

ASX Announcement ([ASX: AXE](#))

20 January 2023

Second Quarter Activities Report and Appendix 4C

For the three months ending 31 December 2022

Significant Activities

- The Company is well capitalised with approximately \$24.3 million cash and no debt.
 - Significant advances made in ¹²CQ chip development, with some of the most powerful supercomputers in the world used to validate the ¹²CQ chip qubit material uniqueness.
 - Major milestone achieved towards commercialisation of Archer's biochip technology, with the development and custom-build of an operational, early stage end-to-end prototype system platform.
 - IP protection sought nationally and internationally for several biochip related patent applications, spanning molecular biology, wettable graphene transistors, and sensing system platforms.
 - The Company is actively and regularly pursuing exposure to international global semiconductor industry participants.
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Archer Materials Limited ("Archer", the "Company", "[ASX: AXE](#)") is pleased to provide its Quarterly Activities Report and Appendix 4C for the three months ending 31 December 2022 ("Quarter").

Commenting on second quarter activities, Greg English, Executive Chairman of Archer, said, "During the Quarter we continued our approach of showing that the ¹²CQ chip qubit material can be compatible with existing technologies, when for the first time we used standard and commercially available metal-oxide-semiconductor ("CMOS") chip technology to detect quantum information in the ¹²CQ qubit material at room temperature.

"In November, Archer in conjunction with EPFL used powerful supercomputers to accurately simulate the behaviour of Archer's ¹²CQ qubit material. The simulations will be used to support the design and development of the more complex quantum devices required for the future operation of the ¹²CQ chip technology.

"Considerable biochip development work was undertaken during the Quarter, including the fabrication of an operational liquid-gated graphene field effect transistor ("gFET"). The transistor consists of a single-atom thick sheet of graphene to act as an ultrasensitive sensor and is an exciting development towards realising an operational biochip technology at Archer.

"In addition to the fabrication of the gFET, the Archer team developed an early-stage prototype of an integrated biochip platform with automated liquid sample handling and readout. The system will allow the Archer team to accurately, reliably, reproducibly, and quickly obtain data related to the Company's biochip devices."

Quarterly Activities to 31 December 2022

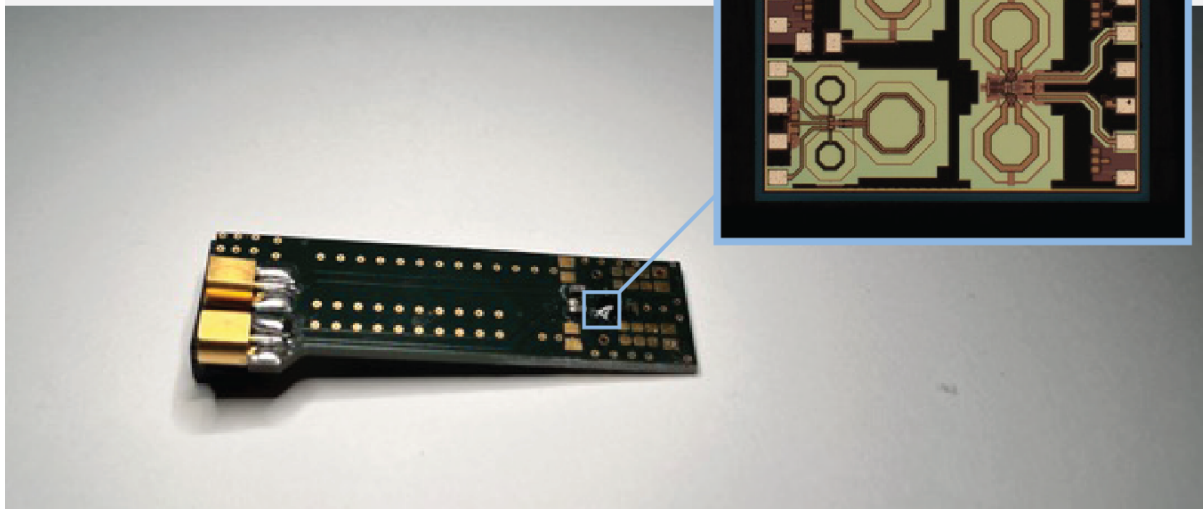
Archer is a technology company that operates within the semiconductor industry. The Company is developing advanced semiconductor devices, including chips relevant to quantum computing and medical diagnostics. The Company is progressing the development of its ^{12}CQ quantum computing qubit processor chip (" ^{12}CQ chip") and 'lab-on-a-chip' biochip technology ("biochip").

Technology development and commercialisation activities

^{12}CQ Chip

Archer's ^{12}CQ chip is a unique qubit processor technology the Company is developing that would allow for mobile quantum computing devices. During the Quarter, Archer made significant steps in the development of its ^{12}CQ chip technology, including detecting quantum information in its qubit material at room temperature using CMOS technology, and using some of the most powerful supercomputers in the world to validate the qubit material uniqueness.

Image 1. The integrated single-chip electron spin resonance detector based on CMOS technology. The CMOS single-chip detector is in a small region of approximately 0.5 mm x 0.5 mm on the printed circuit board (main image). The inset (right) shows a microscope image magnifying the spin-sensitive region in the CMOS device where the quantum spin states in Archer's ^{12}CQ qubit material are detected at room temperature by the miniaturised on-chip componentry.



CMOS is the predominant technology used in designing chips in the semiconductor industry and it is broadly used today to form integrated circuits in numerous and varied applications. Processors, memory, and sensors are among many electronic devices that make use of this technology. The use of CMOS technology in the semiconductor industry is expected to continue in the long-term¹ therefore, it was important to demonstrate the functional incorporation of the ^{12}CQ chip qubit material with CMOS devices (Image 1).

¹ <https://irds.ieee.org/>

The work is a major technological feat, as Archer used a single-chip integrated electron spin resonance detector based on CMOS technology to detect the quantum spin states in the as-prepared ^{12}CQ chip qubit material in a controlled atmosphere at room temperature. The quantum states were found to be sufficiently well preserved when operating in the on-chip environment. The outcome of the work paves the way for implementing complex qubit control required in quantum circuits.

The CMOS single-chip detectors were developed by Archer collaborators at École Polytechnique Fédérale de Lausanne, Switzerland (“EPFL”), are potentially industrially scalable, and were manufactured by Taiwan Semiconductor Manufacturing Company (“TSMC”). They apply the most widely adopted semiconductor technology used to build chips found in most modern-day devices.

During the Quarter, Archer in a joint effort with collaborators at EPFL, the Swiss National Supercomputing Centre (“CSCS”) and the facilities of the Scientific IT and Application Support Center (“SCITAS”) of EPFL, used powerful supercomputers to provide the most accurate simulations of Archer’s ^{12}CQ chip qubit material and validate its uniqueness (Image 2).

The complex atom-structure of the ^{12}CQ chip qubit material requires the enormous power of supercomputers for predictive modelling and realistic simulations of the qubit material properties. The results of such computation often take the form of material behaviour and can be used to validate (or refute) the material properties of interest for technological applications.

For the computations performed by Archer and EPFL, one of Europe’s most powerful supercomputers², the *Piz Daint*³, was utilised. The quantum chemistry simulation work employed a Density-Functional Tight-Binding (“DFTB”) methodology, *i.e.*, a combined density functional theory and tight binding model of the ^{12}CQ chip qubit material at the atom-scale.



Image 2. Photograph representative of the Swiss supercomputing cluster used by Archer and EPFL. Reproduced from the Swiss National Supercomputing Centre website.

² The *Piz Daint* recently ranked 26 out of the top 500 of the most powerful supercomputers in the world:
<https://www.top500.org/lists/top500/list/2022/11/>

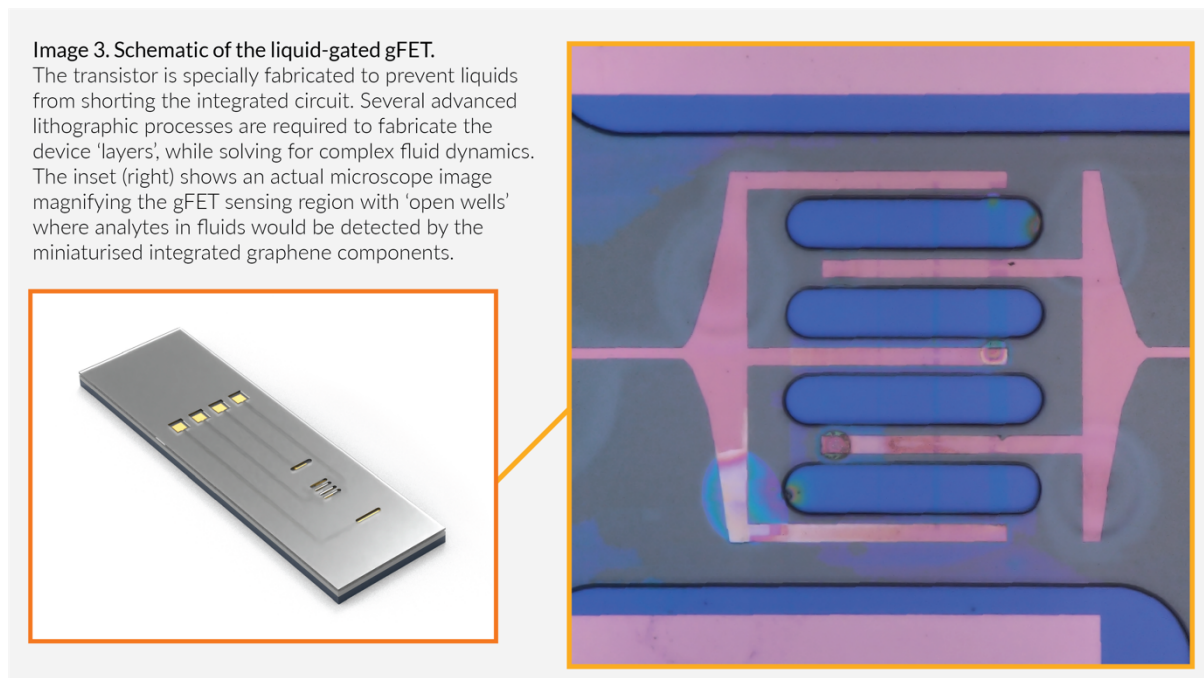
³ <https://www.cscs.ch/computers/piz-daint/> and <https://www.cscs.ch/computers/overview/> and <https://www.epfl.ch/about/>

The results of the work validate Archer's unique qubit material properties, including confirming an intrinsic metallic-like character of the qubit material. This directly translates to supporting the material structure-property paradigm that gives way to the quantum properties described in Archer's internationally patented qubit technology architecture (Exhibit 1).

The outcomes of the supercomputing simulations will be used to fast-track and support the development of Archer's more advanced quantum electronic devices required for ¹²CQ chip operation.

Archer's Biochip

Archer's biochip innovation aims to integrate graphene field effect transistors ("gFETs") into advanced fluidic systems to create miniaturised lab-on-a-chip device platforms for medical diagnostics. Integration of gFETs with on-chip fluidics could potentially enable multiplexing, i.e., the ability to parallelise the detection of multiple biologically relevant target fluids, on a chip.



Archer has made significant technological progress over the last year that fundamentally link to the development of a prototype biochip technology system platform, including designing and fabricating an operational liquid-gated gFET, i.e., a wettable transistor, during the Quarter (Image 3).

During the Quarter, the Company also developed, built, and configured a method, device, and prototype operational system platform for lab-on-a-chip sensing of the electronic properties of biologically relevant fluid samples. This is a major milestone towards commercialisation of Archer's biochip technology.

The end-to-end prototype system platform enables high throughput testing that incorporates gFET chips integrated with multiple fluidic channels, an automated sample handling robot, readout electronics, and software and user interface on a laptop (Image 4).

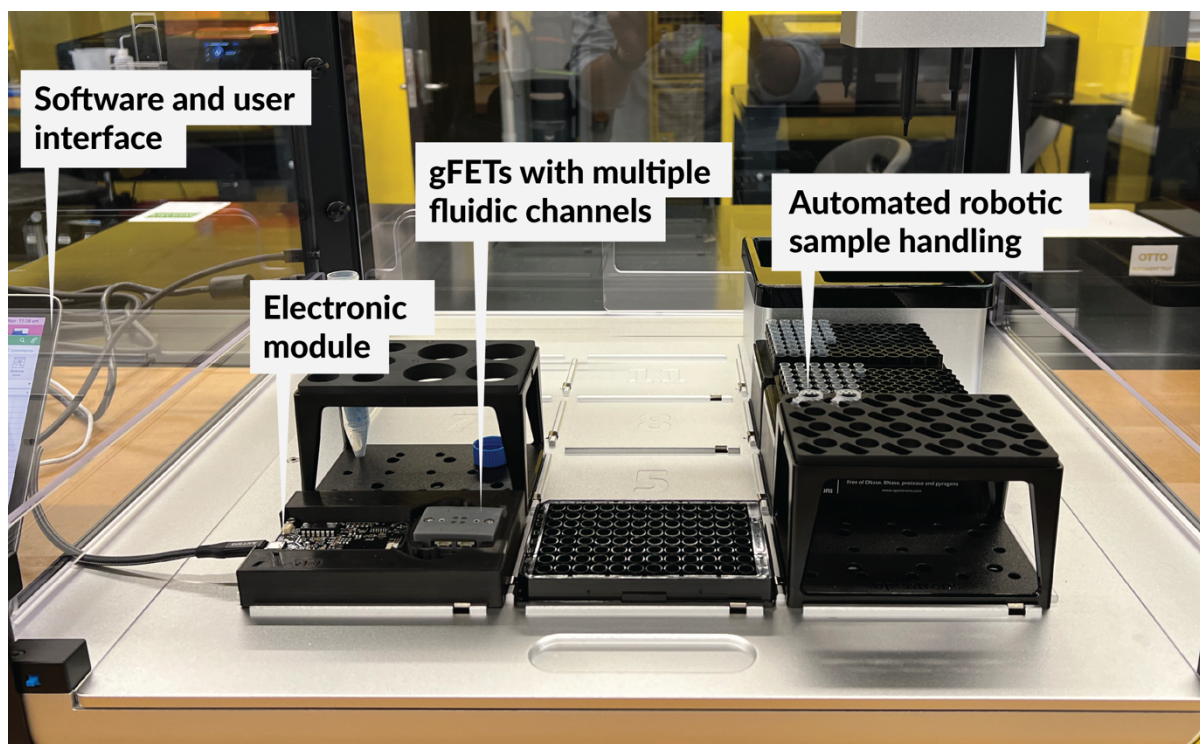


Image 4. Archer's early-stage prototype biochip system platform. Archer will use the technology to perform tests and device optimisation that are commercially relevant. Typically, fluid sample is pipetted onto the active sensing site using an automated programmable robot, to complex multiple fluidic channels, i.e. to the wettable gFET. In this way, the electronic properties of the fluid sample can be tested and analysed, and the results electronically read-out by the user on a computing device connected to custom designed hardware modules and software.

The software and user interface was custom built by Archer and is designed to be used in development, e.g. providing an easy way to run tests on Archer's biochips with different designs. The software is built on several packages in Python. The automated testing uses a programmable robot which directly communicates with the biochip hardware.

The system platform setup is a powerful tool in advancing Archer's biochip development, enabling the improvement of the gFET sensing device active sites, and automating liquid delivery to the chip using feedback from the sensor itself to allow complete hands-off and remotely controllable testing of prototype devices.

Archer will be able to quickly assess the impact of design changes within the biochip and the effectiveness of detection mechanisms. This is anticipated to lead to accelerated development of the Company's proposed sensing pathways to detect biologically relevant information.

The current hardware and software in the system platform is designed to run using a chip with single isolated gFETs as sensors, as gFETs offer an ultrasensitive approach to analyte detection over conventional electronic sensors used in current lab-on-a-chip devices. The early system platform paves the way for the possibility of single-device multiplexing in future designs.

Archer owns 100% of the biochip technology intellectual property. During the Quarter, the Company lodged two biochip-related provisional patents in Australia and proceeded to a full patent application for another, under the Patent Cooperation Treaty (Exhibit 1).

Exhibit 1. Description of Archer's technology patents and patent applications

Filing Date	Technology Summary																		
3 Dec 2015	<p>■ A quantum electronic device. Quantum electronic devices for processing qubits represented by an electron spin on a new type of carbon nanomaterial and methods for using this material in quantum computing.</p> <table border="1"> <thead> <tr> <th>Stage & Coverage</th> <th>Patent/Application Number</th> </tr> </thead> <tbody> <tr> <td colspan="2">Granted</td> </tr> <tr> <td>Japan</td> <td>6809670</td> </tr> <tr> <td>South Korea</td> <td>10-2288974</td> </tr> <tr> <td>China</td> <td>4606612</td> </tr> <tr> <td>United States of America</td> <td>11126925</td> </tr> <tr> <td>Europe</td> <td>3383792</td> </tr> <tr> <td>Australia</td> <td>2016363118</td> </tr> <tr> <td>Hong Kong</td> <td>1256636</td> </tr> </tbody> </table>	Stage & Coverage	Patent/Application Number	Granted		Japan	6809670	South Korea	10-2288974	China	4606612	United States of America	11126925	Europe	3383792	Australia	2016363118	Hong Kong	1256636
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15 Feb 2019	<p>■ Graphene complexes and compositions thereof. Complexes comprising graphene compositions, methods of synthesising these complexes and compositions, and the use of these complexes and compositions in biomolecular sensing.</p> <table border="1"> <thead> <tr> <th>Stage & Coverage</th> <th>Patent/Application Number</th> </tr> </thead> <tbody> <tr> <td colspan="2">Pending</td> </tr> <tr> <td>Australia</td> <td>2020220236</td> </tr> <tr> <td>United States of America</td> <td>17429442</td> </tr> </tbody> </table>	Stage & Coverage	Patent/Application Number	Pending		Australia	2020220236	United States of America	17429442										
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United States of America	17429442																		
1 Dec 2021	<p>■ Detection and quantification of nucleic acids.</p> <table border="1"> <thead> <tr> <th>Stage & Coverage</th> <th>Patent/Application Number</th> </tr> </thead> <tbody> <tr> <td colspan="2">Pending</td> </tr> <tr> <td>Australia</td> <td>2021903898</td> </tr> </tbody> </table>	Stage & Coverage	Patent/Application Number	Pending		Australia	2021903898												
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31 Mar 2022	<p>■ Fabrication and processing of graphene electronic devices on silicon with a SiO₂ passivation layer.</p> <table border="1"> <thead> <tr> <th>Stage & Coverage</th> <th>Patent/Application Number</th> </tr> </thead> <tbody> <tr> <td colspan="2">Provisional Patent</td> </tr> <tr> <td>Australia</td> <td>2022900845</td> </tr> </tbody> </table>	Stage & Coverage	Patent/Application Number	Provisional Patent		Australia	2022900845												
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11 Nov 2022	<p>■ A device, system, and method for sensing an electronic property of fluid sample.</p> <table border="1"> <thead> <tr> <th>Stage & Coverage</th> <th>Patent/Application Number</th> </tr> </thead> <tbody> <tr> <td colspan="2">Provisional Patent</td> </tr> <tr> <td>Australia</td> <td>2022903393</td> </tr> </tbody> </table>	Stage & Coverage	Patent/Application Number	Provisional Patent		Australia	2022903393												
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23 Dec 2022	<p>■ Methods for fabrication of graphene field-effect transistors with a liquid top-gate and associated componentry.</p> <table border="1"> <thead> <tr> <th>Stage & Coverage</th> <th>Patent/Application Number</th> </tr> </thead> <tbody> <tr> <td colspan="2">Provisional Patent</td> </tr> <tr> <td>Australia</td> <td>2022904006</td> </tr> </tbody> </table>	Stage & Coverage	Patent/Application Number	Provisional Patent		Australia	2022904006												
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<p>Patent Family</p> <p>■ ¹²CQ chip ■ Biochip</p>																			

Financial update

The Company's cash balance at the end of the Quarter was \$24,342,000.

The Company holds 1,633,944 shares in Canadian Stock Exchange listed Volatus Capital Corp (CSE:VC) and 11,571,119 shares and 2,892,780 quoted options in ASX listed ChemX Materials Ltd (ASX:CMX).

Archer's accompanying Appendix 4C cashflow report for the Quarter includes an amount of \$131,000 at item 6.1, relating to executive and non-executive director fees paid as salaries and wages.

Corporate

Annual General Meeting

The Company's Annual General Meeting ("AGM") was held on 23 November 2022 in Sydney, Australia. The Chairman's address, AGM presentation, and results of the AGM were lodged to ASX on 23 November 2022. All resolutions put to shareholders at the AGM were passed on a poll.

Issued Capital

Date	Shares	Options
Start of Quarter	248,467,207	35,300,000
New issues during Quarter	Nil	Nil
Options Exercised/forfeited during Quarter	500,000	500,000 ⁽¹⁾
End of Quarter	248,967,207	34,800,000
Date of this Report	248,967,207	33,750,000 ⁽²⁾

(1) The exercise of 500,000 unlisted options, exercisable at \$0.1511 by 31 March 2023.

(2) 1,050,000 unlisted options with an exercise price of \$1.79 and expiring 31 May 2025 lapsed in accordance with the terms of which they were issued.

Other

The Company was removed from the S&P/ASX All Technology Index effective prior to the open of trading on Monday, December 19, 2022, as a result of the December quarterly review.

Stakeholder events and outreach

Archer's CEO, Dr Mohammad Choucair, gave a company presentation at the Stocks Down Under Semiconductor Conference on 15 November 2022 and the presentation was lodged to ASX prior to the event on 15 November 2022. The Company also electronically distributed a number of Newsletters, Insights and Commentary to shareholders during the Quarter.

About Archer

Archer is a technology company that operates within the semiconductor industry. The Company is developing and commercialising advanced semiconductor devices, including chips relevant to quantum computing and medical diagnostics.

The Board of Archer authorised this announcement to be given to ASX.

General Enquiries

Mr Greg English
Executive Chairman

Dr Mohammad Choucair
Chief Executive Officer
Tel: +61 8 8272 3288

Media Enquiries

Tel: +61 2 8091 3240
Email: hello@archerx.com.au

For more information about Archer's activities, please visit our:

Website:

<https://archerx.com.au/>

Twitter:

<https://twitter.com/archerxau>

YouTube:

<https://bit.ly/2UKBBmG>

Sign up to our Newsletter:

<http://eepurl.com/dKosXI>

Appendix 4C

Quarterly cash flow report for entities subject to Listing Rule 4.7B

Name of entity

Archer Materials Limited

ABN

64 123 993 233

Quarter ended ("current quarter")

31 December 2022

Consolidated statement of cash flows	Current quarter \$A'000	Year to date (6 months) \$A'000
1. Cash flows from operating activities		
1.1 Receipts from customers	-	-
1.2 Payments for		
(a) research and development (exclusive of wages allocated to R&D)	(124)	(177)
(b) product manufacturing and operating costs	-	-
(c) advertising and marketing	-	-
(d) leased assets	-	(1)
(e) staff costs	(675)	(1,516)
(f) administration and corporate costs	(348)	(581)
1.3 Dividends received (see note 3)	-	-
1.4 Interest received	143	154
1.5 Interest and other costs of finance paid	-	-
1.6 Income taxes paid	-	-
1.7 Government grants and tax incentives	-	25
1.8 Other (provide details if material)		
1.9 Net cash from / (used in) operating activities	(1,004)	(2,096)

2. Cash flows from investing activities		
2.1 Payments to acquire or for:		
(a) entities	-	-
(b) businesses	-	-
(c) property, plant and equipment	(27)	(53)
(d) investments		
(e) intellectual property	(42)	(49)

Consolidated statement of cash flows	Current quarter \$A'000	Year to date (6 months) \$A'000
(f) other non-current assets	-	-
2.2 Proceeds from disposal of:		
(a) entities	-	-
(b) businesses	-	-
(c) property, plant and equipment	-	-
(d) investments	-	-
(e) intellectual property	-	-
(f) other non-current assets	-	-
2.3 Cash flows from loans to other entities	-	-
2.4 Dividends received (see note 3)	-	-
2.5 Other (provide details if material)	-	-
2.6 Net cash from / (used in) investing activities	(69)	(102)

3. Cash flows from financing activities		
3.1 Proceeds from issues of equity securities (excluding convertible debt securities)	-	-
3.2 Proceeds from issue of convertible debt securities	-	-
3.3 Proceeds from exercise of options	76	76
3.4 Transaction costs related to issues of equity securities or convertible debt securities	-	-
3.5 Proceeds from borrowings	-	-
3.6 Repayment of borrowings	-	-
3.7 Transaction costs related to loans and borrowings	-	-
3.8 Dividends paid	-	-
3.9 Other (provide details if material)	-	-
3.10 Net cash from / (used in) financing activities	76	76

4. Net increase / (decrease) in cash and cash equivalents for the period		
4.1 Cash and cash equivalents at beginning of period	25,339	26,464
4.2 Net cash from / (used in) operating activities (item 1.9 above)	(1,004)	(2,096)
4.3 Net cash from / (used in) investing activities (item 2.6 above)	(69)	(102)

Consolidated statement of cash flows		Current quarter \$A'000	Year to date (6 months) \$A'000
4.4	Net cash from / (used in) financing activities (item 3.10 above)	76	76
4.5	Effect of movement in exchange rates on cash held	-	-
4.6	Cash and cash equivalents at end of period	24,342	24,342

5.	Reconciliation of cash and cash equivalents at the end of the quarter (as shown in the consolidated statement of cash flows) to the related items in the accounts	Current quarter \$A'000	Previous quarter \$A'000
5.1	Bank balances	1,297	1,794
5.2	Call deposits	23,045	23,545
5.3	Bank overdrafts	-	-
5.4	Other (provide details)	-	-
5.5	Cash and cash equivalents at end of quarter (should equal item 4.6 above)	24,342	25,339

6.	Payments to related parties of the entity and their associates	Current quarter \$A'000
6.1	Aggregate amount of payments to related parties and their associates included in item 1 * The above payments relate to fees and salaries paid to Directors during the quarter.	131
6.2	Aggregate amount of payments to related parties and their associates included in item 2	-
<i>Note: if any amounts are shown in items 6.1 or 6.2, your quarterly activity report must include a description of, and an explanation for, such payments.</i>		

Quarterly cash flow report for entities subject to Listing Rule 4.7B

7. Financing facilities	Total facility amount at quarter end \$A'000	Amount drawn at quarter end \$A'000
<i>Note: the term "facility" includes all forms of financing arrangements available to the entity.</i>		
<i>Add notes as necessary for an understanding of the sources of finance available to the entity.</i>		
7.1	-	-
7.2	-	-
7.3	-	-
7.4	-	-
7.5	n/a	
7.6	Include in the box below a description of each facility above, including the lender, interest rate, maturity date and whether it is secured or unsecured. If any additional financing facilities have been entered into or are proposed to be entered into after quarter end, include a note providing details of those facilities as well.	
	n/a	

8. Estimated cash available for future operating activities	\$A'000
8.1	(1,004)
8.2	24,342
8.3	-
8.4	24,342
8.5	24.2 quarters
<i>Note: if the entity has reported positive net operating cash flows in item 1.9, answer item 8.5 as "N/A". Otherwise, a figure for the estimated quarters of funding available must be included in item 8.5.</i>	
8.6	If item 8.5 is less than 2 quarters, please provide answers to the following questions:
8.6.1	Does the entity expect that it will continue to have the current level of net operating cash flows for the time being and, if not, why not?
	Answer: n/a
8.6.2	Has the entity taken any steps, or does it propose to take any steps, to raise further cash to fund its operations and, if so, what are those steps and how likely does it believe that they will be successful?
	Answer: n/a
8.6.3	Does the entity expect to be able to continue its operations and to meet its business objectives and, if so, on what basis?
	Answer: n/a
<i>Note: where item 8.5 is less than 2 quarters, all of questions 8.6.1, 8.6.2 and 8.6.3 above must be answered.</i>	

Compliance statement

- 1 This statement has been prepared in accordance with accounting standards and policies which comply with Listing Rule 19.11A.
- 2 This statement gives a true and fair view of the matters disclosed.

Date: 20 January 2023.....

Authorised by: By the Board.....
(Name of body or officer authorising release – see note 4)

Notes

1. This quarterly cash flow report and the accompanying activity report provide a basis for informing the market about the entity's activities for the past quarter, how they have been financed and the effect this has had on its cash position. An entity that wishes to disclose additional information over and above the minimum required under the Listing Rules is encouraged to do so.
2. If this quarterly cash flow report has been prepared in accordance with Australian Accounting Standards, the definitions in, and provisions of, *AASB 107: Statement of Cash Flows* apply to this report. If this quarterly cash flow report has been prepared in accordance with other accounting standards agreed by ASX pursuant to Listing Rule 19.11A, the corresponding equivalent standard applies to this report.
3. Dividends received may be classified either as cash flows from operating activities or cash flows from investing activities, depending on the accounting policy of the entity.
4. If this report has been authorised for release to the market by your board of directors, you can insert here: "By the board". If it has been authorised for release to the market by a committee of your board of directors, you can insert here: "By the [name of board committee – eg Audit and Risk Committee]". If it has been authorised for release to the market by a disclosure committee, you can insert here: "By the Disclosure Committee".
5. If this report has been authorised for release to the market by your board of directors and you wish to hold yourself out as complying with recommendation 4.2 of the ASX Corporate Governance Council's *Corporate Governance Principles and Recommendations*, the board should have received a declaration from its CEO and CFO that, in their opinion, the financial records of the entity have been properly maintained, that this report complies with the appropriate accounting standards and gives a true and fair view of the cash flows of the entity, and that their opinion has been formed on the basis of a sound system of risk management and internal control which is operating effectively.