



**NANO ONE MATERIALS CORP.**

**INTERIM MANAGEMENT DISCUSSION**

**AND**

**ANALYSIS – QUARTERLY HIGHLIGHTS**

**FOR THE PERIOD ENDED SEPTEMBER 30, 2016**

## **INTERIM MANAGEMENT DISCUSSION AND ANALYSIS – QUARTERLY HIGHLIGHTS**

The following Interim Management Discussion and Analysis – Quarterly Highlights (“Quarterly Highlights”) of Nano One Materials Corp. (“Nano One” or the “Company”) has been prepared to provide material updates to the business operations, liquidity and capital resources of the Company since its last management discussion & analysis, being the Management Discussion & Analysis (“Annual MD&A”) for the fiscal year ended December 31, 2015. This Quarterly Highlights does not provide a general update to the Annual MD&A, or reflect any non-material events since the date of the Annual MD&A.

This Quarterly Highlights has been prepared in compliance with the requirements of section 2.2.1 of Form 51-102F1, in accordance with National Instrument 51-102 – Continuous Disclosure Obligations. This Quarterly Highlights should be read in conjunction with the Annual MD&A, the audited financial statements of the Company for the years ended December 31, 2015 and 2014 and the unaudited condensed interim financial statements for the nine months ended September 30, 2016, together with the notes thereto. In the opinion of management, all adjustments (which consist only of normal recurring adjustments) considered necessary for a fair presentation have been included. The results for the nine months ended September 30, 2016 are not necessarily indicative of the results that may be expected for any future period. Information contained herein is presented as at November 15, 2016 (the “Report Date”), unless otherwise indicated.

The unaudited condensed interim financial statements for the nine months ended September 30, 2016, including comparatives, have been prepared in accordance with International Accounts Standards (“IAS”) 34, “Interim Financial Reporting” using accounting policies consistent with International Financial Reporting Standards (“IFRS”) as issued by the International Accounting Standards Board (“IASB”) and Interpretations issued by the International Financial Reporting Interpretations Committee (“IFRIC”).

External auditors, appointed by the shareholders, have not audited or reviewed the financial statements for the nine month periods ended September 30, 2016 and did not perform the tests deemed necessary to enable them to express an opinion on these unaudited condensed interim financial statements.

For the purposes of preparing this Quarterly Highlights, management, in conjunction with the Board of Directors, considers the materiality of information. Information is considered material if: (i) such information results in, or would reasonably be expected to result in, a significant change in the market price or value of Nano One’s common shares; or (ii) there is a substantial likelihood that a reasonable investor would consider it important in making an investment decision; or (iii) it would significantly alter the total mix of information available to investors. Management, in conjunction with the Board of Directors, evaluates materiality with reference to all relevant circumstances, including potential market sensitivity.

Additional information relevant to the Company’s activities can be found on SEDAR at [www.sedar.com](http://www.sedar.com) and the Company’s website at [www.nanoone.ca](http://www.nanoone.ca). All dollar amounts included therein and in the following Quarterly Highlights are in Canadian dollars, the reporting and functional currency of the Company, except where noted.

## **FORWARD LOOKING STATEMENTS**

Certain statements contained in this Quarterly Highlights may constitute “forward-looking statements”. Such term is defined in applicable securities laws. The forward-looking information includes, without limitation, the success of research and development activities and other similar statements concerning anticipated future events, conditions or results that are not historical facts. These statements reflect management’s current estimates, beliefs, intentions and expectations; they are not guarantees of future performance. The Company cautions that all forward-looking information is inherently uncertain and that actual performance may be affected by a number of material factors, many of which are beyond the

Company’s control. Such factors include, among others, risks relating to research and development; the Company’s intellectual property applications being approved, the Company’s ability to property its proprietary rights from unauthorized use or disclosure, the ability of the Company to obtain additional financing; the Company’s limited operating history; the need to comply with environmental and governmental regulations; fluctuations in currency exchange rates; operating hazards and risks; competition; and other risks and uncertainties. Although the Company has attempted to identify important factors that could cause actual actions, events or results to differ materially from those described in forward-looking information, there may be other factors that cause actions, events or results not to be as anticipated, estimated or intended. Accordingly, actual future events, conditions and results may differ materially from the estimates, beliefs, intentions and expectations expressed or implied in the forward-looking information. All statements are made as of the Report Date and, except as required by law, the Company is under no obligation to update or alter any forward-looking information.

**OVERVIEW**

The Company was incorporated on November 5, 1987. The Company is engaged in developing novel, scalable and low-cost processing technology for the production of high performance nano-structured materials. Nano One’s mission is to establish its patent pending technology as a leading platform for the global production of a new generation of nano-structured composite materials. Nano One is building a portfolio of intellectual property and technology “know-how” for applications in markets that include energy storage, specialty ceramics, pharmaceutical, semiconductors, aerospace, dental, catalysts and communications. The technology simplifies the assembly of complex formulations of organic and inorganic ceramic powders and is suited to growth markets where the commercialization of advanced materials is inhibited by costly and entrenched industrial fabrication methods. Nano One’s first market is lithium-ion cathode materials in the energy storage sector, where its advantageous technology can bring sustainable differentiation and value to early adopters.

**OVERALL PERFORMANCE**

The Company has no revenues, so its ability to ensure continuing operations is its ability to obtain necessary financing to complete the development of novel, scalable and low-cost processing technology for the production of high performance nano-structured materials..

Nano One’s innovative processing technology can be used to produce materials used in a wide range of markets. Nano One’s first addressable market is cathode materials that are used to store and discharge energy in lithium-ion rechargeable batteries. There is growing demand in the lithium-ion battery market for more cost effective and higher performance energy storage solutions. Nano One is well positioned to address these needs with its patent pending technology and sees growth potential for the technology in many other materials markets that include energy storage, dental, catalysts, specialty ceramics, pharmaceutical, semiconductors, agriculture, aerospace and communications.

Nano One has developed a new method of producing high performance cathode materials, which uses equipment and simple methods that are known to scale in a wide range of industrial applications. The process can produce longer lasting composite materials using lower cost feedstock and simpler processing.

With regards to performance, Nano One materials have been assessed by Nano One, by Canada’s National Research Council (NRC) and by several key undisclosed materials producers. Specifically, NRC measured electrochemical performance of LNMC out to a thousand (1000) cycles and results were similar to those measured by Nano One and another undisclosed group. NRC also tested a comparable LNMC reference material prepared by a leader in battery material science and found that Nano One material performed with approximately 20% greater capacity than the reference material. Both the Nano One and NRC results show reasonable energy capacity fading to 85% after 500 1-hour charge-discharge cycles.

With regards to raw material costs, Nano One's liquid phase reaction is tolerant of raw material impurities and irregularities, enabling the use of lower grade feedstock (98-99% purity) instead of battery grade (99.9%) for an estimated ~30% reduction in terms of dollars (\$) per kilogram (kg).

With regards to processing costs, Nano One believes it can reduce the number of manufacturing steps by 75% and reduce throughput from several days to less than a day, when compared with state of the art methodologies described in patents and literature, such as solid state, hydrothermal, co-precipitation, sol-gel, spray pyrolysis and deposition methods. The overall savings in process costs is projected to be ~40% in terms of dollars (\$) per kilogram (kg). Furthermore, improvements to the nanostructure are showing 200-300% longer lasting material that can charge faster or store more energy. Nano One believes the product of these improvements can deliver a 50% reduction in the cost of storing energy in terms of dollars (\$) per kilowatt-hour (kWh).

The process consists of three (3) stages, and the major innovations lie in the first (1<sup>st</sup>) stage where a special mode of combining reactants controls crystal nucleation and growth of particles. Nucleation is the self-assembly of molecules into an organized structure. The desired nano-scale or superfine structure is formed in the first (1<sup>st</sup>) stage of the production cycle and eliminates many steps common to the dominant industrial processes.

In the first (1<sup>st</sup>) stage, salts or other reactants are added to an aqueous (water-based) or other solution located within a proprietary liquid phase reactor system. Nucleation occurs upon the presentation of feedstock and takes place rapidly. The proprietary system allows for control of structural growth and reaction kinetics, with the source materials provided either from bulk or from a continuous flow preparation process. The process is suitable for operation at mild temperatures and atmospheric pressures.

This reactor stage avoids grinding, milling, classification, supercritical conditions, filtering, separation and many other steps that are used in existing industrial methods. Reactants need not be high purity, as less expensive technical grade (as opposed to battery grade) chemicals can be used to achieve a quality output. Nano One's system is less sensitive to impurities and irregularities than other known manufacturing methods and can accommodate, for example, carbonates, hydroxides, and acetates of lithium, cobalt, nickel and manganese graded at 98% and 99% purity. These materials are less costly and more widely available than battery grade feedstock (99.9% and purer) that is commonly used to prepare cathode materials. The reactor operates at mild temperatures and atmospheric pressures, and can be sealed for inert or other environments, allowing for a much safer and simpler laboratory environment. The reactor stage also avoids complexing agents, surfactants, templates, and emulsifiers that are categories of chemicals typically used to initiate nucleation and control growth of structures. Nano One avoids these chemicals and is therefore able to deliver the desired structure using simpler methods and pass them on to the second (2<sup>nd</sup>) stage of drying and the third (3<sup>rd</sup>) stage of firing in a furnace.

In the second (2<sup>nd</sup>) stage, the reactor liquids are passed to an industrial drying system such as a spraying, freezing, evaporating, microwaving or other system.

In the third (3<sup>rd</sup>) stage, dried powders are fired in a conventional furnace such as a rotary kiln, fluidized bed, plasma or other type of furnace. This final stage is known as calcination, where the dried materials are heated to 800-900°C in either an atmospheric or inert environment and are thermally decomposed into, for instance, lithium manganese oxide, steam, ammonia and/or carbon dioxide. The formation of the underlying nano-structure is completed during calcination and the resulting powder is ready for assembly into a battery cell or other application.

The underlying structure and morphology of the materials is preserved through a wide range of thermal processing steps, eliminating the need for long and repeated firings and indicative of a robust and long lasting material. The process produces materials with stable phase composition and high porosity, but which is configurable to meet a variety of density requirements.

The presence of nano-structures early in the process and prior to calcination simplifies processing and is advantageous for performance, throughput and scale-up. Characterization of the materials by electron microscope and x-ray characterizes the size, the composition and the kind of structure, providing evidence of a robust structure that withstands the rigours of drying and calcination and maintains the integrity of its advantageous structure through thousands of charge cycles.

This innovative approach can reduce the complexity and cost of materials production, through lower cost feedstock and fewer steps, while providing nanostructured materials with superior performance characteristics. The reactor, drying and calcination stages can be easily integrated to enable materials to flow from start to finish in a continuous manner and under controlled environmental conditions. In this way, Nano One’s system can be configured for many different composite materials and Nano One believes the three (3) stage process can be rapidly scaled and configured for high volume production.

Typically, synthesis of nano-materials at the benchscale are performed in small quantities anywhere from milligrams to grams of material. Subsequent scale-up from these small quantities often leads to detrimental changes in thermodynamics (heat, temperature, energy, work) and reaction kinetics (reaction rates and chemical change). Nano One recognizes that synthesis of materials must begin at a larger scale where the properties of the system are much closer to production conditions. For this reason, Nano One designed a 6-liter bench scale reactor that is capable of producing up to 150 grams per hour (150 g/hr) or 3 kilograms per day (3 kg/day), with drying and firing stages easily scaled to match. At this scale, there is sufficient enough volume to emulate the thermodynamic and reaction kinetics expected in pilot and full-scale production.

Nano One completed the design phase of its demonstration pilot plant at the end of May 2016 on budget and on schedule. The procurement and construction phase of the Pilot project began on June 1, 2016 and completion of construction remains on schedule for early in 2017. The goal of the pilot is to simulate full scale production of lithium ion cathode materials, showcase Nano One’s patented technology and demonstrate the cost, scalability, performance and novelty of Nano One’s technology to strategic industry players. The pilot will be capable of producing ten (10) kilogram batches of various lithium mixed metal cathode materials that are strategically important to electric vehicle, grid storage and consumer electronic batteries.

The Pilot Plant Project is being supported with a \$2.08M grant from Sustainable Development Technology Canada (“SDTC”). The grant proceeds are non-dilutive, non-repayable and will be payable in installments over the build, commission and demonstration phases with a 10% holdback awarded upon completion of the project in mid 2018. The funds are dispersed at the beginning of each phase, and are subject to Nano One meeting milestones and having matching funds in place. During the period ended September 30, 2016, the Company executed a contribution agreement with Sustainable Development Technology Canada for \$2.08 million technology commercialization grant and received the initial instalment of \$488,944 for the first phase of a lithium battery materials pilot plant project.

During the period ended September 30, 2016, Nano One was also awarded support from the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP). NRC-IRAP will support Nano One’s project to develop High Voltage Cobalt Free Cathode Materials and will contribute up to \$222,857 in non-dilutive and non-repayable funds between June 1, 2016 and November 30, 2017. The objective of the project is to develop, optimize and demonstrate Nano One’s patented processing technology for the synthesis of High Voltage Cobalt Free Cathode Material, commonly known as HV-Spinel, as a cathode in lithium ion batteries. Under this project, Nano One will be optimizing process conditions in preparation for strategic evaluation and scaled up production in the Pilot Plant. This project is on budget and on schedule.

**LIQUIDITY AND FINANCIAL CONDITION**

The Company has not yet realized profitable operations and it has relied on non-operational sources of financing to fund operations. The ability of the Company to achieve its objectives, meet its ongoing

obligations and recover its investments in granted and pending patents, and other assets will depend on management's ability to successfully execute its business plan, achieve profitable operations and obtain additional financing, if or when required. There is no assurance that these initiatives will be successful.

Loss and comprehensive loss for the period ended September 30, 2016 decreased by \$1,690,134. The change was primarily due to the following:

- General and administrative costs of \$1,904,444 (2015 - \$868,178) increased as follows:
  - Research and development increased by \$607,830 primarily due to the Company completing the design phase of a pilot plant and initiating the procurement and construction phase of the pilot plant during the period ended September 30, 2016. The Company saw an increase in grant funds received of \$214,167 (2015 - \$150,523) during the period ended September 30, 2016.
  - Consulting increased by \$82,258 primarily due to consulting fee paid to the Chairman for consulting services provided to the Company in relations to corporate development, fees paid to a consultant in connection with the grant applications and consulting services provided by a strategic advisor, Mr. Joe Lowry.
  - Filing and regulatory fees increased by \$36,213 primarily due to patent application filing fees and fees related to Computershare acting as the agent on the warrants issued in relations to the 2015 reverse takeover.
  - Professional fees decreased by \$41,913 primarily due to work performed in relations to the 2015 reverse takeover.
  - Shareholder communication and investor relations increased by \$305,274 primarily due to an increase in updates to the shareholder community.
- The transaction costs relating to the 2015 reverse takeover plus the aggregate of the fair value of the consideration paid and the net liabilities acquired has been recognized as listing expenses of \$2,556,808, in the statement of loss and comprehensive loss for the period ending September 30, 2015.
- The Company recorded a noncash share-based payments of \$414,091 (2015 – \$578,087) relating to the fair value to the current period.

Liquidity risk is the risk that the Company will not be able to meet its obligations associated with its financial liabilities. The Company has historically relied upon equity financings to satisfy its capital requirements and will continue to depend heavily upon equity capital to finance its activities. The Company's approach to managing liquidity risk is to ensure that it will have sufficient liquidity to meet liabilities when due. The Company started 2016 with a working capital of \$1,249,321, and as at September 30, 2016, the Company had working capital of \$3,303,121. The increase in the working capital of \$2,053,800 was primarily due to:

- completion of two non-brokered private placements of 2,649,583 common shares of the Company for gross proceeds of \$823,000;
- 400,000 stock options were exercised for gross proceeds of \$98,000;
- 10,063,586 warrants were exercised for gross proceeds of \$3,048,383;
- IRAP grants received totalling \$63,138;
- SDTC grant received totalling \$488,994, of which \$337,965 was allocated to deferred government grant;
- general and administrative costs of \$1,904,444;
- deposits of \$263,980 paid in pilot plant equipment orders; and
- purchase of equipment totalling \$47,430;



Recent developments in the capital markets have restricted access to debt and equity financing for many companies. As the Company has no significant income, cash balances will continue to decline as the Company utilizes these funds to conduct its operations, unless replenished by capital fundraising.

	September 30, 2016	December 31, 2015
Working capital	\$ 3,303,121	\$ 1,249,321
Deficit	(9,835,048)	(7,524,353)

## FUTURE PLANS

Nano One plans to develop, optimize and demonstrate the benefits of producing various cathode materials using its processing technology, for use as a cathode in lithium ion batteries. Process parameters for cutting edge materials such as NMC111 and NMC532 will be determined and will inform the design, construction and operation of a demonstration pilot plant. Next generation materials such as HV-Spinel, NMC811 and LMR-NMC will be optimized at the bench scale in preparation for future scale up.

Nano One is collaborating with NORAM and BCRI to design, build and operate the 10-kilogram per day pilot plant to demonstrate the production of lithium ion battery cathode powders. The engineering design and specifications of equipment follow from commercial scale concepts developed by Nano One and NORAM. SDTC has approved \$2.08M in funding towards the procurement, building and commissioning of the pilot plant. Nano One will continue in its current procurement and construction phase and is on budget and on schedule to meet its milestone of having the plant built in early 2017.

Nano One will continue to develop High Voltage Cobalt Free Cathode Materials. NRC-IRAP has approved up to \$222,857 towards further development.

Nano One intends to hire co-op students, chemists, engineers and project managers to support materials development and scale-up efforts. Furthermore, test cell assembly and electrochemical characterization capabilities need to be ramped up to meet internal testing requirements. Nano One will also continue the evaluation of other next generation lithium-ion battery materials as dictated by commercial interests.

Nano One intends to leverage progress on these plans and approach potential strategic interests and key market pull players to collaborate as partners in the demonstration pilot.

## RELATED PARTY DISCLOSURES

Key management personnel are the persons responsible for the planning, directing and controlling the activities of the Company and includes both executive and non-executive directors, and entities controlled by such persons. The Company considers all Directors and Officers of the Company to be key management personnel.

The following transactions were carried out with related parties:

**(a) Purchases of services**

	September 30, 2016 \$	September 30, 2015 \$
Ellis Street Consulting, an entity controlled by John Lando, an executive director is an officer, for consulting fees	-	40,000
Bedrock Capital Corp., an entity controlled by Paul Matysek, an executive director is an officer, for consulting fees	45,000	30,000
Center Cut Capital, an entity controlled by John Lando, an executive director is an officer, for employee benefits	15,246	-
	60,246	70,000

**(b) Key management compensation**

Key management includes directors (executive and non-executive), the Chief Executive Officer, President and Chief Financial Officer. The compensation paid or payable to key management for employee services is shown below:

	September 30, 2016 \$	September 30, 2015 \$
Salary and benefits to the CFO	54,000	63,900
Salary and benefits to the President and Director	56,250	23,738
Salary and benefits to CEO and Director	93,750	106,692
Share-based payments to officers and directors	62,367	473,017
	266,367	667,347

**RISK AND UNCERTAINTIES**

Risk is inherent in all business activities and cannot be entirely eliminated. Our goal is to enable the Company's business processes and opportunities by ensuring that the risks arising from our business activities, the markets and political environments in which we operate is mitigated. The risks and uncertainties described in the Annual MD&A for the year ended December 31, 2015 are considered by management to be the most important in the context of the Company's business and are substantially unchanged as of the Report Date. Those risks and uncertainties are not inclusive of all the risks and uncertainties the Company may be subject to and other risks may apply.