001 Australian Radiation Protection and Nuclear Safety Act (Cwlth) 1998 Nuclear Non-Proliferation (Safeguards) Act (Cwlth) 1997 Navigation Act (Cwlth) Customs Act 1901 and Customs (Prohibited Exports) Regulations 1958
International Regulatory Requirements for maritime transport	IAEA Regulations for the Safe Transport of Radioactive Material TS-R-1 (2005) IMDG Code for shipment by sea in packaged form Code of Safe Practice for Solid Bulk Cargoes 2004 IARC – International Agency for Research on Cancer

End of Report. SDS Date: 19 May 2008

MULTIMODAL DANGEROUS GOODS FORM

This form may be used as a dangerous goods declaration as it meets the requirements of SOLAS 74, chapter VII, regulation 4; MARPOL 73/78, Annex III, regulation 4

1 Shipper/Consignor/Sender		2 Transport document number		
		3 Page 1 of pages	4 Shipper's reference	
			5 Freight Forwarder's reference	
6 Consignee		7 Carrier (to be completed by the carrier)		
		SHIPPER'S DECLARATION I hereby declare that the contents of this consignment are fully and accurately described below by the Proper Shipping Name, and are classified, packaged, marked and labelled/placarded and are in all respects in proper condition for transport according to the applicable international and national governmental regulations.		
8 This shipment is within the limitations prescribed for: (Delete non-applicable) PASSENGER AND CARGO AIRCRAFT / CARGO AIRCRAFT ONLY		9 Additional handling information		
10 Vessel/flight no. and date	11 Port/place of loading			
12 Port/place of discharge	13 Destination			
14 Shipping marks	*Number and kind of packages; description of goods	Gross mass (kg)	Net mass (kg)	Cube (m³)
15 Container identification No./ vehicle registration No.	16 Seal number(s)	17 Container/vehicle size & type	18 Tare mass (kg)	19 Total gross mass (including tare) (kg)
CONTAINER/VEHICLE PACKING CERTIFICATE I hereby declare that the goods described above have been packed/ loaded into the container/vehicle identified above in accordance with the applicable provisions. † **MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER/VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING/LOADING.**		21 RECEIVING ORGANISATION RECEIPT Received the above number of packages/containers/trailers in apparent good order and condition unless stated hereon: RECEIVING ORGANISATION REMARKS:		
20 Name of company		Haulier's name Vehicle reg. no. Signature and date		22 Name of company (OF SHIPPER PREPARING THIS NOTE)
Name/Status of declarant				Name/status of declarant
Place and date				Place and date
Signature of declarant		DRIVER'S SIGNATURE		Signature of declarant

* **DANGEROUS GOODS:**
You must specify: UN No., Proper Shipping Name, hazard class, packing group, (where assigned) marine pollutant and observe the mandatory requirements under applicable national and international governmental regulations. For the purposes of the IMDG Code see 5.4.1.4

† For the purposes of the IMDG Code, see 5.4.2

Appendix 5: Emergency response equipment

The list of equipment that could be utilised in the event of an incident involving a spill of Olympic Dam radioactive material to assist in the clean up operations, and replenishment of the area to ensure minimal impact of the environment is listed below.

Type of equipment	Reason for use
Olympic Dam uranium recovery vehicle and container	▪ Olympic has a uranium recovery vehicle and container specifically set up for rapid response to a spill. ▪ The container can also be loaded onto a train or other vehicle for long distance response and contains all the HazMat containment and cleanup equipment and supplies for a response to a remote area.
Bobcat (and sweeper attachment)	▪ Easy operation in confined areas. ▪ Sweeper may be used to gather spilt radioactive material on hard surfaces (Note: dust from sweeping operation may create a dust hazard).
Vacuum truck	▪ Good for situation when large amounts are spilt especially on hard surfaces.
ERP trailer	▪ Trailer that contains a variety of equipment that can be mobilised to site to provide initial resources which include but not limited to: – Genset/Compressor/Water pump – PPE requirements – fire extinguishers – warning signs, flashing lights, witches hats etc – shovels, brooms, rakes etc. – recovery drums.
Backhoe	To recover radioactive materials, contaminated soils and land reconditioning.
CAT 950 Loader	To recover radioactive materials, contaminated soils and land reconditioning where easy access is available.
12m Tip truck	Delivery of clean soils to site and/or removal of contaminated soils.
Grader	Ability to gather contaminated soil, level and spread new soils.
Water truck	Minimise or eliminate the hazard of dust during clean up and recovery process.
12 m float deck with outriggers	Ability to carry equipment to incident site and/or return of damaged equipment.
Mobile cranes	Provide lifting activities as required.

Schedules will be developed for preventative maintenance and or replacement where necessary of the resources to ensure the availability of the resource equipment should an incident occur.

APPENDIX I3

Potential aquatic impact of copper sulphide

I3.1 ISSUE

Some stakeholders have expressed concern in their submissions to the Olympic Dam Expansion Draft EIS that spills of copper concentrate containing uranium (hereafter 'concentrate') could affect aquatic environments. A review of these submissions indicates that this concern is based on the assertion that 'copper is an algicide'. This fear is unfounded because concentrate is primarily copper sulphide, which is not water-soluble and therefore not available for uptake by living organisms, as is explained further in this appendix.

However copper, as copper sulfate ($CuSO_4$) or as a complex compound with certain organic substances such as ethanolamine, is registered for use as an algaecide in Australia. These products are used to control algae and cyanobacteria in drinking water reservoirs, farm dams, tanks or irrigation supplies (House and Burch 2002).

I3.2 COPPER TOXICOLOGY

The SA Environment Protection (Water Quality) Policy sets a limit of 0.01 mg/L for copper (Cu) based on total copper (Environment Protection Authority (SA) 2003). However, toxicity of copper in aquatic systems depends on the concentration of dissolved, free cupric (Cu^{+2}) ions, not on total copper. For this reason, this technical note focuses on dissolved copper.

Total copper includes both dissolved (ionic) and insoluble copper. However, the toxicity of copper in aquatic systems depends on the concentration of dissolved, free cupric (Cu^{+2}) or cuprous (Cu^{+1}) ions. Copper in its ionic form can be taken up by living organisms, that it, it is bioavailable. Copper sulfate is highly soluble – more than 200 g of $CuSO_4$ will dissolve in one litre of water (International Occupational Safety and Health Information Centre 2001) – and has high bioavailability. This accounts for the toxicity of $CuSO_4$ to aquatic organisms.

Evidence for the key role of dissolved copper is summarised by the United States Environmental Protection Agency, which uses dissolved metal as its criterion for copper. It states: 'The use of dissolved metal more closely approximates the bioavailable fraction of the metal in the water column than does total recoverable metal' (US EPA 2007a). The US EPA set criteria for the protection of ecosystems in seawater at a maximum dissolved copper of 4.8 μg/L (acute effects) and 3.1 μg/L (chronic effects) (US EPA 2007b).

The Australia and New Zealand Guidelines for Fresh and Marine Water Quality (PIMC/NRMMC 2000) also emphasise the importance of speciation (i.e. whether the compound is dissolved) when considering the toxicity of copper.

A case study presented in PIMC/NRMMC (2000) illustrates this. Stream water with total copper of 10.35 μg/L was found to contain only about two per cent bioavailable copper (inorganic dissolved metal ions and weakly bound organic complexes) (PIMC/NRMMC 2000). In addition, they state that 'in most natural water, the concentration of available dissolved organic complexing ligands (copper complexation capacity) is greatly in excess of total dissolved copper and this ensures that inorganic copper concentrations are well below concentrations of toxicological concern'. In other words, total copper is not all in a form that can be taken up by aquatic species.

For marine waters, a trigger value for copper of 1.3 μg/L was derived as appropriate for waters of the type found in Darwin Harbour (PIMC/NRMMC 2000). Where concentrations are below this trigger value, the risk to the environment from copper is low.

I3.3 SOLUBILITY AND CONCLUSION

Metallurgical analyses of the Olympic Dam concentrate indicate that it is composed of copper sulphide with small amounts of impurities including iron salts, silica, lead salts and uranium oxide (U_3O_8).

Copper sulphides (CuS and Cu_2S) are officially classified as sparingly soluble in water. The solubility product constants for CuS and Cu_2S are 6 x 10-37 and 2.5 x 10-48 respectively (Dean 1992). These values are very small and confirm that both compounds exhibit very low solubility.

The solubility product constants were used to calculate the theoretical concentrations at Cu^{+1} or Cu^{+2} in water from copper sulphide after mixing (i.e. at equilibrium). The concentrations, together with the normal concentration of copper in seawater, and the concentrations that are toxic to aquatic life, are summarised in Table 1.

Table 1: Comparative table of copper concentrations and legal limits

Parameter	Concentration	Source
Cu^{+2} ion concentration at equilibrium	2.16×10^{-14} g/L	Calculated from Ksp
Cu^{+1} ion concentration at equilibrium	4.31×10^{-14} g/L	Calculated from Ksp
SA EPA criterion (total Cu)	10^{-2} mg/L	EPA (SA) 2003
Dissolved Cu value for 95% protection	1.3×10^{-6} g/L	PIMC/NRMMC 2000
Dissolved Cu value (acute effects)	4.8×10^{-6} g/L	US EPA 2007b
Dissolved Cu value (chronic effects)	3.1×10^{-6} g/L	
Solubility of $CuSO_4$ (anhydrous) in water	203 g/L	International Occupational Safety and Health Information Centre 2001
Concentration of Cu^{+2} when used as algicide	10^{-3} g/L	House and Burch 2002
Normal concentration of Cu in seawater	9×10^{-7} g/L	Turekian 1976

The very low solubility of copper sulphide in water as calculated from solubility products is illustrated by the following comparisons:

- a saturated solution of copper sulphide has less than 1/10,000,000 of the normal concentration of copper in seawater
- a saturated solution of copper sulphide has less than 1/100,000,000 of the maximum allowable concentration of copper allowed by the US EPA or the Australia New Zealand Water Quality Guidelines.

Initial dissolution studies of copper concentrate have yielded results which support the theoretical calculations.

Over a long timeframe (i.e. several months), it is conceivable that some of the copper sulphide could oxidise to a more soluble form. However, given the long time required for this to occur, the closed wagons to be used for transport, the proposed closed storage and transfer facilities and the routine turnover of concentrate temporarily stored at the East Arm Facility, this outcome is highly unlikely.

Thus, the concern that copper sulphide will pose a hazard in terms of toxicity is unfounded.

I3.4 REFERENCES

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