STATEMENT OF ROBERT RIDLEY

1. **Background and qualifications**

1.1 I am the Superintendent of Railway Planning and Logistics for BHP Billiton Iron Ore's (**BHPBIO**) Pilbara operations. I was appointed to that position in 1999.

1.2 I first joined BHPBIO in 1988 and during that time have held the positions of Railroad Operations Foreman, Inspector, Train Controller and Train Operations Supervisor in addition to my current position. I hold an "A" class Locomotive Drivers Certificate.

2. **BHPBIO's Rail Systems in the Pilbara**

2.1 BHPBIO operates 2 heavy haulage railways between the iron ore mines managed by BHPBIO in the Pilbara region of Western Australia and Port Hedland. The railways are single track and standard gauge.

2.2 One of the railway lines runs 426 km from Newman to Nelson Point in Port Hedland and is known as the **Newman line**.

2.3 The other line runs 208 km from the Yarrie and Nimingarra mines in the East Pilbara to Finucane Island at Port Hedland and is known as the **Goldsworthy line**.

2.4 There are also 3 separate spur lines that connect various BHPBIO's mine sites (namely, Jimblebar, Mining Area C and Yandi) to the Newman line.

2.5 BHPBIO's railway is a fully integrated component of its iron ore business which comprises:

(a) a number of iron ore mines;

(b) the Newman line and Goldsworthy line, including the spur lines to the Newman line and Goldsworthy line; and

(c) facilities at Nelson Point and Finucane Island in Port Hedland.

2.6 The railway is fully integrated with the other aspects of BHPBIO's iron ore business and has a direct relationship with the other components of BHPBIO's operations. The operation of each component is dependent on the operation of the other components. For example, if the railway is shut down due to an accident or so that maintenance and repair work can be carried out, this will affect operations at the mines and the ports.

2.7 The operation of each component of this integrated system must be matched to the requirements and capabilities of the other. For example, the port facilities at Port Hedland can only safely and practically unload, stockpile and ship a certain maximum quantity of ore at a time. Therefore, before there can be any increase in the number of trains running on the railway and delivering iron ore to the port, there must be a determination of whether the port facilities can safely and practically unload and clear the trains arriving at the ports.

2.8 Similarly, all individual components that make up the railway system also have a direct relationship with each other and these components must also be matched in requirements and capabilities. For example, a track structure must be capable of carrying the loads required to meet the forecast tonnes that have to be transported over it. The track structure includes the earth substructure, sleepers to carry the load and hold the rails in gauge, and ballast to stop it all moving and provide a loading buffer and drainage. Each of these must match the capabilities of the other as the system is only as capable as the lowest factor. This is known as component capability.

2.9 In this context, significant research and development has been undertaken by and for BHPBIO to identify efficient and safe ways and means of:

(a) increasing the capabilities of single items without compromising the integrity of the total system; and

(b) raising the overall railway system capability.

3. **Research & Development into Rail System**

3.1 The geographic and meteorological conditions encountered by BHPBIO's railway operations in the Pilbara are amongst the most severe in the world. The operations also face some of the most arduous operational requirements in terms of tonnage carried and loads applied to the various components.

3.2 Since the Newman line was first opened in 1969, BHPBIO has continuously studied, refined and improved its railway systems and operations based on the knowledge it has gained over the years.

3.3 The research and development undertaken by BHPBIO over the years has resulted in BHPBIO becoming the world leader in heavy haul railway technology. This is evidenced by the relatively high number of papers which are published and presented at both national and international levels.

3.4 Ongoing research and development activities undertaken by, or for, BHPBIO are aimed at:

(a) preventing rail accidents and failures;

(b) prolonging the life of components;

(c) increasing the capabilities of components;

(d) improving efficiencies;

(e) identifying cost savings;

(f) increasing system capabilities; and

(g) improving rail safety.

3.5 The research and development activities have enabled BHPBIO to, amongst other things, significantly:

(a) improve rail safety performance;

(b) reduce the number of instances of broken rail tracks;

(c) increase the quantity of ore railed;

(d) increase the number of train runs;

(e) improve employee productivity; and

(f) increase the length of trains while decreasing the train cycle times.

Annexed to this statement and marked "**RR1**" is a bundle of diagrams which show these changes in quantitative terms.

3.6 BHPBIO currently uses the Principals and Engineers of the Institute of Railway Technology at Monash University (**IRT**) to assist in its rail research and development activities.

3.7 Historically, site employees undertook this research and development work. These employees subsequently moved to BHP Engineering. They later became part of BHP

Minerals Research Pty Ltd's Rail Research & Development Group and were based at the Melbourne Research Laboratories (**MRL**). In 2000 MRL was spun out from BHP Billiton into IRT. Each move has provided a wider resource pool of skills, greater access to external facilities and exposure to a wider variety of rail environments that has delivered benefit to BHPBIO.

3.8 There is an agreement between BHP Minerals Research Pty Ltd and Monash University that effectively provided for the transfer of the responsibilities of the MRL group to IRT. The agreement contains the terms and conditions upon which IRT undertakes research and development activities for individual members of the BHP Billiton group.

3.9 Under the Research Services Agreement:

(a) any intellectual property owned by or licensed to IRT before the commencement of a particular research and development project remains the property of IRT; and

(b) any intellectual property in or arising out of a particular research and development project vests in the particular BHP Billiton group member that engaged IRT to carry out the research and development project.

3.10 For many years, BHPBIO has also engaged R C Wright & Associates, independent contractors, to provide rail research and development services to BHPBIO. As with intellectual property developed by IRT, all intellectual property described as being developed by R C Wright & Associates is also owned by BHPBIO.

3.11 BHPBIO spends (on average) approximately $1m - $2m a year in rail research and development programs.

3.12 As a result of the research and development activities over the years, numerous types and forms of intellectual property pervade the rail systems and operations. These are described in further detail below.

4. Intellectual Property in the Rail System

4.1 There are numerous items of intellectual property used in the railway system. These items of intellectual property include:

(a) Components of the Control and Signalling systems;

(b) the Wheel – rail interaction program;

(c) the Management of Long Trains program;

(d) Vehicle stability monitors;

(e) Track and Ore Car monitors;

(f) Components of the Automatic Train Protection system;

(g) Components of the Wheel Impact Monitors; and

(h) Components of the Hot Wheel and Hot Box Detectors.

Each of these is described in greater detail below.

4.2 Control and Signalling system

(a) All railway operations on the Newman line and Goldsworthy line are controlled from a solid state interlocked control system known as the Centralised Traffic Control (**CTC**) system. Specialised computer hardware and digital communications powered by solar technology support the signalling system.

(b) The CTC and signalling system controls and manages safe train movements along the railway. The CTC is controlled remotely by a Train Controller from a central location (currently, in Port Hedland). Other items of intellectual property described below are linked to and feed back into the CTC to warn the Train Controller and the train drivers about unsafe conditions such as overheated wheels and bearings, and dragging equipment.

(c) The mainline CTC is based on computer hardware and software that was originally provided by Westinghouse and attached servers which have subsequently been configured and enhanced exclusively for BHPBIO by R C Wright & Associates and on Yard CTC provided by Alstom Australia.

(d) There can only be one control system for the railway. If a third party wishes to use BHPBIO's railway, then to ensure the safety of both BHPBIO's trains and the third party's trains, the third party's rail operations will need to be integrated with the operation of the CTC system.

(e) For example, if one of BHPBIO's trains trips a Wheel Impact Monitor (described in greater detail below), an alarm is generated and transmitted via the radio system to warn the train driver to halt the train, so that the damaged wheels can be repaired or replaced so as to avoid any further damage to the track or risks to train safety. The alarms are generated simultaneously to the Train Controller in CTC.

(f) The main method of communication between the Train Controller operating the CTC, train drivers and other BHPBIO employees at the mine sites or port facilities is by radio. BHPBIO is licensed to use a particular radio frequency for its radio communications.

4.3 **Wheel and Rail Interaction**

(a) One of the key aims of the rail research and development activities is to assess and improve the performance of the wheel and rail interface. When BHPBIO first started running its trains it experienced very high wear rates in both the carriage wheels and rail track. Over the years, substantial research and development work has been undertaken on many fronts to address this problem, including in relation to:

(i) wheel and rail materials;

(ii) wheel and rail profiles;

(iii) wheel and rail maintenance; and

(iv) rail lubrication.

(b) The research and development work has led to BHPBIO being regarded today as a world leader in the management of the wheel and rail interface. In fact, the research program in the late 1970's pioneered profile grinding as part of rail maintenance. Now, these procedures are used widely by major railway operators. The rail profile developed for BHPBIO is held by One Steel for use in the production of the rail which they supply to BHPBIO. The supply agreement with BHPBIO prohibits One Steel from supplying rail with this profile to any other party without BHPBIO's consent.

(c) Essentially, profile grinding or "profiling" involves:

(i) The grinding of rail tracks as soon after installation as is practicable so that the tracks have profiles that match the "ideal" profile specifications determined by IRT. Those specifications are confidential and are calculated and determined through IRT's research and development programs which take into account the manner in which BHPBIO uses the railway and the unique specifications of each component of BHPBIO's rail system.

(ii) The employment of rail grinders to regularly grind the face of the railway track so that the "ideal" profile is constantly maintained.

(iii) The use of video imaging technology to measure the profile of each wheel on each ore car. Aspects of a wheel profile include: flange height, flange width, vertical flange, hollowing depth, rim thickness and wheel diameter. The measurements determine how closely (or not) the wheel profiles match the track profile.

(iv) The employment of wheel turning machines to regularly machine the profile of the wheels on the ore cars so that they match the track profile.

(d) This "profiling" reduces friction between the carriage wheels and the track and ensures that each carriage wheel runs along the same contact point on the track throughout the railway line.

(e) Profiling:

(i) improves vehicle stability;

(ii) reduces the incidences of derailment and other rail accidents that might be caused by worn or damaged wheels or tracks;

(iii) avoids the need to lubricate the railway track (use of lubrication is quite common on heavy haul railways);

(iv) increases the longevity of the track by reducing the wear and tear that would otherwise occur;

(v) increases operational efficiency by increasing track usage times; and

(vi) reduces repair, maintenance and capital investment costs in the long term.

(f) This wheel/rail interface program has been ongoing for some years with MRL/IRT having significant interaction with BHPBIO's employees with responsibility for track maintenance. Rail defects have reduced significantly over time resulting in reduced risk of associated derailments. This is due to the strict management of the wheel and rail interface.

(g) The amount of rail grinding carried out is primarily driven by the tonnage carried on the track, weld performance, rail surface condition (rolling contact fatigue) and to a lesser extent profile restoration. In the sharper curves (between 1° and 3°), rail grinding occurs on a 4 week cycle, extending out to 3 months for shallow curves and tangent track.

(h) IRT's research and development into what is the "ideal" wheel and track profile is ongoing to continuously improve performance, efficiency, safety and to adjust to changes in BHPBIO mining operations.

(i) It should be noted that, currently, IRT has set 3 different rail profiles for the railway lines:

(i) one profile applies to straight tracks;

(ii) one applies to the high leg of curved tracks; and

(iii) one applies to the low point of leg tracks.

(j) If third party access were granted to the railway line, unless the rail management procedures employed by BHPBIO (including profiling) are adopted, there would be:

(i) an increased risk of rail track damage and rail accidents;

(ii) a significant reduction in the life of the rail tracks; and

(iii) a significant increase in operating and maintenance costs for BHPBIO.

(k) In order to employ BHPBIO's rail management procedures:

(i) BHPBIO would effectively have to disclose to the third party the "ideal" profile specifications determined by IRT so that the wheels on the ore cars used by the third party match the profile of BHPBIO's railway track;

(ii) the third party would have to regularly submit its ore cars to video imaging of the ore car wheels to determine whether machining is required; and

(iii) BHPBIO would have to perform the machining of the wheels on the ore cars used by the third party.

(l) This assumes, however, that the third party uses wheels of the same composition, specification and standard as those on BHPBIO's ore cars. If wheels of a different composition, specification and standard are used, the current "ideal" profile specifications determined by IRT for BHPBIO may not be appropriate. Extensive research and development may be required to determine what the "ideal" profile specifications would be for those wheels. If the profile specifications turn out to be different to those determined for BHPBIO, then the entire wheel – rail interface program might break down. This would result in substantially increased costs and substantially decreased efficiency and carrying capacity for BHPBIO.

4.4 **Management of Long Trains**

(a) Train breakages (that is, where a train breaks into two or more sections) are a potential major cause of train accidents and delays. With trains now regularly longer than 3 kilometres, significant stress is placed on the couplers and draft gear. This stress is also referred to as "in-train forces".

(b) The primary factor affecting in-train forces is driver action. In simple terms, driver action refers to the manner (how hard or gentle, how fast or slow) in which train drivers drive the trains. Research and development programs have been carried out to assess 'best practice' driving methods and conditions with this information being fed back to train drivers. Projects are also being carried out to look at the design of the coupler and draft gear assemblies and testing is also currently taking place to look at alternative materials for the fabrication of these components.

(c) Unless BHPBIO discloses its 'best-practice' driving methods and conditions to a third party's train drivers, the risks of train accidents and damage is likely to increase. This may compromise safety and is likely to increase delays which will have an adverse impact on BHPBIO's operations.

4.5 **Vehicle Stability Monitoring**

(a) The rolling stock at BHPBIO was identified as having significant lateral stability (known as "hunting") difficulties in the early 90's. The lower the lateral stability, the more the ore cars are seen to wobble as they travel along the track. Lateral instability can lead to, and is one of the common causes of, derailments and other rail accidents.

(b) A major research program was undertaken to identify the cause of lateral instability, rectify vehicles with stability problems and monitor fleet conditions to identify rogue vehicles.

(c) A novel system of track instrumentation was developed and correlated against vehicle response. This system has been used on a regular basis over recent years to identify vehicles with higher activity. More recently, the system has been enhanced to also identify wheels causing high stress on the rail and also wheel-sets with a tracking bias.

(d) Permanent stations have recently been constructed which form part of BHPBIO's ongoing vehicle wayside detection systems. Through modifications to rolling stock (introduction of constant contact sidebearers), vehicle stability is no longer a major issue at current operating conditions.

(e) Unless BHPBIO discloses its research and development findings and intellectual property so that a third party can make similar modifications to its rolling stock, the risk of train derailments and accidents is likely to increase. This may compromise safety and is likely to increase delays and have an adverse impact on BHPBIO's operations.

4.6 **Track and Ore Car Monitoring**

(a) It is common practice for railway operators to monitor vehicle responses to track geometry also commonly known as track quality. Track quality is important from both a safety and operational efficiency point of view.

(b) Like most rail operators around the world, BHPBIO has traditionally used track geometry recording cars as their primary means of assessing track quality. However, over the last few years there has been an ongoing program to use instrumented ore cars (**IOC**) developed by IRT as additional sources of feedback regarding track quality. Three such cars are now in operation every day of the week. I understand that BHPBIO is one of the first railways to utilise instrumented wagons in this manner.

(c) The IOC is, in simple terms, a special ore car that has various on board sensors and gauges that measure the stresses and strains on the car as it travels along the railway. Operation of the IOC is fully remote with data now being directly downloaded and input to a database developed by IRT and CSC (Computer Science Corporation). This database automatically feeds track performance information back to track maintenance personnel and also to operations personnel to assist short to medium term maintenance planning. The information is also used to determine how the trains should be driven (for example, at what speed, when brakes should be applied and how hard they should be applied) at different points along the railway lines.

(d) In particular, the IOC measures:

(i) vertical suspension (ride quality);

(ii) wheel – rail acceleration (rail track condition);

(iii) in-train forces;

(iv) lateral stability ("hunting");

(v) longitudinal train forces (these are the pulling forces the individual ore cars on the train experience when it ascends a hill and the pushing forces they experience when the train descends a hill);

(vi) car body / draft gear pocket strains;

(vii) bearing temperature;

(viii) brake pipe pressure;

(ix) dumping forces (when ore is loaded into the ore car); and

(x) strains on the side walls of the ore cars (especially when they are being rotated in rotary car dumpers during the unloading of ore).

(e) The IOC has led to a significant reduction in train breakages. Each breakage usually takes up to 6 hours on average to clear.

(f) With the success of the IOC program, additional information is now being collected on vehicle structural performance which will assist in managing the fleet condition. New uses for the IOC continue to be found.

(g) Unless BHPBIO provides a third party with access to the IOC program and related intellectual property, the risk of train breakages and accidents is likely to increase.

4.7 **Automatic Train Protection system**

(a) BHPBIO employs a collision avoidance system on its trains known as the Automatic Train Protection (**ATP**) system that is installed on board all lead locomotives.

(b) In simple terms, the ATP provides automatic application of emergency brakes if the train driver does not take action when required to do so at set locations or when required by signals emitted by the signalling system. The ATP also gives the train driver advance speed restriction warnings and data on breaking curves that are relative to the train's type, weight and length. It also prevents trains from entering unauthorised tracks.

(c) The ATP is provided by General Electric Transportation Systems (**GETS**). GETS took approximately 2 years to re-configure the standard collision avoidance system into one that is now exclusive to BHPBIO. This configuration of ATP is not available to anyone else.

(d) Unless BHPBIO provides a third party with the ATP and related intellectual property, and the third party installs the ATP on board its locomotives, the risk of train collisions and accidents is likely to increase.

4.8 **Wheel Impact Monitoring**

(a) As mentioned above, wheel impact monitors are employed by BHPBIO to measure levels of wheel to rail track impacts as the ore cars travel on the rail tracks. The monitors identify "out of round" wheels on ore cars or wheels with "flat spots". These damaged wheels have the potential to cause serious damage to the rail tracks.

(b) The in track monitors are provided by Technis but have been developed further and reconfigured by BHPBIO and IRT. The monitors are linked to the CTC.

(c) If "out of round" wheels on ore cars or wheels with "flat spots" are identified, the ore car is not allowed to run on the tracks any further until the wheels are replaced or repaired.

4.9 **Hot Box and Hot Wheel detectors**

(a) BHPBIO installs wayside:

(i) Hot Wheel Detectors (**HWD**) which are infrared sensors which detect variations in temperatures of wheels relative to the rest of the train; and

(ii) Hot Box Detectors (**HBD**) which are infrared sensors which detect variations in temperatures of axle boxes relative to the rest of the train.

Both the HWD and the HBD detect increasing heat trends and send warnings and alarms when variations exceeding defined parameters occur.

(b) The hardware for the HWD and HBD were developed by GETS while the software was developed by R C Wright & Associates exclusively for BHPBIO.

(c) The HWD and HBD are an early warning system to help prevent and avoid train derailments and accidents.

(d) Unless BHPBIO provides a third party with the HWD, HBD and related intellectual property, the risk of train accidents is likely to increase.

(e) Unless BHPBIO provides a third party with access to the radio frequencies or provides third party transmitter units to enable receipt of alarms, the risk of train derailments and accidents is likely to increase.

5. Other Intellectual Property used in the Railway System

5.1 Rail Welding

(a) Rail welding has been identified as one of the major limitations associated with increased axle loads. Due to the very small market represented by heavy haulage rail systems, rail component manufacturers have been reticent to develop significant new products to suit the heavy axle loads encountered by the heavy haulage industry. As a result, a major research and development program has been carried out to ensure that the best performance can be achieved from the existing products.

(b) The result of the research and development program has led to a movement away from the traditional aluminothermic process of welding to the more robust flash-butt process. This has resulted in a large reduction in rail track breakages being recorded.

(c) While flash-butt welding of rail tracks is not unique to BHPBIO, there is special equipment and tools used in the process which have been developed by BHPBIO employees and which are unique to the company. There are no patents, registered designs or manuals relating to this equipment and tools.

(d) The vehicle stability monitoring system is also important to the performance of track and in particular welds, as it will allow rogue wagons to be removed prior to causing significant track damage.

5.2 Axle Loads

(a) Increasing axle loads is one of the key issues in extracting maximum performance from BHPBIO's Pilbara operations. Proactive management and intensive research and component monitoring have been instrumental to BHPBIO currently carrying the heaviest axle loads for a mainstream heavy haul railway.

(b) The first axle load study was in 1981 which recommended that axle loads could go to 32 tonnes. The major limitation on this was the limited carrying capacity of the bridges on the railway lines. The significant cost of upgrading bridges made higher axle loads economically unattractive. The 1981 axle load study was based on existing literature. Subsequent detailed testing of bridges indicated that the actual loading on these structures was much less than those required for design and rating in the relevant Australian standard. These reduced loadings reflect the high vehicle and track maintenance standards adopted within the BHPBIO operation.

(c) As a result, through an ongoing review of bridge loadings, and the monitoring of axle loads, axle load variability and the dynamic loadings on the bridges, higher axle loads can now be tolerated without bridge upgrading. An annual detailed bridge inspection program was also implemented to ensure satisfactory and safe performance.

(d) A second study of axle loads in 1987 indicated that 35 tonne axle loads could be economically and technically justified. This data was again reviewed in the late 1990's indicating that operating in the 35 to 37 tonne range was feasible. The railway has now been operating in that range for quite a few years.

(e) A Failure Mode and Effects Analysis on 40 tonne axle loads was carried out several years ago and this identified a couple of impediments to further increases in axle load, namely bearing performance and rail welds. These issues have formed a major part of ongoing research to allow the axle load lever to again be moved. A copy of a paper presented in Railway Gazette International about this topic is annexed and marked "**RR2**".

5.3 **Weighbridges**

(a) BHPBIO have employed dynamic in track weighbridges on its railway. Essentially, these weighbridges record and count individual wheel weights on ore cars as the train passes through the weighbridge. Software developed by R C Wright & Associates then reports on axle, bogie, ore car tare, gross weights and weight distribution and bias.

(b) There are also Overloaded Car Detectors on the in track weighbridge which link to software developed by IRT to identify individual axle loads which exceed set values to trigger alarms in the CTC centre.

5.4 **Acoustic bearing detection devices**

(a) BHPBIO uses acoustic bearing detection devices known as "RailBAM" on its railway. RailBAM is, in simple terms, acoustic track side microphones that are linked to a software program that detects noisy bearings on ore cars which can be an indication of cone faults, roller faults, cup faults, looseness or fretting.

6. **Third Party Access**

6.1 In general terms, another user could run its rolling stock on Newman and Goldsworthy lines without using any of the special technology described above. Naturally, the party would not achieve the efficiencies or gain the benefits which BHPBIO has achieved through use of this technology.

6.2 However, access to the railway lines by another user without using this technology will inevitably result in substantially increased maintenance and replacement costs to BHPBIO. It is also very likely to result in decreased carrying capacity and delays in BHPBIO's uses of the lines. The deterioration in performance may be very significant in financial and operational terms.

6.3 It is very difficult to predict or quantify the actual degree of impact of access by another party will have on BHPBIO's railway system or the amount of increased costs and delays and deterioration in service. There are a number of uncertainties and variables which are not likely to be able to be resolved without detailed testing and trials. This would require a detailed understanding of the rolling stock and systems to be employed by the other user. However, it is safe to say that it is highly likely that there will be a significant reduction in efficiency and safety with the use of the railways by another company.

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ROBERT RIDLEY

4 October 2004