



## **Manganese Battery Metals** *The future for the Los Pumas Manganese Project - Chile*





# Focus on the EV Battery Market



- ❑ SUH is engaging technical specialists to guide process and development option studies for the use of Los Pumas ore in Nickel Cobalt Manganese (NCM) batteries or similar, aimed at the EV market
- ❑ SUH target is to provide manganese ores to produce High Purity Manganese Sulphate Monohydrate (HPMSM) plus option for up to three additional products
- ❑ Mn used in the vast majority of NCM batteries. HPMSM is currently the lowest cost NCM cathode metal and lowers the cost of batteries
- ❑ SUH strives to produce Carbon Neutral Manganese for HPMSM or similar



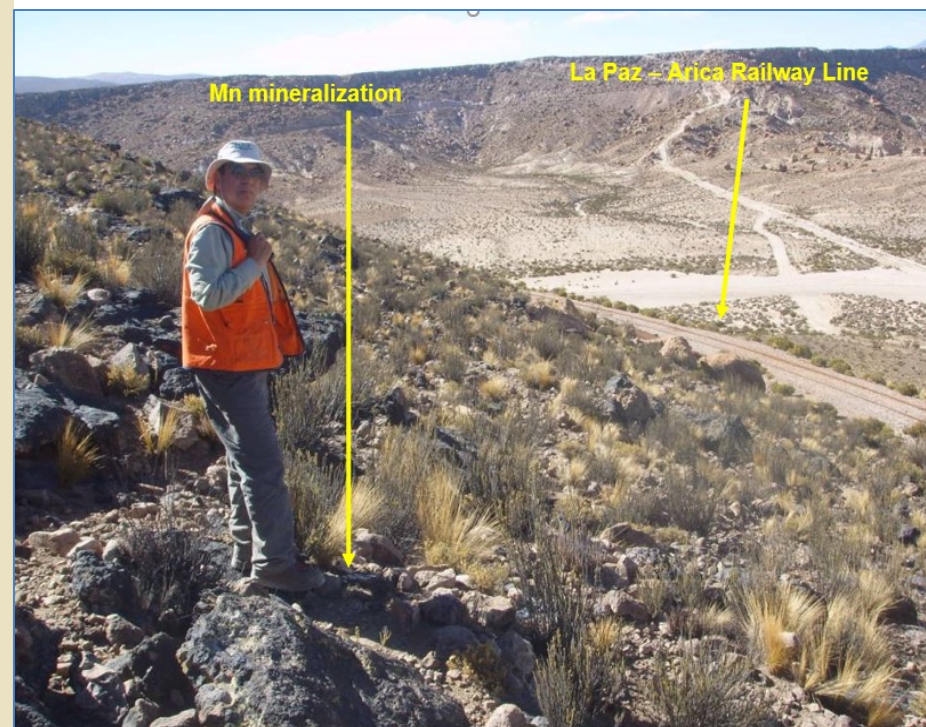




# The Los Pumas Manganese Project



- ❑ Project 100% owned located Northern Chile
- ❑ Mineral Resource Estimate - 23.7Mt @ 7.81% Mn (4% Mn COG)
- ❑ 38% Mn concentrate from initial metallurgical Test work
- ❑ Low Iron & Phosphorous, High Silica
- ❑ Close to Surface
- ❑ Simple Mining – 2.5mtpa plant
- ❑ Strip ratio circa 1:1
- ❑ Excellent logistics and near mine infrastructure
- ❑ Project plan to utilise hydro and solar power and minimise carbon footprint in all phases of production in this low population area





# Los Pumas - Location



- Los Pumas located in northern Chile
- 175km from Arica (Port city)
- Main port for Bolivia
- Exports & Imports Tin, Steel, Lead concentrate & Soya
- Location is close to USA west coast and China for optimal end user supply







# Manganese – A Growing Demand



- ❑ Manganese (Mn) is the fourth most used metal on earth in terms of tonnage
- ❑ Used in steel, specialty alloys and aluminium products
- ❑ Traditionally the market has been dominated by the steel and alkaline battery industries
- ❑ The electrification of the global vehicle fleet requires vast amounts of cathode materials
- ❑ Batteries are trending toward higher manganese content for safer, more cost-effective solutions

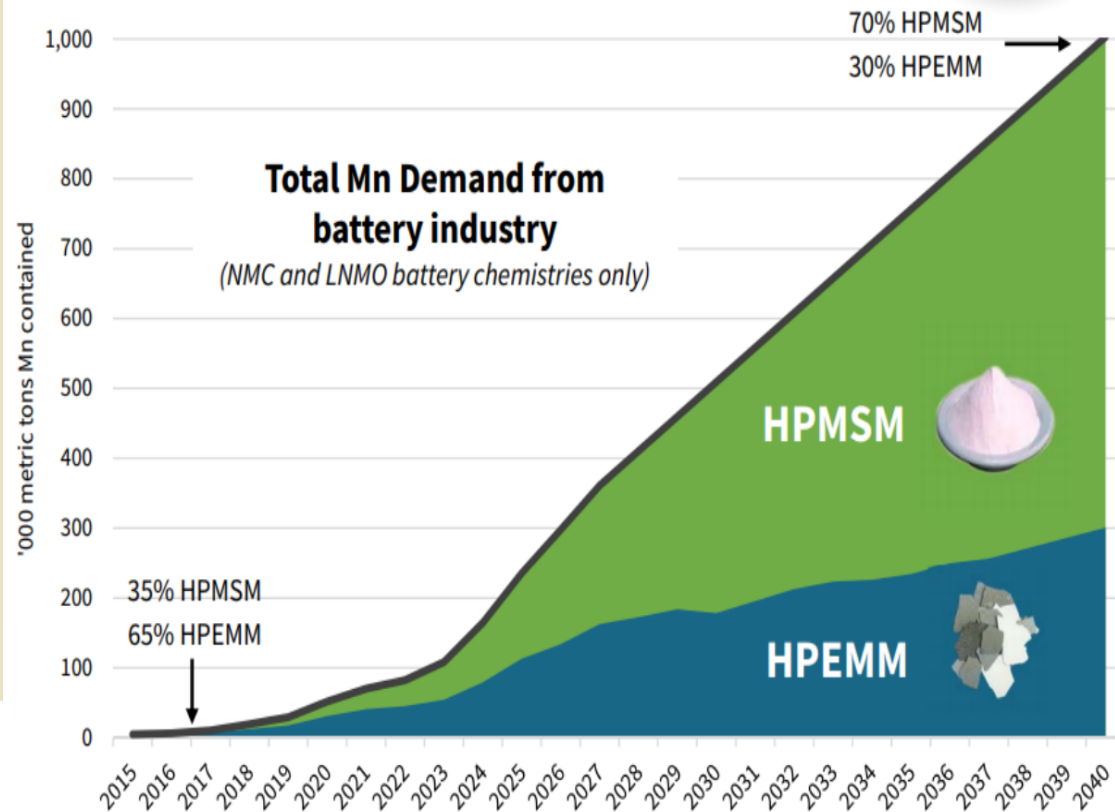




# High Purity Manganese



- ❑ Nickel and cobalt supply constraints to meet the demand for projected EV growth
- ❑ Tesla and VW plan to mass produce a new battery with a high proportion of manganese and no cobalt - Tesla ~ 33% Mn & VW >50% Mn
- ❑ The new cathode designs are expected to reduce costs without compromising performance



Ref: Future Battery Industries – Li-ion battery cathode manufacture in Australia



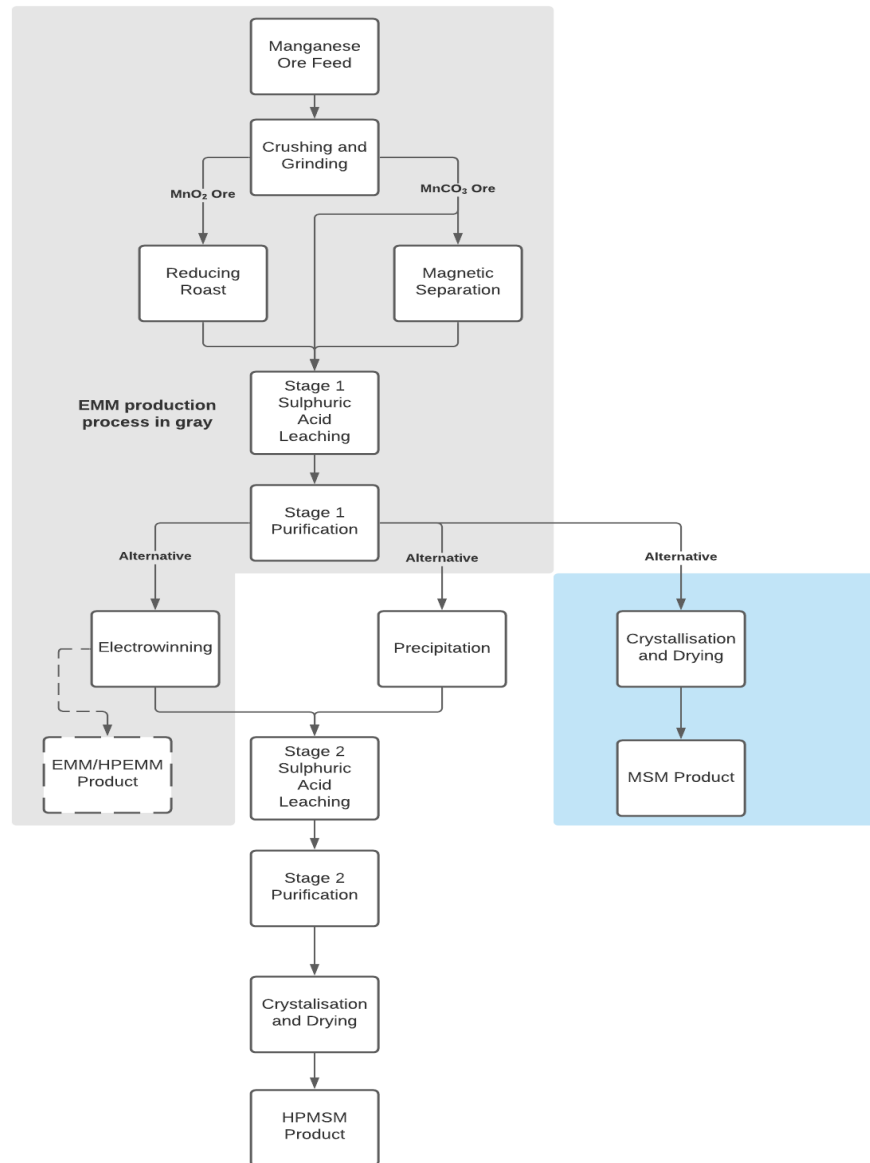
# Process analysis to produce HPMSM



- ❑ The option for a reducing roast, sulphuric acid leach and intermediate electrowinning before HPMSM crystallisation proved to be the most efficient process, with lowest technical risk
- ❑ The flowsheet analysis has identified that the following three additional products could be produced by eliminating different steps in the identified process
- ❑ Electro manganese metal (EMM)/ High purity EMM (HPEMM) – established market
- ❑ Agricultural manganese sulphate monohydrate (MSM) – growing market
- ❑ Sulphate of Potash is a by-product of the HPMSM process (SOP – growing market)
- ❑ The ability to produce a range of different products enhances the robustness of the Los Pumas Manganese Project
- ❑ Optimal process flowsheet to product HPMSM from Los Pumas material and testwork ongoing



# Process flowsheet – HPMSM & Alternatives





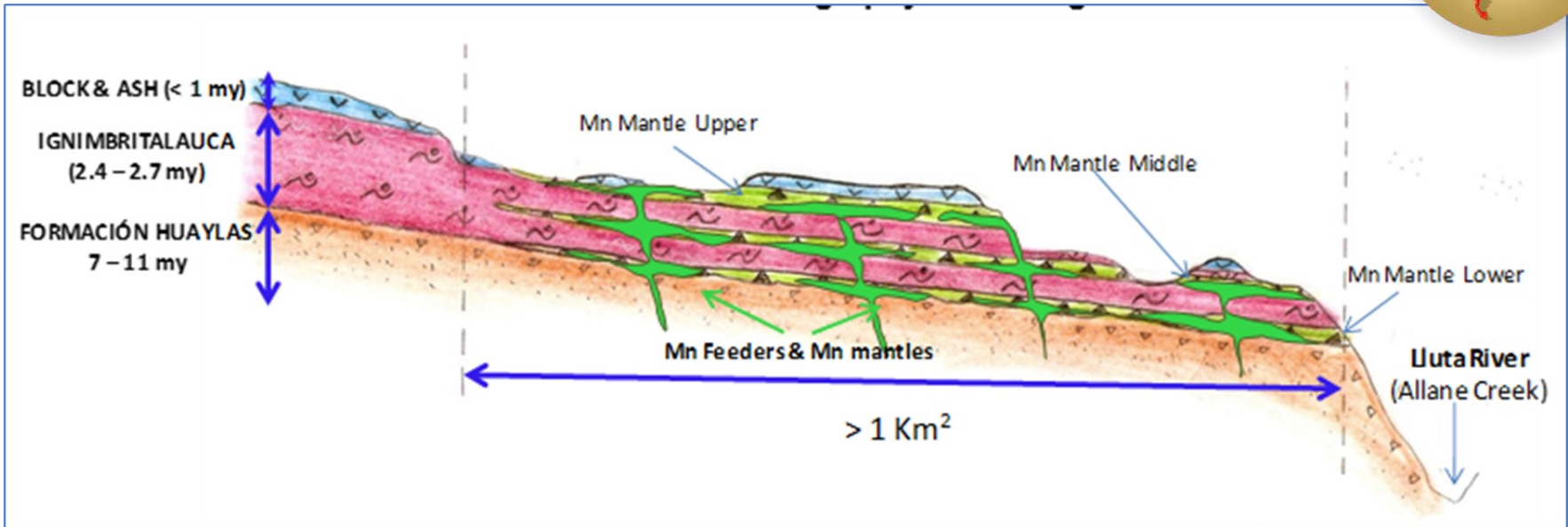


- ❑ Arica – La Paz railway line runs next to Los Pumas
- ❑ Chapinquina Hydroelectric Power ~ 55km from Los Pumas
- ❑ Town of Putre ~ 35km - workers, logistics and equipment support





# Simple Geology – Good mining parameters



- ❑ Sub-horizontal mineralization (in top 20 meters) with negligible stripping in early years
- ❑ Excellent potential to increase resources laterally and deeper
- ❑ Resource limited to drilling
- ❑ Drilled on average to 27 meters depth
- ❑ Vertical feeder zones have not been tested (vertical drilling used only)



- ☐ Geology & Drilling
- ☐ Deposit hosted by the Huaylas Formation (Upper Miocene age) and the Lauca Ignimbrite (Upper Pliocene)
- ☐ Lauca Ignimbrite hosts most of the manganese mineralisation at Los Pumas
- ☐ Sub-horizontal mineralization (in top 20 meters)
- ☐ 487 holes of RC completed for 14,024 m
- ☐ 32 diamond holes for 652m mainly for metallurgical holes and bulk density samples
- ☐ 220 holes to 1m depth at surface assayed and included in the resource – effective grade control for early mining
- ☐ 11 samples from 4 shafts (depths between 16 to 20m) for dense media pilot plant testing and comminution tests
- ☐ Processing
- ☐ Throughput 2.5mtpa
- ☐ Concentration is best achieved via Dense Media Separation (DMS)
- ☐ Proposed process plant consists of a three-stage crushing circuit, screening facilities, and two stage dense media separation
- ☐ DMS plant split into coarse and fine circuits to maximise efficiency from the cyclones to suit the size ranges
- ☐ 38% Mn concentrate from initial metallurgical Test work
- ☐ Environmental & Social
- ☐ Environmental Impact Statement completed – resubmission required

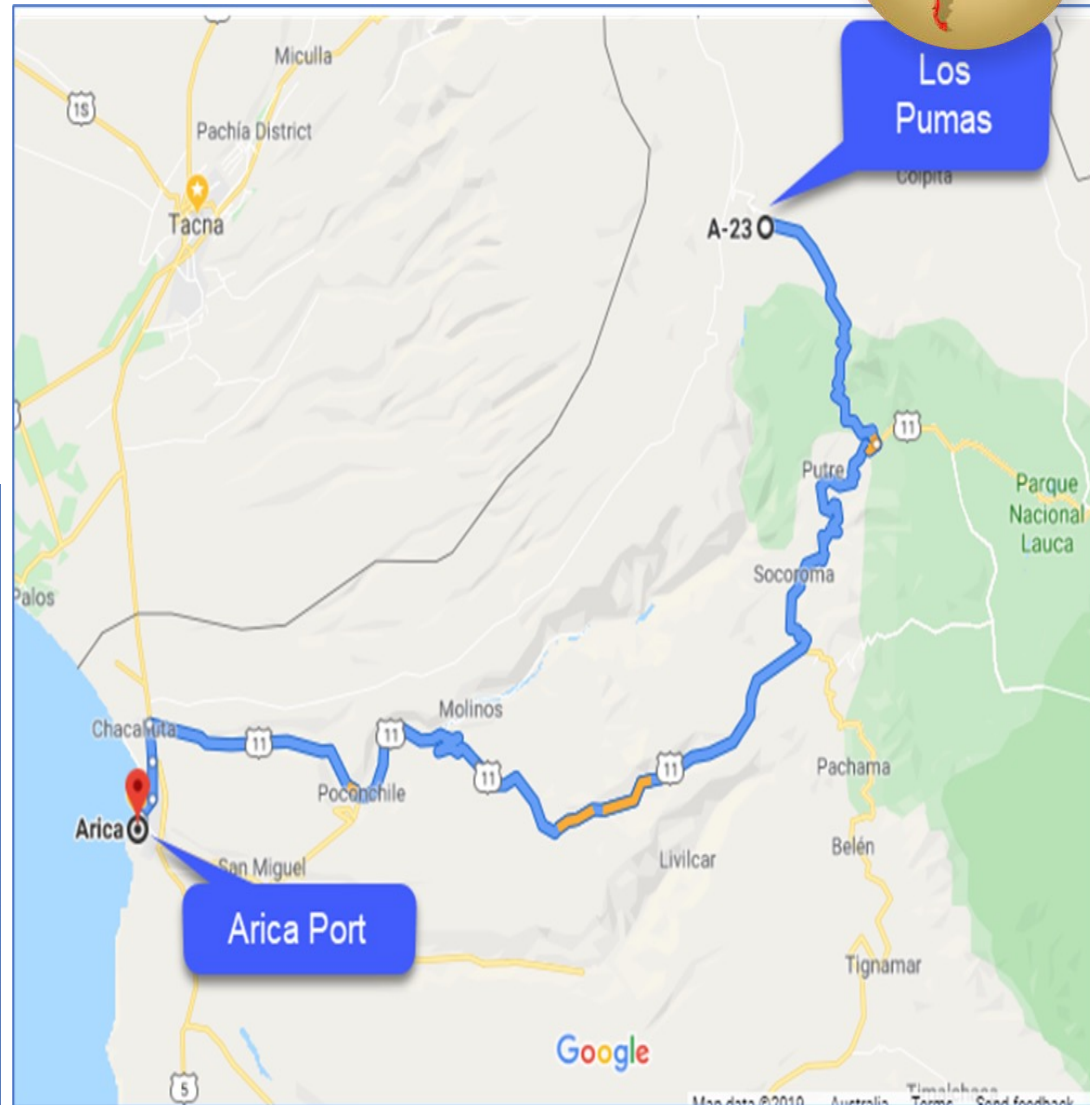
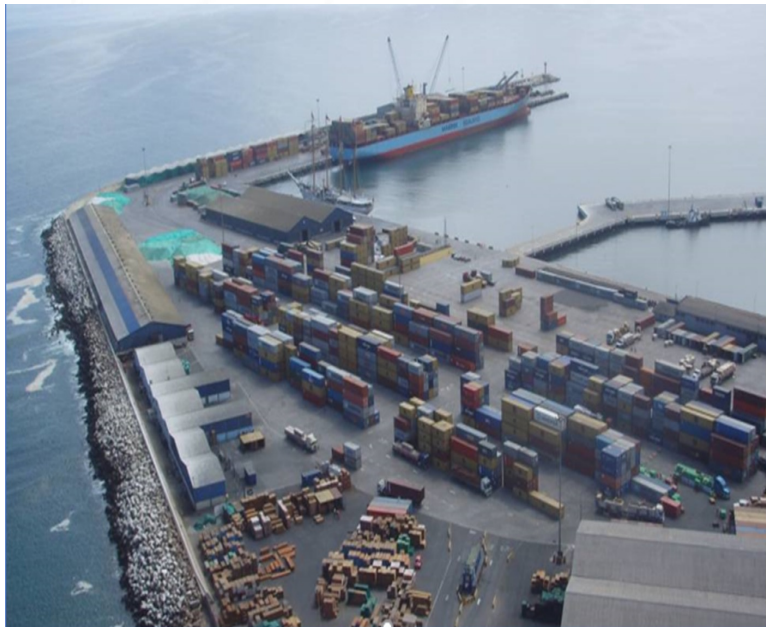




# Los Pumas - Logistics



- ❑ 175km by sealed road and railway to the Arica port
- ❑ Arica – La Paz railway line re-opened May 21
- ❑ Opportunities for lower transport costs





- ❑ Emissions impact will be an integral part of our project plan and possible future mine design, not an add-on or an afterthought
- ❑ Minimise transportation of consumables and people to/from site
- ❑ Energy efficiency key consideration for all mine processing equipment
- ❑ Water usage – recycling, reducing, reusing
- ❑ Circular economy – minimise waste, reduce/reuse wherever practical
- ❑ Adherence to global climate standards
- ❑ Task Force on Climate-related Financial Disclosures
- ❑ Sustainability Accounting Standards Board
- ❑ United Nations Sustainability Development Goals
- ❑ Look to implement ESG reporting





# Next Steps



- ❑ SUH engaging technical specialists to guide process and development option studies for the use of Los Pumas ore in NCM batteries and EV markets
- ❑ Capex - PEA study was US\$74.2m- in review to update and add HPMSM processing
- ❑ Engineering studies underway to revise and reduce
- ❑ **JV/ end user partner (EV Manufacturer or EV Battery manufacturer) sought for offtake**
- ❑ Support develop the Los Pumas Manganese Project to supply a carbon neutral battery cathode product





# Los Pumas Manganese Resource



Los Pumas Manganese Project: Total Measured and Indicated Resources - JORC (2004) Compliant. As announced to the market on 25 March 2011.

Resource (at 4% Mn cut-off)	Tonnes Millions	Mn %	SiO <sub>2</sub> %	Fe <sub>2</sub> O <sub>3</sub> %	Al %	K %	P %
<i>Measured</i>	5.27	7.39	57.85	2.78	5.62	2.88	0.05
<i>Indicated</i>	13.06	7.65	55	2.96	5.64	2.92	0.05
<b><i>Measured plus Indicated</i></b>	<b>18.34</b>	<b>7.58</b>	<b>55.82</b>	<b>2.91</b>	<b>5.62</b>	<b>2.91</b>	<b>0.05</b>
<i>Inferred</i>	5.39	8.59	51.44	2.72	5.49	2.69	0.06
<b><i>Total</i></b>	<b>23.73</b>	<b>7.81</b>					

Metallurgical studies have demonstrated greater than 38% Mn concentrates are achievable by DMS with low impurities and high silica product.

In relation to the above resources, the Company confirms that it is not aware of any new information or data that materially affects the information in the announcements, and all material assumptions and technical parameters in the announcements underpinning the estimates in the relevant market announcement continue to apply and have not materially changed.





# Disclaimer



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## Process Specialist

Process modelling and analysis was undertaken by Dr Will Goodall, Principal Consultant, MinAssist Pty Ltd. Dr Goodall is a metallurgical process consultant with 20 years' experience in process development and optimisation across a wide range of commodities. With a focus on battery and specialty metals Dr Goodall has undertaken process assessment and development for several battery metal projects, including detailed assessment of alternative feedstocks and process options for production of HPMSM.

## Competent/Qualified Person Statement

The information in this presentation that relates to exploration activities, exploration targets, exploration results or Mineral Resources, was prepared under the supervision of Adam Anderson who is a Member of the Australasian Institute of Mining and Metallurgy. Mr. Anderson has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration, and to the activity he is undertaking, to qualify as a "competent person" as defined in the 2012 edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr. Anderson has reviewed and approved the information contained in this presentation.

For further information regarding the projects, including a description of SUH's quality assurance program, quality control measures, the geology, samples collected and testing procedures in respect of SUH's projects, please refer to the Technical Reports and News Releases on the Company's website at [www.shmining.com.au](http://www.shmining.com.au)

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