

The information in this preliminary prospectus supplement is not complete and may be changed. This preliminary prospectus supplement and the accompanying prospectus are not an offer to sell and are not soliciting an offer to buy these securities in any jurisdiction where the offer or sale is not permitted.

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SUBJECT TO COMPLETION, DATED OCTOBER 14, 2025

Preliminary Prospectus Supplement
(To Prospectus dated October 14, 2025)



\$ of Shares of Common Stock

We are offering shares of our common stock, par value \$0.01 per share, having an aggregate offering price of \$, pursuant to this prospectus supplement and the accompanying prospectus.

Our common stock is currently traded on the Nasdaq Capital Market ("Nasdaq") under the symbol "ASPI." On October 13, 2025, the closing price of our common stock was \$13.32 per share.

The underwriters have agreed to purchase the common stock from us at a price of \$ per share, which will result in approximately \$ of proceeds to us, before offering expenses assuming no exercise by the underwriters of the option described below. The underwriters propose to offer the shares of common stock from time to time for sale in one or more transactions on Nasdaq, the existing trading market for our common stock, in negotiated transactions or otherwise at market prices prevailing at the time of sale, at prices related to prevailing market prices or at negotiated prices, subject to receipt and acceptance by it and subject to its right to reject any order in whole or in part. See "Underwriting."

We have granted the underwriters an option for a period of 30 days from the date of this prospectus supplement to purchase up to \$ of additional shares of common stock at the price per share set forth above. If the underwriters exercise the option in full, the total proceeds to us, before expenses, will be \$.

Investing in our securities involves a high degree of risk. See "Risk Factors" on page S-10 of this prospectus supplement, on page 4 of the accompanying prospectus and in our filings with the U.S. Securities and Exchange Commission that are incorporated by reference into this prospectus supplement and the accompanying prospectus.

Neither the U.S. Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus supplement is truthful or complete. Any representation to the contrary is a criminal offense.

The underwriters expect to deliver the shares of common stock to purchasers on or about , 2025.

Cantor

Lucid Capital Markets

The date of this prospectus supplement is , 2025.

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ABOUT THIS PROSPECTUS SUPPLEMENT

This prospectus supplement is part of an automatic shelf registration statement that we have filed with the Securities and Exchange Commission, or “SEC,” as a “well-known seasoned issuer” as such term is defined in Rule 405 under the Securities Act of 1933, as amended, or the “Securities Act,” utilizing a “shelf” registration process.

This prospectus supplement and the accompanying prospectus relate to the offering of our common stock. Before buying any shares of common stock that we are offering, we urge you to carefully read this prospectus supplement and the accompanying prospectus, together with the information incorporated by reference as described under the headings “Where You Can Find More Information” and “Incorporation by Reference” in this prospectus supplement. These documents contain important information that you should consider when making your investment decision.

This document is in two parts. The first part is this prospectus supplement, which describes the terms of this offering of common stock and adds to and updates information contained in the accompanying prospectus and the documents incorporated by reference into this prospectus supplement and the accompanying prospectus. The second part, the accompanying prospectus, including the documents incorporated by reference therein, provides more general information, some of which may not apply to this offering. Generally, when we refer to this prospectus, we are referring to both parts of this document combined. To the extent there is a conflict between the information contained in this prospectus supplement, on the one hand, and the information contained in the accompanying prospectus or in any document incorporated by reference that was filed with the SEC, before the date of this prospectus supplement, on the other hand, you should rely on the information in this prospectus supplement. If any statement in one of these documents is inconsistent with a statement in another document having a later date, the statement in the document having the later date modifies or supersedes the earlier statement.

You should rely only on the information contained in or incorporated by reference in this prospectus supplement, the accompanying prospectus and in any free writing prospectus that we have authorized for use in connection with this offering. Neither we nor any of the underwriters have authorized anyone to provide you with different information. If anyone provides you with different or inconsistent information, you should not rely on it. We are not, and the underwriters are not, making an offer to sell these securities in any jurisdiction where the offer or sale is not permitted. You should assume that the information appearing in this prospectus supplement, the accompanying prospectus, the documents incorporated by reference in this prospectus supplement and the accompanying prospectus, and in any free writing prospectus that we have authorized for use in connection with this offering, is accurate only as of the date of those respective documents. Our business, financial condition, results of operations and prospects may have changed since those dates. You should read this prospectus supplement, the accompanying prospectus, the documents incorporated by reference in this prospectus supplement and the accompanying prospectus, and any free writing prospectus that we have authorized for use in connection with this offering, in their entirety before making an investment decision.

We are offering to sell, and seeking offers to buy, shares of common stock only in jurisdictions where offers and sales are permitted. The distribution of this prospectus supplement and the accompanying prospectus and the offering of the common stock in certain jurisdictions may be restricted by law. Persons outside the United States who come into possession of this prospectus supplement and the accompanying prospectus must inform themselves about, and observe any restrictions relating to, the offering of the common stock and the distribution of this prospectus supplement and the accompanying prospectus outside the United States. This prospectus does not constitute, and may not be used in connection with, an offer to sell, or a solicitation of an offer to buy, any securities offered by this prospectus supplement and the accompanying prospectus by any person in any jurisdiction in which it is unlawful for such person to make such an offer or solicitation.

Unless otherwise indicated, all references in this prospectus supplement to “\$” or “dollars” are to U.S. dollars and financial information presented in this prospectus supplement that is derived from financial statements incorporated by reference is prepared in accordance with accounting principles generally accepted in the United States.

PROSPECTUS SUPPLEMENT SUMMARY

This summary highlights certain information about us, this offering and information contained elsewhere in or incorporated by reference into this prospectus supplement. This prospectus summary is not complete and does not contain all of the information that you should consider before making an investment decision. For a more complete understanding of our company, you should read and consider carefully the more detailed information included or incorporated by reference in this prospectus supplement and the accompanying prospectus, including the factors described under the heading "Risk Factors," beginning on page S-10 of this prospectus supplement and page 4 of the accompanying prospectus, as well as the information incorporated herein by reference, before making an investment decision.

In this prospectus supplement, unless the context otherwise requires, the terms "ASP Isotopes," "we," "us" and "our" refer to ASP Isotopes Inc. together with its consolidated subsidiaries.

Overview

We are a development stage advanced materials company dedicated to the development of technology and processes that, if successful, will allow for the enrichment of natural isotopes into higher concentration products, which could be used in several industries. Our proprietary technologies, the Aerodynamic Separation Process ("ASP technology") and Quantum Enrichment technology ("QE technology"), are designed to enable the production of isotopes used in several industries. Our initial focus is on the production and commercialization of enriched Carbon-12 ("C-12"), Carbon-14 ("C-14"), Silicon-28 ("Si-28") and Ytterbium-176 ("Yb-176").

We commenced commercial production of enriched isotopes at both of our ASP enrichment facilities located in Pretoria, South Africa during the first half of 2025. Our first ASP enrichment facility is designed to enrich light isotopes, such as C-14 and C-12. The second ASP enrichment facility, which is substantially larger than the first, should have the potential to enrich kilogram quantities of relatively heavier isotopes, including but not limited to Si-28. We anticipate shipping the first commercial batch of enriched C-12 and enriched Si-28 during the fourth quarter of 2025. We anticipate shipping the first commercial batch of enriched C-14 in the first half of 2026. We have also completed the commissioning phase and are producing commercial samples of highly enriched Yb-176 at our third enrichment facility, a QE technology facility, which is our first laser-based enrichment plant. The customer acceptance process for Yb-176 is relatively lengthy and we expect to ship commercial quantities of Yb-176 during the fourth quarter of 2025 or the first half of 2026. In addition, we have started planning additional isotope enrichment plants both in South Africa and in other jurisdictions, including Iceland and the United States. We believe the C-14 we may produce using the ASP technology could be used in the development of new pharmaceuticals and agrochemicals. We believe the Si-28 we may produce using the ASP technology may be used to develop advanced semiconductors and in quantum computing. We believe the Yb-176 we may produce using the QE technology may be used to create radiotherapeutics that treat various forms of oncology.

In addition, we are considering the future development of the ASP technology for the separation of Zinc-68 and Xenon-129/136 for potential use in the healthcare end market, Germanium 70/72/74 for potential use in the semiconductor end market, and Chlorine -37 for potential use in the nuclear energy end market. We are also considering the future development of QE technology for the separation of Nickel-64, Gadolinium-160, Ytterbium-171, Lithium 6 and Lithium7.

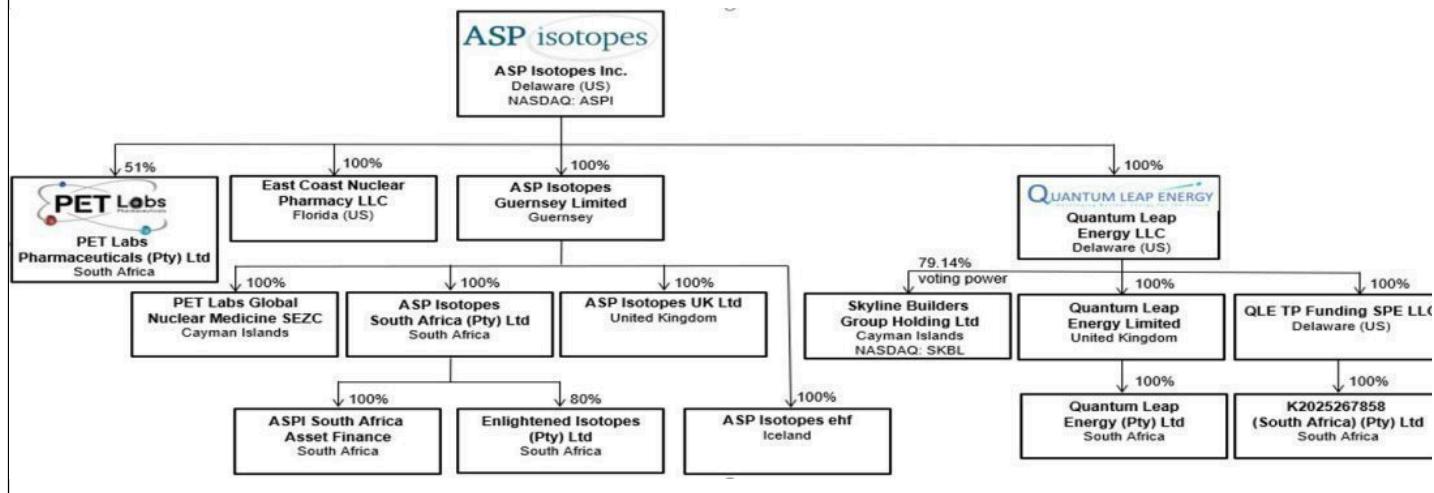
We are also pursuing an initiative to apply our enrichment technologies to the enrichment of Uranium-235 ("U-235") in South Africa. We believe that the U-235 we may produce using quantum enrichment technology may be commercialized as a nuclear fuel component for use in the new generation of high-assay low-enriched uranium (HALEU)-fueled small modular reactors that are now under development for commercial and government uses. In November 2024, we entered into a memorandum of understanding with The South African Nuclear Energy Corporation (Necsa), a South African state-owned company responsible for undertaking and promoting research and development in the field of nuclear energy and radiation sciences, to collaborate on the research, development and ultimately the commercial production of advanced nuclear fuels. Subject to the receipt of funding and all required permits and licenses to begin enrichment of U-235 in South Africa, it is anticipated that the research, development and ultimate construction of a HALEU production facility will take place at South Africa's main nuclear research center at Pelindaba in Pretoria.

In furtherance of the South African uranium enrichment initiative, in May 2025, we entered into a loan agreement with TerraPower, which provides conditional commitments from TerraPower to us through one of our wholly-owned U.S.-based subsidiaries for a multiple advance term loan totaling \$22,000,000 for the purpose of partially funding the construction of a proposed new uranium enrichment facility in South Africa. The total loan amount is inclusive of a 10% original issue discount on each disbursement and carries a fixed interest rate of 10% per annum. Per the terms of the Loan Agreement and subject to the satisfaction of various conditions precedent to disbursements (including receiving all required licenses and permits to perform uranium enrichment in South Africa), we will receive aggregate loan disbursements of \$20,000,000. The Loan Agreement matures on May 16, 2032. Interest will begin accruing upon each milestone disbursement we receive and will be added to the principal balance until November 2027. Principal and interest payments will be made in 60 equal installments beginning in November 2027. We do not plan to request drawdown on this loan until early 2026 when construction of the uranium enrichment facility is expected to begin. In addition to the loan agreement, in May 2025, we and TerraPower entered into two supply agreements for the HALEU expected to be produced at our uranium enrichment facility. The initial core supply agreement is intended to support the supply of the required first fuel cores for the initial loading of TerraPower's Natrium project in Wyoming. The long-term supply agreement is a 10-year supply agreement of up to a total of 150 metric tons of HALEU, commencing in 2028 through end of 2037.

Our Subsidiaries

We operate principally through subsidiaries. ASP Isotopes Guernsey Limited (the holding company of ASP Isotopes ehf, ASP Isotopes South Africa (Proprietary) Limited, Enlightened Isotopes (Pty) Ltd and ASP Isotopes UK Limited) will be focused on the development and commercialization of high-value, low-volume isotopes for highly specialized end markets (such as C-14, Si-28 and Yb-176). September 2023, we formed another subsidiary, Quantum Leap Energy LLC, or “QLE,” which also has a subsidiary in the United Kingdom (Quantum Leap Energy Ltd), to focus on the development and commercialization of advanced nuclear fuels, such as HALEU and Lithium-6. ASP Isotopes UK Ltd is the owner of our ASP technology and QE technology. In addition, we have a 51% ownership stake in PET Labs Pharmaceuticals Proprietary Limited (PET Labs), a South African radiopharmaceutical operations company focused on the production of fluorinated radioisotopes and active pharmaceutical ingredients, through which we entered the downstream medical isotope production and distribution market. QLE also formed QLE TP Funding SPE LLC, a Delaware limited liability company, as a wholly owned subsidiary to act as a special purpose borrower for a loan transaction with TerraPower (the “QLE SPE Borrower”). The QLE SPE Borrower has formed a subsidiary in South Africa to act as the project company for a proposed new uranium enrichment facility at Pelindaba, South Africa.

Our corporate structure and ownership of our subsidiaries as of September 30, 2025 is set forth in the chart below:



Our Segments

We manage our operations as two operating segments: (i) nuclear fuels, and (ii) specialist isotopes and related services:

- **Nuclear Fuels.** This segment is focused on research and development of technologies and methods used to produce HALEU and Lithium-6 for the advanced nuclear fuels target end market.
- **Specialist Isotopes and Related Services.** This segment is focused on research and development of technologies and methods used to separate high-value, low-volume isotopes (such as C-14, Mo-100 and Si-28) for highly specialized target end markets other than advanced nuclear fuels, including pharmaceuticals and agrochemicals, nuclear medical imaging and semiconductors, as well as services related to these isotopes, and this segment includes PET Labs.

As previously announced, our board of directors intends to pursue the separation of our Nuclear Fuels business and Specialist Isotopes and Related Services business in two independent companies. The regulatory landscape and supply chain for nuclear fuel production differs significantly from that of medical isotopes, hence we and QLE have different business models and we believe that both companies would benefit if QLE is independently managed and financed. We plan to effect the separation through a spin-out of QLE in a transaction that results in QLE as a separate public company with shares listed on a U.S. national securities exchange and a portion of QLE's common equity to be distributed to the Company's stockholders as of a to-be-determined future record date and, although no assurance can be given, we are aiming to initiate the process for listing of QLE as a separate public company during the fourth quarter of 2025, subject to market conditions and obtaining applicable approvals and consents and complying with applicable rules and regulations and public market trading and listing requirements. While we currently expect that a spin-out of QLE as a separate public company is the most likely separation transaction, our board of directors remains committed to maximizing shareholder value creation, and will continue to evaluate other options for separation to maximize shareholder value.

Our Strategy

Commence commercial production at each of our enrichment facilities in Pretoria, South Africa.

We commenced commercial production of enriched isotopes at both of our ASP enrichment facilities located in Pretoria, South Africa during the first half of 2025. Our first ASP enrichment facility is designed to enrich light isotopes, such as C-14 and C-12. The second ASP enrichment facility, which is substantially larger than the first, should have the potential to enrich kilogram quantities of relatively heavier isotopes, including but not limited to Si-28. We anticipate shipping the first commercial batch of enriched C-12 and enriched Si-28 during the fourth quarter of 2025. We anticipate shipping the first commercial batch of enriched C-14 in the first half of 2026. We have also completed the commissioning phase and are producing commercial samples of highly enriched Yb-176 at our third enrichment facility, a QE technology facility, which is our first laser-based enrichment plant. The customer acceptance process for Yb-176 is relatively lengthy and we expect to ship commercial quantities of Yb-176 during the fourth quarter of 2025 or the first half of 2026.

Demonstrate the capability to produce commercial quantities of enriched C-14, Si-28 and Yb-176 using the ASP and QE technologies and capitalize on the opportunity to solve many supply chain challenges that currently exist.

We intend to demonstrate the capability to produce C-14, Si-28 and Yb-176 at a scale that can support anticipated customer demand for all three isotopes.

Historically, Russia has been the sole supplier of C-14, which is used as a tracer in the development of new pharmaceuticals and agrochemicals. The supply chain has been inherently fragile with inconsistent service. We have received an initial supply of feedstock from our customer and have started the enrichment of C-14.

Isotopically enriched silicon is regarded as a promising material for semiconductor quantum information due to its very long coherence times and its compatibility with the readily available industrial platform. We believe that the ASP technology is ideally suited to the production of this isotope because it has the ability to enrich molecules of low molecular mass. Other electronic gasses that can likely be enriched using ASP Technology include disilane and germane.

Enriched Ytterbium-176 can be irradiated to produce Lutetium-177, which has been identified for use in oncology, particularly in targeted radionuclide therapy ("TRT"). TRT is used in the treatment of various types of cancers, including neuroendocrine tumors, prostate cancer, and bone metastases, among others. There are numerous ongoing clinical trials studying Lutetium-177 PSMA-617 in patients with metastatic castration-resistant prostate cancer. We have obtained all necessary licenses within South Africa to proceed with the commercial development of this product.

Continue identifying potential offtake customers and strategic partners for our enriched isotopes.

We have significant interest from potential offtake customers for the enriched isotopes that we intend to produce. In June 2023, we entered into a tolling agreement with a Canadian customer for the entire capacity of our C-14 production facility. In April and June 2024, we entered into purchase orders with a US semiconductor company and a global industrial gas company for the supply of highly enriched silicon-28. We are currently in discussions with potential customers that have an interest in entering into long-term supply agreements for kilogram quantities of Si-28 and larger quantities of Xe-129, Ge 72, Ge-74, Zn-68, and Cl-37. We intend to identify additional potential customers and strategic partners for isotopes that we may produce at our existing and planned enrichment facilities.

Demonstrate the capability to produce high-assay low-enriched uranium (HALEU) using our enrichment technologies and meet anticipated demand for the new generation of HALEU-fueled small modular reactors and advanced reactor designs that are now under development for commercial and government uses.

We plan to begin research and development for the enrichment of uranium to demonstrate our capability to produce HALEU using Quantum Enrichment technology. We anticipate a future demand for HALEU for the new generation of HALEU-fueled small modular reactors ("SMRs") and advanced reactor designs that are now under development for commercial and government uses. SMRs are viewed as being cheaper, safer, and more versatile than traditional large-scale nuclear reactors, and development of the new technology is receiving considerable funding from the U.S. Department of Energy, as well as from the governments of other countries. There is currently no commercial production of HALEU in the United States. We are currently conducting a feasibility study with respect to constructing an enrichment facility in South Africa, the U.S. and the United Kingdom. We are currently in discussions with nuclear regulatory authorities in multiple countries, including the UK Atomic Energy Authority, UK Office of Nuclear Regulation (ONR), Nuclear Energy Corporation of South Africa (NECSA), the South African Department of Mineral Resources and Energy (DMRE), United States Department of Energy (DOE) and the United States Nuclear Regulatory Commission (NRC), regarding the construction of a nuclear fuel plant in these countries.

We intend to progress our uranium enrichment initiative first in South Africa. In November 2024, we entered into a Memorandum of Understanding ("MOU") with The South African Nuclear Energy Corporation (Necsa) to collaborate on the research, development and ultimately the commercial production of advanced nuclear fuels. Necsa is a state-owned company established by the Republic of South Africa Nuclear Energy Act in 1999 with a mandate to undertake and promote research and development in the field of nuclear energy and radiation sciences. Necsa is also responsible for processing source material, and co-operating with other institutions on nuclear and related matters. The proposed structure under discussion for the delivery of the objectives of the MOU contemplates the formation of a new entity in South Africa with a board of directors consisting of at least two representatives from ASPI and Necsa. It is anticipated that the research, development and ultimate construction of a HALEU production facility will take place at South Africa's main nuclear research center located at Pelindaba, Pretoria.

Alongside our talks with regulators, we have entered into agreements or are currently discussing with multiple counterparties engaged in the development of SMR reactors to produce HALEU to further their research efforts and future commercial endeavors. For example, in May 2025, we entered into a loan agreement with TerraPower, which provides conditional commitments from TerraPower to us through one of our wholly-owned U.S.-based subsidiaries for a multiple advance term loan totaling \$22,000,000 for the purpose of partially funding the construction of a proposed new uranium enrichment facility in South Africa. Per the terms of the loan agreement and subject to the satisfaction of various conditions precedent to disbursements (including receiving all required licenses and permits to perform uranium enrichment in South Africa), we will receive aggregate loan disbursements of \$20,000,000. We do not plan to request drawdown on this loan until early 2026 when construction of the uranium enrichment facility is expected to begin. In addition to the loan agreement, in May 2025, we and TerraPower entered into two supply agreements for the HALEU expected to be produced at our uranium enrichment facility in South Africa. The initial core supply agreement is intended to support the supply of the required first fuel cores for the initial loading of TerraPower's Natrium project in Wyoming. The long-term supply agreement is a 10-year supply agreement of up to a total of 150 metric tons of HALEU, commencing in 2028 through end of 2037.

Demonstrate the effectiveness and value in the use of stable isotopes in the downstream radiopharmacy market, after acquiring 51% ownership interest in PET Labs, the leading radiopharmacy in South Africa. This investment will address the radioisotope needs of South Africa as well as certain neighboring countries.

Under the terms of a Share Purchase Agreement, dated October 30, 2023, we acquired 51% of the issued share capital of PET Labs Pharmaceuticals Proprietary Limited, a company incorporated in the Republic of South Africa ("PET Labs"). PET Labs is a South African radiopharmaceutical operations company, dedicated to nuclear medicine and the science of radiopharmaceutical production. As a result of this transaction, we entered into the downstream radiopharmacy market that we intend to service in the future. This transaction will help provide the market with adequate proof of concept of the value of utilizing Mo-100 in downstream SPECT imaging procedures while providing supply chain stability to the region of South Africa and neighboring countries. We intend to expand PET Labs' existing operations by adding two new cyclotrons to its service footprint, enabling the company to properly expand its other revenue generation mediums, which is anticipated to drive free cash flow to the company.

Capitalize on the Proposed Acquisition of Renergen.

On May 20, 2025, we entered into agreement with Renergen Limited, a public company incorporated under the laws of the Republic of South Africa focused on production of liquefied helium (LHe) and liquefied natural gas (LNG) ("Renergen"), pursuant to which, subject to the terms and conditions thereof, we will make an offer to acquire all of the issued ordinary shares of Renergen ("Renergen Ordinary Shares"), in exchange for shares of our common stock (the "Company Common Stock"), as described below (the "Offer"). The combination of Renergen and ASP Isotopes aims to create a global leader in the production of critical and strategically important materials, including electronic gases such as helium, various fluorinated products and isotopically enriched gases. The combination is expected to create a vertically and horizontally integrated supply chain with significant geographic and customer overlap with substantial synergies expected from 2026. We believe we have a proven ability to integrate complementary businesses, as demonstrated by the success of the improved operational performance of our acquired businesses.

We intend to implement the Offer through the implementation of a scheme of arrangement (the "Scheme") in accordance with Sections 114 and 115 of the South African Companies Act, No. 71 of 2008 (the "Companies Act"). As a result of the implementation of the Scheme, Renergen will become our wholly owned subsidiary. On the implementation date of the Scheme (the "closing date of the acquisition"), the holders of record of Renergen Ordinary Shares, who are registered as such in Renergen's securities register as of the applicable record date for purposes of the listing requirements of the Johannesburg Stock Exchange, or "JSE" (the "Scheme Record Date"), will exchange 100% of the issued Renergen Ordinary Shares as of the Scheme Record Date, excluding treasury shares, in exchange for consideration consisting of 0.09196 shares of Company Common Stock for each Renergen Ordinary Share (the "Scheme Consideration" and the shares of Company Common Stock to be issued as the Scheme Consideration or in the Standby Offer, the "Consideration Shares"). Any entitlements to fractions of shares of Company Common Stock that otherwise would be issuable pursuant to the Scheme will be rounded down to the nearest whole number of shares and a cash payment will be made for any fractional shares resulting from such rounding. In no event will we issue more than 14,270,000 Consideration Shares.

On August 27, 2025, we listed our securities on the Main Board of the JSE under the abbreviated name "ASPI", share code "ISO" and international securities identification number US00218A1051. Because we have not raised any capital with this listing, until such time as the Scheme is implemented, we expect trading in our shares on the JSE to be limited.

On September 15, 2025, we extended the date for the fulfillment of the conditions to our offer to acquire 100% of the Ordinary Shares (excluding treasury shares) of Renergen from September 30, 2025 to November 28, 2025 in order to allow the parties additional time to satisfy conditions to closing relating to the receipt of the remaining required regulatory approval and certain third party consents. The implementation of the Scheme remains subject to the approval of the Financial Surveillance Department of the South African Reserve Bank (FinSurv).

Capitalize on the Acquisition of a Controlling Interest in Skyline Builders Group Holding Limited.

On August 29, 2025, QLE became a controlling shareholder of Skyline Builders Group Holding Limited, a company incorporated under the laws of the Cayman Islands ("SKBL") with its Class A Ordinary Shares listed on The Nasdaq Stock Market LLC under the symbol "SKBL". QLE invested in SKBL's Class A Ordinary Shares, Class B Ordinary Shares and warrants to purchase Class A Ordinary Shares for the aggregate purchase price of \$2.5 million. Each warrant is immediately exercisable and entitles the holder to acquire Class A Ordinary Shares for a period of five years following August 29, 2025. QLE, as a holder of warrants, does not have the right to exercise any portion of any warrant, to the extent that QLE (together with the holder's affiliates) would beneficially own in excess of 9.99% of the number of Class A Ordinary Shares outstanding immediately after giving effect to the exercise of the applicable warrant.

QLE intends to use SKBL to pursue opportunities to acquire assets in the critical materials supply chain that we believe will help secure important feedstocks that we believe are vital to the security of the United States and long-term growth of QLE. As of the date of this prospectus supplement, QLE is the holder of 79.14% of the aggregate voting power represented by all outstanding Class A Ordinary Shares and Class B Ordinary Shares of SKBL.

In addition, on August 29, 2025, Paul Mann, our Chairman and Chief Executive Officer and Chairman of the Board of Managers of QLE, purchased, for the aggregate purchase price of \$2.5 million, as an individual investor: Class A Ordinary Shares and certain warrants to purchase Class A Ordinary Shares of SKBL on the same terms as QLE's investment in Class A Ordinary Shares and warrants, provided that Mr. Mann, as a holder of warrants, does not have the right to exercise any portion of any warrant, to the extent that such holder (together with the holder's affiliates) would beneficially own in excess of 4.99% of the number of Class A Ordinary Shares outstanding immediately after giving effect to the exercise of the applicable warrant.

Liquidity Update

We have experienced net losses and negative cash flows from operating activities since our inception. We incurred net losses (before deemed dividend on inducement warrant for common stock) of approximately \$83.5 million and \$15.9 million for the six months ended June 30, 2025 and 2024, respectively, and approximately \$32.3 million and \$16.3 million for the years ended December 31, 2024 and 2023, respectively.

We expect that our cash and cash equivalents of approximately \$67.7 million as of June 30, 2025, along with net proceeds of approximately \$56.3 million received in July 2025 from the issuance of common stock in a registered direct offering and net proceeds from this offering, will be sufficient to fund our operating expenses and capital requirements for more than 12 months from the date the financial statements for the quarter ended June 30, 2025 were issued. We anticipate that we will need to continue to raise capital through additional equity and/or debt financings, including, but not limited to, offering securities described in this prospectus supplement, and/or collaborative development agreements to fund our operations.

There can be no assurance that we will achieve or sustain positive cash flows from operations or profitability or that we will be able to raise capital through additional equity or debt offerings, or collaborative development agreements, to fund our operations. Such funding may not be available on a timely basis on terms acceptable to us, or at all. If we are unable to raise additional capital when required or on acceptable terms, we may be required to scale back or discontinue the advancement of product candidates, reduce headcount, reorganize, merge with another entity, or cease operations.

Implications of Being an Emerging Growth Company and Smaller Reporting Company

We qualify as an "emerging growth company" as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act. An emerging growth company may take advantage of relief from certain reporting requirements and other burdens that are otherwise applicable generally to public companies. These provisions include:

- reduced obligations with respect to financial data, including presenting only two years of audited financial statements and only two years of selected financial data;
- an exemption from compliance with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, or the Sarbanes-Oxley Act;
- reduced disclosure about our executive compensation arrangements in our periodic reports, proxy statements, and registration statements; and
- exemptions from the requirements of holding non-binding advisory votes on executive compensation or golden parachute arrangements.

In addition, under the JOBS Act, emerging growth companies can delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have elected to avail ourselves of this exemption from new or revised accounting standards, and, therefore, we will not be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies or that have opted out of using such extended transition period, which may make comparison of our financial statements with those of other public companies more difficult. We may take advantage of these reporting exemptions until we no longer qualify as an emerging growth company, or, with respect to adoption of certain new or revised accounting standards, until we irrevocably elect to opt out of using the extended transition period.

We will remain an emerging growth company until the earliest of (i) the last day of the fiscal year in which we have total annual gross revenues of \$1.235 billion or more; (ii) the last day of our fiscal year following the fifth anniversary of the date of the completion of our initial public offering; (iii) the date on which we have issued more than \$1 billion in nonconvertible debt during the previous three years; and (iv) the date on which we are deemed to be a large accelerated filer under the rules of the SEC.

We may choose to take advantage of some but not all of these reduced reporting obligations.

We are also a “smaller reporting company” as defined in the Securities Exchange Act of 1934, as amended, or the “Exchange Act.” We may continue to be a smaller reporting company even after we are no longer an emerging growth company. We may take advantage of certain of the scaled disclosures available to smaller reporting companies until our annual revenues are less than \$100 million during the most recently completed fiscal year and our voting and non-voting common stock held by non-affiliates is \$700 million or more measured on the last business day of our second fiscal quarter.

Corporate Information

ASP Isotopes Inc. was incorporated as a Delaware corporation in September 2021. Our principal executive offices are located at 601 Pennsylvania Avenue NW, South Building, Suite 900, Washington, D.C. 20004, and our telephone number is (202) 756-2245. Our website address is www.aspisotopes.com. Information contained on, or that can be accessed through, our website is not part of and is not incorporated by reference into this prospectus supplement and accompanying prospectus, and you should not consider information on our website to be part of this prospectus supplement and accompanying prospectus.

Risks Factors

Investing in our securities involves a high degree of risk. See “Risk Factors” on page S-10 of this prospectus supplement, page 4 of the accompanying prospectus and in the documents incorporated by reference into this prospectus supplement and accompanying prospectus, as updated by any related free writing prospectus and other future filings we make with the SEC that are incorporated by reference into this prospectus supplement and accompanying prospectus, for a discussion of the factors we urge you to consider carefully before deciding to purchase our securities.

THE OFFERING

Common Stock offered by us \$ of shares of common stock

Common Stock to be outstanding after this offering shares (or shares, if the underwriters' option to purchase additional shares is exercised in full)⁽¹⁾

Underwriters option We have granted the underwriters an option to purchase up to an additional \$ of shares of common stock from us. This option is exercisable, in whole or in part, for a period of 30 days from the date of the underwriting agreement.

Use of proceeds We intend to use the net proceeds from this offering for general corporate purposes, including working capital, operating expenses, and capital expenditures. See the "Use of Proceeds" section in this prospectus supplement for a more complete description of the intended use of proceeds from this offering.

Risk factors Before deciding to invest in shares of our common stock, you should read carefully the risks set forth under the caption "Risk Factors" beginning on page S-10 of this prospectus supplement and page 4 of the accompanying prospectus, as well as the risks described in sections of the documents incorporated by reference into this prospectus supplement and accompanying prospectus captioned "Risk Factors."

Nasdaq symbol "ASPI"

(1) The common stock outstanding after the offering is based on 93,406,629 shares of our common stock outstanding as of October 10, 2025 and excludes the following:

- 606,000 shares of common stock issuable upon the exercise of options to purchase shares of our common stock outstanding as of October 10, 2025, at a weighted-average exercise price of \$2.00 per share;
- 69,778 shares of common stock issuable upon the exercise of warrants to purchase shares of our common stock outstanding as of October 10, 2025, at a weighted-average exercise price of \$2.19 per share;
- 1,324,685 shares of our common stock reserved for issuance under our 2022 Equity Incentive Plan, or 2022 Plan, (and any future automatic increase in shares reserved for issuance thereunder) as of October 10, 2025;
- 1,015,000 shares of our common stock reserved for issuance under our 2024 Inducement Equity Incentive Plan, or 2024 Plan, as of October 10, 2025; and
- 2,000,000 shares of our common stock reserved for issuance under our 2025 Inducement Equity Incentive Plan as of October 10, 2025.

Except as otherwise indicated, all information in this prospectus assumes no exercise of the option granted to the underwriters and no repurchase of shares of our common stock subsequent to October 10, 2025.

RISK FACTORS

Investing in shares of our common stock involves risks. Before making an investment decision, you should carefully review the risks and uncertainties described below under “Risks Related to this Offering” and under the heading “Risk Factors” contained in our most recent Annual Report on Form 10-K, or any updates in our subsequent SEC filings, together with all of the other information appearing in this prospectus supplement and the accompanying prospectus or incorporated by reference into this prospectus supplement or the accompanying prospectus, in light of your particular investment objectives and financial circumstances. The risks so described are not the only risks facing our company. There may be other unknown or unpredictable economic, business, competitive, regulatory or other factors that could have material adverse effects on our future results. Past financial performance may not be a reliable indicator of future performance and historical trends should not be used to anticipate results or trends in future periods. Our business, financial condition and results of operations could be materially adversely affected by any of these risks. In that event, the market price of our common stock could decline and you could lose all or part of your investment. You should carefully consider all of the information set forth in this prospectus supplement, the accompanying prospectus and the documents incorporated by reference herein and therein with your respective legal counsel, tax and financial advisors and/or accountants prior to purchasing our securities.

Risks Related to this Offering

The trading price of our common stock has been, and is likely to continue to be, highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control.

The stock market in general and the market for our common stock have experienced extreme volatility that has often been unrelated to the operating performance of particular companies. For example, since our initial public offering in November 2022 and until the last reported sale price of shares of our common stock on October 13, 2025, the market price of our common stock has ranged from a high of \$13.49 to a low of \$0.32. As a result of this volatility, you may not be able to sell your common stock at or above the indicative offering price of \$ _____ per share and you may lose some or all of your investment.

If securities analysts do not publish research or reports about our business or if they publish negative evaluations of our stock, the price of our stock could decline.

The trading market for our common stock will rely, in part, on the research and reports that industry or financial analysts publish about us or our business. There can be no assurance that existing analysts will continue to cover us or that new analysts will begin to cover us. There is also no assurance that any covering analyst will provide favorable coverage. A lack of research coverage or adverse coverage may negatively impact the market price of our common stock. In addition, if one or more of the analysts covering our business downgrade their evaluations of our stock or the stock of other companies in our industry, the price of our stock could decline.

If you purchase shares of common stock in this offering, you will incur immediate and substantial dilution in the net tangible book value per share of common stock as a result of this offering.

Investors in this offering will experience immediate dilution in their net tangible book value per share to the extent of the difference between the purchase price per share of common stock and the “adjusted” net tangible book value per share after giving effect to the offering. The offering price for one share of common stock is substantially higher than the net tangible book value per share of our common stock. As a result, investors purchasing shares in this offering will incur immediate dilution of \$ _____ per share of common stock, representing the difference between our as adjusted net tangible book value per share after giving effect to this offering and the indicative purchase price of \$ _____ per share. For additional information on the dilution that you will experience immediately after this offering, see the section titled “Dilution.”

You may experience future dilution as a result of future equity or debt offerings or other issuances of our shares of common stock.

In order to raise additional capital, we may in the future offer additional shares of our common stock or other securities, including securities convertible into or exchangeable for shares of our common stock, at prices that may not be the same as the price per share in this offering. We may sell shares or other securities in any other offering at a price that is less than the price per share paid by investors in this offering, and investors purchasing shares or other securities in the future could have rights superior to those of existing stockholders. Sales of additional amounts of shares of our common stock or other securities convertible into shares of common stock, could significantly dilute our stockholders.

We have broad discretion in the use of the net proceeds from this offering and may invest or spend the proceeds in ways with which you do not agree and in ways that may not yield a return on your investment.

Although we currently intend to use the net proceeds from this offering in the manner described in the section titled “Use of Proceeds” in this prospectus supplement, our management will have broad discretion in the application of the net proceeds from this offering and could spend the proceeds in ways that do not improve our results of operations or enhance the value of our common stock. You will not have the opportunity to influence our decisions on how to use the net proceeds from this offering. The failure by our management to apply these funds effectively could result in financial losses that could harm our business and cause the price of our common stock to decline. Pending their use, we may invest the net proceeds from this offering in a manner that does not produce income or that loses value.

Future sales of a number of our shares of common stock in the public markets, or the perception that such sales could occur, could depress the market price of our shares of common stock or cause it to be highly volatile.

Sales of shares of our common stock in the public markets, or the perception that such sales could occur, could depress the market price of shares of our common stock or cause it to be highly volatile and impair our ability to raise capital through the sale of additional equity securities. A substantial number of shares of common stock are being offered by this prospectus supplement and the accompanying prospectus, and we cannot predict if and when shares sold in this offering, if any, will be resold in the public markets. We cannot predict the number of these shares that might be resold nor the effect that future sales of our shares of common stock would have on the market price of shares of our common stock.

Because we do not anticipate paying any cash dividends on our capital stock in the foreseeable future, capital appreciation, if any, will be your sole source of gain.

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all of our future earnings, if any, to finance the growth and development of our business. As a result, capital appreciation, if any, of our common stock will be your sole source of gain for the foreseeable future, and investors seeking cash dividends should not purchase shares of our common stock.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus supplement, the accompanying prospectus, the information incorporated by reference in this prospectus supplement and the accompanying prospectus, and any free writing prospectus that we have authorized for use in connection with this offering, contain forward-looking statements within the meaning of Section 27A of the Securities Act and Section 21E of the Securities Exchange Act of 1934, as amended, or the “Exchange Act”.

These statements are based on management’s beliefs, expectations and assumptions about future events, conditions and results, and on information currently available to management. All statements contained in this prospectus, including documents incorporated by reference herein, other than statements of historical fact, are forward-looking statements, including, but not limited to, statements regarding our ability to complete the construction of, commission and successfully operate isotope enrichment plants in a cost-effective manner; our ability to meet applicable regulatory requirements for the use of the isotopes we may produce using the ASP technology or the quantum enrichment process; our ability to obtain regulatory approvals for the production and distribution of isotopes; our ability to meet our capital requirements and obtain funding for our operations and future growth; and statements regarding our business strategies, use of capital, results of operations and financial position, and plans and objectives for future operations. In some cases, you can identify forward-looking statements by the words “may,” “will,” “could,” “would,” “should,” “expect,” “intend,” “plan,” “anticipate,” “believe,” “estimate,” “predict,” “project,” “potential,” “continue,” “ongoing,” or the negative of these terms, and similar expressions intended to identify statements about the future, although not all forward-looking statements contain these words. Discussions containing these forward-looking statements may be found, among other places, in the sections entitled “Business,” “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” incorporated by reference from our most recent Annual Report on Form 10-K as may be updated by our subsequent quarterly reports on Form 10-Q or our current reports on Form 8-K that we have filed or will file with the SEC.

We caution readers that these forward-looking statements are not a guarantee of future performance. Because forward-looking statements are inherently subject to risks and uncertainties, some of which cannot be predicted or quantified, you should not rely on these forward-looking statements as predictions of future events. The events and circumstances reflected in our forward-looking statements may not be achieved or occur and actual results could differ materially from those projected in the forward-looking statements.

This prospectus supplement and the accompanying prospectus, including documents incorporated by reference herein and therein, also contain estimates and other statistical data made by independent parties and by us relating to market size and growth and other data about our industry. This data involves a number of assumptions and limitations, and you are cautioned not to give undue weight to such estimates. In addition, projections, assumptions and estimates of our future performance and the future performance of the markets in which we operate are necessarily subject to a high degree of uncertainty and risk.

Except as required by law, we assume no obligation to update these forward-looking statements publicly, or to revise any forward-looking statements to reflect events or developments occurring after the date of this prospectus supplement, even if new information becomes available in the future. All forward-looking statements are qualified in their entirety by this cautionary statement.

USE OF PROCEEDS

We estimate that the net proceeds to us from the sale of shares of our common stock that we are offering will be approximately \$ million, after deducting the underwriting discounts and commissions and estimated offering expenses payable by us, or approximately \$ million if the underwriters exercise their option to purchase additional shares in full.

We currently intend to use the net proceeds from this offering for general corporate purposes, including working capital, operating expenses, and capital expenditures. We may also use a portion of the net proceeds from this offering to acquire or invest in businesses, products and technologies that are complementary to our own, and although we actively engage in discussions with respect to possible acquisitions and investments, we have no binding commitments or agreements to complete any such acquisitions or investments as of the date of this prospectus.

As of June 30, 2025, we had cash and cash equivalents of approximately \$67.7 million. On July 25, 2025, we raised an additional \$56,300,000 in net proceeds from issuing 7,500,000 shares of its common stock at a price of \$8.00 per share. We believe that the net proceeds from this offering, together with our existing cash will be sufficient to meet our anticipated cash needs for at least the next 12 months. However, we may seek to raise additional funds through equity or debt financing arrangements. Our future capital requirements and the availability of and accessibility to additional funds will depend on many factors, including those described in the section of this prospectus captioned “Risk Factors” and incorporated by reference in this prospectus supplement and the accompanying prospectus.

As of the date of this prospectus, we cannot specify with certainty all of the particular uses for the net proceeds to us from this offering. As a result, our management will have broad discretion regarding the timing and application of the net proceeds from this offering. Pending our use of the net proceeds from this offering as described above, we plan to invest the net proceeds of this offering in short-term, interest-bearing, investment-grade instruments, certificates of deposit or direct or guaranteed obligations of the U.S. government.

DIVIDEND POLICY

We have never declared or paid any cash dividends on our common stock. We currently intend to retain all future earnings, if any, for use in the operations and expansion of our business. As a result, we do not anticipate paying cash dividends in the foreseeable future. Any future determination as to the declaration and payment of cash dividends will be at the discretion of our board of directors, subject to applicable laws, and will depend on factors our board of directors deems relevant, including, among others, our financial condition, results of operations, capital requirements, contractual restrictions, general business conditions, and any other factors that our board may deem relevant.

CAPITALIZATION

The following sets forth our cash and cash equivalents and capitalization on a consolidated basis as of June 30, 2025:

- on an actual basis; and
- on an as adjusted basis to reflect the sale of shares of common stock in this offering at the indicative offering price of \$ per share, after deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

We have presented our capitalization on both an actual and an as adjusted basis to reflect the issuance and sale of shares offered hereby, but not the application of the net proceeds from the issuance and sale of such shares. See “Use of Proceeds.”

You should read the following table along with our financial statements and the accompanying notes to those statements, together with the information set forth under “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in our Annual Report on Form 10-K for the year ended December 31, 2024 and our Quarterly Report for the quarter and six-month period ended June 30, 2025, which are incorporated by reference in this prospectus supplement and the accompanying prospectus.

	As of June 30, 2025 (unaudited) (in thousands, except share data)	
	Actual	As Adjusted
Cash and cash equivalents	\$ 67,679	
Notes payable	1,736	
Finance lease liabilities	665	
Operating lease liabilities	1,140	
Convertible notes payable, at fair value	98,148	
Stockholders’ equity:		
Preferred stock, \$0.01 par value; 10,000,000 shares authorized, no shares issued and outstanding actual; shares issued and outstanding as adjusted	-	
Common stock, \$0.01 par value; 500,000,000 shares authorized, 83,905,417 shares issued and outstanding actual; shares issued and outstanding as adjusted	839	
Additional paid-in capital	164,046	
Accumulated deficit	(139,682)	
Accumulated other comprehensive income	29	
Total stockholders’ equity attributed to ASP Isotopes Inc. stockholders	25,232	
Noncontrolling interests in consolidated subsidiaries	3,079	
Total stockholders’ equity	28,311	
Total capitalization	<u>\$ 130,000</u>	

The table above is based on 83,905,417 shares of common stock outstanding as of June 30, 2025 and excludes the following:

- 2,431,000 shares of common stock issuable upon the exercise of options to purchase shares of our common stock outstanding as of June 30, 2025, at a weighted-average exercise price of \$1.89 per share;
- 221,519 shares of common stock issuable upon the exercise of warrants to purchase shares of our common stock outstanding as of June 30, 2025, at a weighted-average exercise price of \$2.19 per share;
- 1,335,155 shares of our common stock reserved for issuance under our 2022 Plan (and any future automatic increase in shares reserved for issuance thereunder) as of June 30, 2025; and
- 1,545,000 shares of our common stock reserved for issuance under our 2024 Plan as of June 30, 2025.

DILUTION

If you invest in our common stock in this offering, your ownership interest will be diluted immediately to the extent of the difference between the offering price per share you will pay in this offering and the as adjusted net tangible book value per share of our common stock after this offering.

Our net tangible book value as of June 30, 2025 was approximately \$21.9 million, or \$0.26 per share. Our net tangible book value per share is determined by dividing our total tangible assets, less total liabilities and noncontrolling interests, by the number of shares of our common stock outstanding as of June 30, 2025. Dilution with respect to net tangible book value per share represents the difference between the amount per share paid by purchasers of our shares in this offering and the net tangible book value per share of our shares immediately after this offering.

After giving effect to the sale of shares in this offering at the indicative offering price of \$ per share and after deducting the underwriting discount and estimated offering expenses payable by us, our as adjusted net tangible book value as of June 30, 2025 would have been approximately \$ million, or \$ per share. This represents an immediate increase in net tangible book value of \$ per share to existing stockholders and immediate dilution of \$ per share to investors purchasing our shares in this offering at the indicative offering price. The following table illustrates this dilution on a per share basis:

Indicative offering price per share	\$	
Historical net tangible book value per share as of June 30, 2025	\$	0.26
Increase in net tangible book value per share attributable to this offering	\$	
As adjusted net tangible book value per share after this offering	\$	
Dilution in net tangible book value per share to investors in this offering	\$	

If the underwriters exercise their option to purchase additional shares in full, the as adjusted net tangible book value would increase to approximately \$ million, or \$ per share, representing an increase to existing stockholders of approximately \$ per share, and an immediate dilution of approximately \$ per share to the investors in this offering.

The table above is based on 83,905,417 shares of common stock outstanding as of June 30, 2025 and excludes the following:

- 2,431,000 shares of common stock issuable upon the exercise of options to purchase shares of our common stock outstanding as of June 30, 2025, at a weighted-average exercise price of \$1.89 per share;
- 221,519 shares of common stock issuable upon the exercise of warrants to purchase shares of our common stock outstanding as of June 30, 2025, at a weighted-average exercise price of \$2.19 per share;
- 1,335,155 shares of our common stock reserved for issuance under our 2022 Plan (and any future automatic increase in shares reserved for issuance thereunder) as of June 30, 2025; and
- 1,545,000 shares of our common stock reserved for issuance under our 2024 Plan as of June 30, 2025.

To the extent that options or warrants are exercised, new options, warrants or restricted stock awards are issued, or we issue additional shares of common stock upon the foregoing events or for any other reason in the future, there will be further dilution to investors participating in this offering.

In addition, we may choose to raise additional capital due to market conditions or strategic considerations even if we believe that we have sufficient funds for our current or future operating plans. To the extent that additional capital is raised through the sale of equity or convertible debt securities, the issuance of these securities could result in further dilution to our stockholders.

UNDERWRITING

We intend to enter into an underwriting agreement with the underwriters listed in the table below. Cantor Fitzgerald & Co. and Lucid Capital Markets, LLC are the joint bookrunning managers and representatives (the “Representatives”) of the several underwriters for the offering. We refer to the underwriters listed in the table below as the “underwriters.” Subject to the terms and conditions of the underwriting agreement, we have agreed to sell to the underwriters, and the underwriters have agreed to severally purchase from us, shares of our common stock. Our common stock trades on the Nasdaq Capital Market under the symbol “ASPL.”

Pursuant to the terms and subject to the conditions contained in the underwriting agreement, we have agreed to sell to the underwriters named below, and each underwriter severally has agreed to purchase from us, the respective number of shares of common stock set forth opposite its name below:

Underwriter	Number of Shares
Cantor Fitzgerald & Co.	
Lucid Capital Markets, LLC	
Total	

The underwriting agreement provides that the obligation of the underwriters to purchase the shares of common stock offered by this prospectus supplement and the accompanying prospectus is subject to certain conditions. The underwriters are obligated to purchase all of the shares of common stock offered hereby if any of the shares are purchased.

Underwriters Option

We have granted the underwriters an option to buy up to an additional \$ of shares of common stock from us at the at the offering price listed on the cover page of this prospectus supplement, less the underwriting discounts and commissions. The underwriters may exercise this option at any time, in whole or in part, during the 30-day period after the date of the underwriting agreement.

Commissions and Expenses

The Representatives are purchasing the shares of common stock from us at \$ per share (representing approximately \$ of proceeds to us, before offering expenses). The Representatives may offer the shares of common stock from time to time to purchasers directly or through agents, or through brokers in brokerage transactions on Nasdaq, or to dealers in negotiated transactions or in a combination of such methods of sale, or otherwise, at a fixed price or prices, which may be changed, or at market prices prevailing at the time of sale, at prices related to such prevailing market prices or at negotiated prices. The difference between the price, at which the Representatives purchase shares from us and the price at which the Representatives resell such shares may be deemed underwriting compensation. If the Representatives effect such transactions by selling shares of common stock to or through dealers, such dealers may receive compensation in the form of discounts, concessions or commissions from the Representatives and/or purchasers of shares of common stock for whom they may act as agents or to whom they may sell as principal.

We estimate expenses payable by us in connection with this offering, other than the underwriting discounts and commissions referred to above, will be approximately \$. We have also agreed to reimburse the Representatives for up to \$110,000 of certain of their counsels’ fees and expenses, which reimbursed fee is deemed underwriting compensation for this offering by FINRA.

Indemnification

Pursuant to the underwriting agreement, we have agreed to indemnify the underwriters against certain liabilities, including liabilities under the Securities Act, or to contribute to payments that the underwriters or such other indemnified parties may be required to make in respect of those liabilities.

Lock-Up Agreements

We and all of our directors and executive officers (the “lock-up parties”) have agreed that, subject to certain exceptions, without the prior written consent of the underwriters, we and they will not, and will not publicly disclose an intention to, as applicable, in the case of (i) the company, during a period ending 90 days after the closing of this offering, (ii) our executive officers, during an initial period of 60 days after the closing of this offering, plus an additional period of 30 days thereafter, and (iii) our directors, during an initial period of 30 days after the closing of this offering, plus an additional period of 30 days thereafter (each such period, a “restricted period”; and the 30-day additional period at the end of the restricted periods applicable to our executive officers and directors, the “limited restricted period”):

- offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend or otherwise transfer or dispose of, directly or indirectly, any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock (the “restricted securities”);
- file any registration statement with the SEC relating to the offering of any restricted shares; or
- enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the restricted shares whether any such transaction described above is to be settled by delivery of common stock or such other securities, in cash or otherwise.

The restrictions described in the immediately preceding paragraph do not apply to such transfers or dispositions by a lock-up party:

- as a bona fide gift;
- to any trust for the direct or indirect benefit of the lock-up party or the lock-up party’s family member in a transaction not involving the disposition for value;
- by will, other testamentary document or intestate succession to the legal representative, heir, beneficiary, or the lock-up party’s family member;
- provided that in the case of any such transfer, except as required by the SEC rules and regulations, no filing by any party (donor, donee, transferor or transferee) under the Exchange Act or other public announcement shall be required or shall be made voluntarily in connection with such transfer or distribution during the restricted period;
- to a charity or educational institution;
- upon the vesting of restricted stock awards or stock units or upon the exercise of stock options issued under any of our equity incentive plans or an employment arrangement described, or incorporated by reference, in this prospectus supplement or accompanying prospectus or upon a vesting event of the our securities or upon the exercise of options to purchase our securities, in each case on a “cashless” or “net exercise” basis or to cover tax obligations of the lock-up party in connection with such vesting or exercise, provided that, except as required by the SEC rules and regulations, no filing under Section 13 or Section 16(a) of the Exchange Act or other public announcement shall be required or shall be voluntarily made;
- pursuant to agreements described, or incorporated by reference, in this prospectus supplement or accompanying prospectus, under which we have the option to repurchase such securities or a right of first refusal with respect to the transfer of such securities, provided that if the lock-up party is required to file a report under Section 13 or Section 16(a) of the Exchange Act reporting a reduction in beneficial ownership of common stock during the restricted period, the lock-up party shall include a statement in such schedule or report describing the purpose of the transaction;
- the establishment of a trading plan pursuant to Rule 10b5-1 under the Exchange Act for the transfer of common stock, provided that (i) such plan does not provide for the transfer of common stock during the restricted period and (ii) to the extent a public announcement or filing under the Exchange Act, if any, is required of or voluntarily made by or on behalf of the lock-up party or us regarding the establishment of such plan, such public announcement or filing shall include a statement to the effect that no transfer of common stock may be made under such plan during the restricted period;
- by operation of law, such as pursuant to a qualified domestic order or in connection with a divorce settlement, provided that any filing under Section 13 or Section 16(a) of the Exchange Act that is required to be made during the restricted period as a result of such transfer shall include a statement that such transfer has occurred by operation of law;
- pursuant to a pre-existing trading plan pursuant to Rule 10b5-1 under the Exchange Act for the transfer of common stock, provided that any filing made pursuant to Section 16(a) of the Exchange Act shall include a footnote to the effect that such sales of shares are being made pursuant to such 10b5-1 Plan;
- any sale by an executive officer or director of up to 30,000 shares during the limited restricted period;
- pursuant to a bona fide third party tender offer, merger, consolidation or other similar transaction made to all holders of common stock involving a change of control of us after the closing of this offering and approved by our board of directors; provided that in the event that the tender offer, merger, consolidation or other such transaction is not completed, shares of common stock owned by the lock-up party shall remain subject to the lock-up restrictions described in this prospectus supplement during the restricted period; and
- with the prior written consent of the underwriters.

In addition, the restrictions set forth above do not apply in certain circumstances, including:

- the issuance of shares contemplated by the underwriting agreement, in each case that are described in the registration statement of which this prospectus supplement is a part;
- the issuance of shares of our capital stock pursuant to employee benefit plans, qualified stock option plans or other employee compensation plans existing on the date of this prospectus supplement or pursuant to currently outstanding options, warrants or rights not issued under one of those plans;
- the grant of equity awards pursuant to equity plans existing on the date of this prospectus supplement; the issuance of (or the entry into an agreement with respect to the issuance of) shares of our capital stock or other securities in connection with any acquisition or joint venture transaction by us or any of our subsidiaries and/or a merger of a direct subsidiary with and into us; and
- the filing of any registration statement on Form S-8.

Electronic Distribution

This prospectus supplement and the accompanying prospectus may be made available in electronic format on websites or through other online services maintained by the underwriters or by their affiliates. In those cases, prospective investors may view offering terms online and prospective investors may be allowed to place orders online. Other than this prospectus supplement and the accompanying prospectus in electronic format, the information on the underwriters' websites or our website and any information contained in any other websites maintained by the underwriters or by us is not part of this prospectus supplement, the accompanying prospectus or the registration statement of which this prospectus supplement and the accompanying prospectus forms a part, has not been approved and/or endorsed by us or the underwriters in their capacity as underwriters, and should not be relied upon by investors.

Other Relationships

In the ordinary course of their business activities, the underwriters and their affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities) and financial instruments (including bank loans) for their own account and for the accounts of their customers. Such investments and securities activities may involve security and/or instruments of ours or our affiliates. The underwriters and their affiliates may also make investment recommendations and/or publish or express independent research views in respect of such securities or financial instruments and may hold, or recommend to clients that they acquire, long and/or short positions in such securities and instruments.

LEGAL MATTERS

The validity of the securities being offered hereby will be passed upon for us by Blank Rome LLP. Ellenoff Grossman & Schole LLP is acting as counsel for the underwriters in connection with this offering.

EXPERTS

The consolidated balance sheets of ASP Isotopes Inc. and Subsidiaries as of December 31, 2024 and 2023, and the related consolidated statements of operations and comprehensive loss, changes in stockholders' equity, and cash flows for each of the years then ended, have been audited by EisnerAmper LLP, independent registered public accounting firm, as stated in their report which is incorporated herein by reference. Such financial statements have been incorporated herein by reference in reliance on the report of such firm given upon their authority as experts in accounting and auditing.

The consolidated statement of financial position of Renergen Limited ("Renergen") as of February 28, 2025 and February 29, 2024, the related consolidated statement of profit or loss and other comprehensive loss, consolidated statement of changes in equity, and consolidated statement of cash flows for each of the years then ended, have been audited by BDO South Africa Incorporated, independent registered public accounting firm, as stated in their report which is incorporated herein by reference, which report contains a material uncertainty explanatory paragraph regarding Renergen's ability to continue as a going concern. Such financial statements have been incorporated by reference herein in reliance on the report of such firm given upon their authority as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

As permitted by SEC rules, this prospectus supplement omits certain information that is included in the registration statement, of which this prospectus supplement forms a part, and its exhibits. Since this prospectus supplement may not contain all of the information that you may find important, we urge you to review the full text of these documents. If we have filed a contract, agreement or other document as an exhibit to the registration statement, of which this prospectus supplement forms a part, please read the exhibit for a more complete understanding of the document or matter involved. Each statement in this prospectus supplement, including statements incorporated by reference as discussed above, regarding a contract, agreement or other document is qualified in its entirety by reference to the actual document.

We are subject to the information reporting requirements of the Exchange Act and, in accordance with these requirements, we file annual, quarterly and current reports, proxy statements, information statements, and other information with the SEC. You may read and copy any materials we file with the SEC at the SEC's website at www.sec.gov or on our website at www.aspisotopes.com. Information contained on, or that can be accessed through, the SEC's website or our website is not part of and is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.

INCORPORATION BY REFERENCE

SEC rules permit us to incorporate information by reference into this prospectus supplement and the accompanying prospectus. This means that we can disclose important information to you by referring you to another document filed separately with the SEC. The information incorporated by reference is considered to be part of this prospectus supplement and the accompanying prospectus, except for information superseded by information contained in this prospectus supplement or the accompanying prospectus or in any subsequently filed incorporated document. This prospectus supplement and the accompanying prospectus incorporate by reference the documents set forth below that we have previously filed with the SEC (other than information in such documents that is deemed to be furnished and not filed). These documents contain important information about us and our business and financial condition.

- Our Annual Report on Form 10-K for the year ended December 31, 2024, filed with the SEC on [March 31, 2025](#), and as amended by that Form 10-K/A filed with the SEC on [April 30, 2025](#);
- Our Quarterly Report on Form 10-Q for the quarter ended March 31, 2025, filed with the SEC on [May 20, 2025](#);
- Our Quarterly Report on Form 10-Q for the quarter ended June 30, 2025, filed with the SEC on [August 14, 2025](#);
- Our Current Reports on [Form 8-K](#) filed with the SEC on [April 15, 2025](#), [May 20, 2025](#), [May 22, 2025](#), [May 27, 2025](#), [May 28, 2025](#), [June 2, 2025](#), [June 4, 2025](#), [June 11, 2025](#), [July 11, 2025](#), [July 17, 2025](#), [July 24, 2025](#), [July 25, 2025](#), [July 28, 2025](#), [July 30, 2025](#), [August 8, 2025](#), [August 15, 2025](#), [September 8, 2025](#), [September 22, 2025](#), [September 29, 2025](#), [October 3, 2025](#) and [October 14, 2025](#); and
- The description of the Company's common stock contained in [Exhibit 4.1](#) incorporated by reference into our Annual Report on Form 10-K filed with the SEC on March 31, 2025, including any amendments or reports filed for the purpose of updating such description.

All documents that we file (other than information in such documents that is deemed to be furnished and not filed) pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act on or after the date of this prospectus supplement and prior to the termination of the offering of any of the securities covered under this prospectus shall be deemed to be incorporated by reference into this prospectus supplement and the accompanying prospectus and will automatically update and supersede the information in this prospectus supplement, the accompanying prospectus and any previously filed documents.

Any statement contained herein or in a document incorporated or deemed to be incorporated by reference into this prospectus supplement and the accompanying prospectus shall be deemed to be modified or superseded for purposes of this prospectus supplement and the accompanying prospectus to the extent that a statement contained in such subsequently filed document which also is or is deemed to be incorporated by reference into this prospectus supplement and the accompanying prospectus, modifies or supersedes such earlier statement. Any statement so modified or superseded shall not be deemed, except as so modified or superseded, to constitute a part of this prospectus supplement and the accompanying prospectus.

Documents incorporated by reference are available from us without charge, excluding all exhibits.

You may obtain documents incorporated by reference into this prospectus supplement and the accompanying prospectus at no cost by requesting them in writing or by telephone from us at our executive offices at:

ASP Isotopes Inc.
601 Pennsylvania Avenue NW
South Building, Suite 900
Washington, D.C. 20004
(202) 756-2245
Attention: Corporate Secretary

You may also access these documents, free of charge, on the SEC's website at www.sec.gov or on our website at www.aspisotopes.com. Information contained on, or that can be accessed through, the SEC's website or our website is not part of and is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.



\$250,000,000
Common Stock
Preferred Stock
Debt Securities
Warrants
Units

We may from time to time offer and sell any securities described in this prospectus, either individually or in combination with other securities, in one or more offerings of up to \$250.0 million in aggregate initial offering price.

This prospectus provides a general description of the securities we may offer. We will provide the specific terms of the securities offered in one or more supplements to this prospectus. The prospectus supplements will also describe the specific manner in which these securities will be offered. We may also authorize one or more free writing prospectuses to be provided to you in connection with these offerings. The prospectus supplement and any related free writing prospectus may add, update or change information contained in this prospectus. Please read carefully this prospectus, the applicable prospectus supplement, any related free writing prospectus, and the documents incorporated by reference before you invest in any of our securities. **This prospectus may not be used to offer or sell any securities unless accompanied by the applicable prospectus supplement.**

Our common stock is listed on the Nasdaq Capital Market ("Nasdaq") under the symbol "ASPI." On October 13, 2025, the last reported sale price of our common stock was \$13.32 per share. The applicable prospectus supplement will contain information, where applicable, as to any other listing on Nasdaq or any securities market or other exchange of the securities, if any, covered by the prospectus supplement.

Investing in our securities involves a high degree of risk. See "Risk Factors" on page 4 of this prospectus and in the documents incorporated by reference into this prospectus, as updated by the applicable prospectus supplement, any related free writing prospectus and other future filings we make with the Securities and Exchange Commission that are incorporated by reference into this prospectus, for a discussion of the factors we urge you to consider carefully before deciding to purchase our securities.

We may sell these securities directly to investors, through agents designated from time to time or to or through underwriters or dealers. For additional information on the methods of sale, please see the section titled "*Plan of Distribution*" in this prospectus. If any underwriters are involved in the sale of any securities with respect to which this prospectus is being delivered, the names of such underwriters and any applicable commissions or discounts will be set forth in a prospectus supplement. The price to the public of such securities and the net proceeds we expect to receive from such sale will also be set forth in a prospectus supplement.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The date of this prospectus is October 14, 2025

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ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement that we filed with the Securities and Exchange Commission, or the “SEC,” as a “well-known seasoned issuer” as such term is defined in Rule 405 under the Securities Act of 1933, as amended, or the “Securities Act,” using a “shelf” registration process. Under this shelf registration process, we may, from time to time, offer and sell any combination of the securities described in this prospectus, in one or more offerings, for an aggregate initial offering price of up to \$250.0 million.

THIS PROSPECTUS MAY NOT BE USED TO OFFER AND SELL SECURITIES UNLESS IT IS ACCOMPANIED BY A PROSPECTUS SUPPLEMENT.

This prospectus provides a general description of the securities we may offer. Each time we sell securities under this prospectus, we will provide a prospectus supplement that will contain specific information about the terms of that offering. We may also authorize one or more free writing prospectuses to be provided to you that may contain material information relating to a particular offering. The prospectus supplement and any related free writing prospectus may also add, update or change information contained in this prospectus or in any documents that we have incorporated by reference into this prospectus. To the extent there is a conflict between any statement contained in this prospectus, any applicable prospectus supplement, any related free writing prospectus or any document incorporated by reference into this prospectus, the statement in the document having the later date modifies or supersedes the earlier statement.

The information appearing in this prospectus, any prospectus supplement or any related free writing prospectus is accurate only as of their respective dates, and any information we have incorporated by reference is accurate only as of the date of the document incorporated by reference, regardless of the time of delivery of this prospectus, any applicable prospectus supplement or any related free writing prospectus, or the time of any sale of a security. Our business, financial condition, results of operations and prospects may have changed materially since those dates.

You may rely only on the information contained in, or incorporated by reference into, this prospectus and any applicable prospectus supplement, or the information contained in any free writing prospectus we have authorized for use in connection with a specific offering. We have not authorized anyone to provide you with different or additional information.

This prospectus, any prospectus supplement or any related free writing prospectus does not constitute an offer to sell or the solicitation of an offer to buy any securities other than the securities described in this prospectus or an applicable prospectus supplement or an offer to sell or the solicitation of an offer to buy such securities in any circumstances or in any jurisdictions where it is unlawful to do so.

As permitted by SEC rules and regulations, the registration statement of which this prospectus forms a part includes additional information not contained in this prospectus. This prospectus also contains summaries of certain provisions of the documents described herein, but all summaries are qualified in their entirety by reference to the actual documents. You may read the registration statement and the other reports we file with the SEC, and you may obtain copies of the actual documents summarized herein (if and when filed with the SEC), at the SEC’s website or at its offices described in the section of this prospectus titled “*Where You Can Find More Information.*”

The representations, warranties and covenants made by us in any agreement that is filed as an exhibit to the registration statement of which this prospectus forms a part or any document that is incorporated by reference into this prospectus were made solely for the benefit of the parties to such agreement, including, in some cases, for the purpose of allocating risk among the parties to such agreements, and should not be deemed to be a representation, warranty or covenant to you. Moreover, such representations, warranties or covenants were accurate only as of the date when made. Accordingly, such representations, warranties and covenants should not be relied on as accurately representing the current state of our affairs.

In this prospectus, unless the context otherwise requires, the terms “ASP Isotopes,” “we,” “us” and “our” refer to ASP Isotopes Inc. together with its consolidated subsidiaries.

THE COMPANY

We are a development stage advanced materials company dedicated to the development of technology and processes that, if successful, will allow for the enrichment of natural isotopes into higher concentration products, which could be used in several industries. Our proprietary technologies, the Aerodynamic Separation Process (“ASP technology”) and Quantum Enrichment technology (“QE technology”), are designed to enable the production of isotopes used in several industries. Our initial focus is on the production and commercialization of enriched Carbon-14 (“C-14”), Silicon-28 (“Si-28”) and Ytterbium-176 (“Yb-176”).

In addition, we are considering the future development of the ASP technology for the separation of Zinc-68 and Xenon-129/136 for potential use in the healthcare end market, Germanium 70/72/74 for potential use in the semiconductor end market, and Chlorine -37 for potential use in the nuclear energy end market. We are also considering the future development of QE technology for the separation of Nickel-64, Gadolinium-160, Ytterbium-171, Lithium 6 and Lithium7.

We are also pursuing an initiative to apply our enrichment technologies to the enrichment of Uranium-235 (“U-235”) in South Africa. We believe that the U-235 we may produce using quantum enrichment technology may be commercialized as a nuclear fuel component for use in the new generation of high-assay low-enriched uranium (HALEU)-fueled small modular reactors that are now under development for commercial and government uses.

Quantum Leap Energy

In September 2023, we formed Quantum Leap Energy LLC, a Delaware limited liability company (“QLE”), to focus on the development and commercialization of advanced nuclear fuels, such as HALEU and Lithium-6. QLE’s direct wholly owned subsidiary Quantum Leap Energy Limited (“QLE UK”), has its operations in the United Kingdom. QLE UK’s direct wholly owned subsidiary, Quantum Leap Energy Proprietary Limited (“QLE South Africa”), has its operations in South Africa. QLE also formed QLE TP Funding SPE LLC, a Delaware limited liability company (the “QLE SPE Borrower”), as a wholly owned subsidiary to act as a special purpose borrower for a loan transaction with TerraPower, a US nuclear innovation company. The QLE SPE Borrower has formed a subsidiary in South Africa to act as the project company for a proposed new uranium enrichment facility at Pelindaba, South Africa.

As previously announced, our board of directors intends to pursue the separation of our Nuclear Fuels business and Specialist Isotopes and Related Services business in two independent companies. The regulatory landscape and supply chain for nuclear fuel production differs significantly from that of medical isotopes, hence we and QLE have different business models and we believe that both companies would benefit if QLE is independently managed and financed. We plan to effect the separation through a spin-out of QLE in a transaction that results in QLE as a separate public company with shares listed on a U.S. national securities exchange and a portion of QLE’s common equity to be distributed to the Company’s stockholders as of a to-be-determined future record date and, although no assurance can be given, we are aiming to initiate the process for listing of QLE as a separate public company during the fourth quarter of 2025, subject to market conditions and obtaining applicable approvals and consents and complying with applicable rules and regulations and public market trading and listing requirements. While we currently expect that a spin-out of QLE as a separate public company is the most likely separation transaction, our board of directors remains committed to maximizing shareholder value creation, and will continue to evaluate other options for separation to maximize shareholder value.

ASP Isotopes Inc. was incorporated as a Delaware corporation in September 2021. Our principal executive offices are located at 601 Pennsylvania Avenue NW, South Building, Suite 900, Washington, D.C. 20004, and our telephone number is (202) 756-2245. Our website address is www.aspisotopes.com. Information contained on, or that can be accessed through, our website is not part of and is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.

RISK FACTORS

Investing in our securities involves a high degree of risk. The prospectus supplement applicable to each offering of our securities will contain a discussion of the risks applicable to an investment in ASP Isotopes Inc. Prior to making a decision about investing in our securities, you should carefully consider the specific factors discussed under the heading “*Risk Factors*” in the applicable prospectus supplement, together with all of the other information contained or incorporated by reference in the prospectus supplement or appearing or incorporated by reference in this prospectus. You should also consider the risks, uncertainties and assumptions discussed under the heading “*Risk Factors*” included in our most recent annual report on Form 10-K, as may be updated by our subsequent quarterly reports on Form 10-Q or our current reports on Form 8-K that we have filed with the SEC, all of which are incorporated herein by reference, and which may be amended, supplemented or superseded from time to time by reports we file with the SEC in the future. The risks and uncertainties we have described are not the only ones we face. Additional risks and uncertainties not presently known to us or that we currently deem immaterial may also affect our operations. The occurrence of any of these risks might cause you to lose all or part of your investment in the offered securities.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus, including documents incorporated by reference herein, contains, and any prospectus supplement may contain, forward-looking statements. These statements are based on management's beliefs, expectations and assumptions about future events, conditions and results, and on information currently available to management. All statements contained in this prospectus, including documents incorporated by reference herein, and any prospectus supplement, other than statements of historical fact, are forward-looking statements, including, but not limited to, statements regarding our ability to complete the construction of, commission and successfully operate isotope enrichment plants in a cost-effective manner; our ability to meet applicable regulatory requirements for the use of the isotopes we may produce using the ASP technology or the quantum enrichment process; our ability to obtain regulatory approvals for the production and distribution of isotopes; our ability to meet our capital requirements and obtain funding for our operations and future growth; and statements regarding our business strategies, use of capital, results of operations and financial position, and plans and objectives for future operations. In some cases, you can identify forward-looking statements by the words "may," "will," "could," "would," "should," "expect," "intend," "plan," "anticipate," "believe," "estimate," "predict," "project," "potential," "continue," "ongoing," or the negative of these terms, and similar expressions intended to identify statements about the future, although not all forward-looking statements contain these words. Discussions containing these forward-looking statements may be found, among other places, in the sections entitled "Business," "Risk Factors" and "Management's Discussion and Analysis of Financial Condition and Results of Operations" incorporated by reference from our most recent Annual Report on Form 10-K, as may be updated by our subsequent quarterly reports on Form 10-Q or our current reports on Form 8-K that we have filed or will file with the SEC.

Because forward-looking statements are inherently subject to risks and uncertainties, some of which cannot be predicted or quantified, you should not rely on these forward-looking statements as predictions of future events. The events and circumstances reflected in our forward-looking statements may not be achieved or occur and actual results could differ materially from those projected in the forward-looking statements.

This prospectus, including documents incorporated by reference herein, also contains estimates and other statistical data made by independent parties and by us relating to market size and growth and other data about our industry. This data involves a number of assumptions and limitations, and you are cautioned not to give undue weight to such estimates. In addition, projections, assumptions and estimates of our future performance and the future performance of the markets in which we operate are necessarily subject to a high degree of uncertainty and risk.

Except as required by law, we assume no obligation to update these forward-looking statements publicly, or to revise any forward-looking statements to reflect events or developments occurring after the date of this prospectus, even if new information becomes available in the future. All forward-looking statements are qualified in their entirety by this cautionary statement.

USE OF PROCEEDS

We will retain broad discretion over the use of the net proceeds from the sale of our securities offered hereby. Except as described in any prospectus supplement or any related free writing prospectus that we may authorize to be provided to you, we currently intend to use the net proceeds from the sale of our securities offered hereby for working capital and general corporate purposes, which may include capital expenditures, debt repayment, research and development, sales and marketing and general and administrative expenses. We may also use a portion of the net proceeds from this offering to acquire or invest in businesses, products and technologies that are complementary to our own, and although we actively engage in discussions with respect to possible acquisitions and investments, we have no binding commitments or agreements to complete any such acquisitions or investments as of the date of this prospectus. Pending the application of the net proceeds, we may invest the net proceeds in short-term, investment grade, interest-bearing securities, certificates of deposit or direct or guaranteed obligations of the U.S. government.

We will set forth in the applicable prospectus supplement or free writing prospectus our intended use for the net proceeds received from the sale of any securities sold pursuant to the prospectus supplement or free writing prospectus.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock is a summary and does not purport to be complete. It is subject to, and qualified in its entirety by reference to, our Certificate of Incorporation and Amended and Restated Bylaws, or “Bylaws. This description also summarizes applicable provisions of Delaware law. Our Certificate of Incorporation and Bylaws are filed as exhibits to the registration statement, of which this prospectus forms a part. We encourage you to read our Certificate of Incorporation, Bylaws and the applicable provisions of Delaware law for additional information.

General

As of the date of this prospectus, our Certificate of Incorporation authorizes us to issue 500,000,000 shares of common stock, \$0.01 par value per share, and 10,000,000 shares of preferred stock, par value \$0.01 per share, of which all shares of preferred stock are undesignated. As of October 10, 2025, 93,406,629 shares of common stock were issued and outstanding, and no shares of preferred stock were issued and outstanding.

Common Stock

The holders of our common stock are entitled to one vote per share on all matters to be voted upon by the stockholders. The holders of our common stock are entitled to receive ratably those dividends, if any, that may be declared from time to time by our board of directors out of funds legally available, subject to preferences that may be applicable to preferred stock, if any, then outstanding. In the event of a liquidation, dissolution or winding up of our company, the holders of common stock will be entitled to share ratably in all assets remaining after payment of liabilities, subject to prior distribution rights of preferred stock, if any, then outstanding. Our common stock has no preemptive or conversion rights or other subscription rights or redemption or sinking fund provisions.

Our common stock is traded on Nasdaq under the symbol “ASPI.”

The transfer agent and registrar for our common stock is Equiniti Trust Company, LLC (formerly, American Stock Transfer & Trust Company, LLC). The transfer agent’s address is 55 Challenger Road, Ridgefield Park, NJ 07660.

Preferred Stock

Our Certificate of Incorporation authorizes our board of directors to establish one or more series of preferred stock. Unless otherwise required by law or any stock exchange, the authorized shares of preferred stock will be available for issuance without further action by the holders of our common stock. Our board of directors will be able to determine, with respect to any series of preferred stock, the powers (including voting powers), preferences and relative, participating, optional, conversion or other special rights, and the qualifications, limitations, or restrictions thereof. No shares of preferred stock have been issued or are outstanding as of the date of the filing of this registration statement. If we sell any series of preferred stock under this prospectus, we will file a certificate of designation relating to that series, which will be incorporated by reference into the registration statement of which this prospectus forms a part. The prospectus supplement will describe:

- the title and stated value;
- the number of shares we are offering;
- the liquidation preference per share;
- the purchase price per share;
- the dividend rate per share, dividend period and payment dates and method of calculation for dividends;
- whether dividends will be cumulative or non-cumulative and, if cumulative, the date from which dividends will accumulate;
- our right, if any, to defer payment of dividends and the maximum length of any such deferral period;
- the procedures for any auction and remarketing, if any;
- the provisions for a sinking fund, if any;
- the provisions for redemption or repurchase, if applicable, and any restrictions on our ability to exercise those redemption and repurchase rights;
- any listing of the preferred stock on any securities exchange or market;

- whether the preferred stock will be convertible into our common stock or other securities of ours, including warrants, and, if applicable, the conversion period, the conversion price, or how it will be calculated, and under what circumstances it may be adjusted;
- whether the preferred stock will be exchangeable into debt securities, and, if applicable, the exchange period, the exchange price, or how it will be calculated, and under what circumstances it may be adjusted;
- voting rights, if any, of the preferred stock;
- preemption rights, if any;
- restrictions on transfer, sale or other assignment, if any;
- a discussion of any material or special United States federal income tax considerations applicable to the preferred stock;
- the relative ranking and preferences of the preferred stock as to dividend rights and rights if we liquidate, dissolve or wind up our affairs;
- any limitations on issuances of any class or series of preferred stock ranking senior to or on a parity with the series of preferred stock being issued as to dividend rights and rights if we liquidate, dissolve or wind up our affairs; and
- any other specific terms, rights, preferences, privileges, qualifications or restrictions of the preferred stock.

Anti-Takeover Matters in our Governing Documents and Under Delaware Law

Our Certificate of Incorporation and our Bylaws contain, and the DGCL contains, provisions that are intended to enhance the likelihood of continuity and stability in the composition of our board of directors. These provisions are intended to avoid costly takeover battles, reduce our vulnerability to a hostile or abusive change of control, and enhance the ability of our board of directors to maximize stockholder value in connection with any unsolicited offer to acquire us. However, these provisions may have an antitakeover effect and may delay, deter, or prevent a merger or acquisition by means of a tender offer, a proxy contest, or other takeover attempt that a stockholder might consider in its best interest, including those attempts that might result in a premium over the prevailing market price for the shares of common stock held by stockholders.

Authorized But Unissued Capital Stock

The authorized but unissued shares of common stock and preferred stock are available for future issuance without stockholder approval, subject to any limitations imposed by the listing standards of Nasdaq. These additional shares may be used for a variety of corporate finance transactions, acquisitions and employee benefit plans. The existence of authorized but unissued and unreserved common stock and preferred stock could make more difficult or discourage an attempt to obtain control of us by means of a proxy contest, tender offer, merger, or otherwise.

Classified Board of Directors

Our Certificate of Incorporation provides that our board of directors be divided into three classes, with the classes as nearly equal in number as possible and each class serving three-year staggered terms. Directors may only be removed from our board of directors for cause by the affirmative vote of at least 66 2/3% of the voting power of all of our then-outstanding shares of capital stock entitled to vote generally in the election of directors, voting together as a single class. In addition, our Certificate of Incorporation provides that, subject to the rights granted to one or more series of preferred stock then outstanding, any newly created directorship on the board of directors that results from an increase in the number of directors and any vacancies on our board of directors will be filled only by the affirmative vote of a majority of the remaining directors, even if less than a quorum, or by a sole remaining director. A director chosen to fill a position resulting from an increase in the number of directors will hold office until the next election of the director's class and until the director's successor is duly elected and qualified, or until the director's earlier death, resignation or removal. These provisions may have the effect of deferring, delaying, or discouraging hostile takeovers, changes in control of us or changes in our management.

Delaware Anti-Takeover Law

We are subject to Section 203 of the DGCL, which is an anti-takeover law. In general, Section 203 prohibits a publicly held Delaware corporation from engaging in a business combination with an interested stockholder for a period of three years following the date that the person became an interested stockholder, unless the business combination or the transaction in which the person became an interested stockholder is approved in a prescribed manner. Generally, a business combination includes a merger, asset or stock sale, or another transaction resulting in a financial benefit to the interested stockholder. Generally, an interested stockholder is a person who, together with affiliates and associates, owns 15% or more of the corporation's outstanding voting stock or is the corporation's affiliate or associate and was the owner of 15% or more of the corporation's outstanding voting stock at any time within the three-year period immediately before the date of determination. The existence of this provision may have an anti-takeover effect with respect to transactions that are not approved in advance by our board, including discouraging attempts that might result in a premium over the market price for the shares of common stock held by stockholders.

No Cumulative Voting

Under Delaware law, the right to vote cumulatively does not exist unless the certificate of incorporation specifically authorizes cumulative voting. Our Certificate of Incorporation does not authorize cumulative voting. Therefore, stockholders holding a majority of the shares of our stock entitled to vote generally in the election of directors are able to elect all of our directors.

Special Stockholder Meetings

Our Certificate of Incorporation provides that special meetings of our stockholders may be called at any time only by or at the direction of the board of directors, the chair of the board of directors or our Chief Executive Officer. Our Bylaws prohibit the conduct of any business at a special meeting other than as specified in the notice for such meeting. These provisions may have the effect of deferring, delaying, or discouraging hostile takeovers or changes in control or management.

Director Nominations and Stockholder Proposals

Our Bylaws establish advance notice procedures with respect to stockholder proposals and the nomination of candidates for election as directors, other than nominations made by or at the direction of the board of directors or a committee of the board of directors. In order for any matter to be "properly brought" before a meeting, a stockholder will have to comply with advance notice requirements and provide us with certain information. Generally, to be timely, a stockholder's notice must be received at our principal executive offices not less than 90 days nor more than 120 days prior to the first anniversary date of the immediately preceding annual meeting of stockholders. Our Bylaws also specify requirements as to the form and content of a stockholder's notice. Our Bylaws allow the chair of a meeting of the stockholders to adopt rules and regulations for the conduct of that meeting that may have the effect of precluding the conduct of certain business at that meeting if the rules and regulations are not followed. These provisions may also defer, delay, or discourage a potential acquirer from conducting a solicitation of proxies to elect the acquirer's own slate of directors or otherwise attempting to influence or obtain control.

Stockholder Action by Written Consent

Pursuant to Section 228 of the DGCL, any action required to be taken at any annual or special meeting of the stockholders may be taken without a meeting, without prior notice, and without a vote if a consent or consents in writing, setting forth the action so taken, is or are signed by the holders of outstanding stock having not less than the minimum number of votes that would be necessary to authorize or take such action at a meeting at which all shares of our stock entitled to vote thereon were present and voted, unless the certificate of incorporation provides otherwise. Our Certificate of Incorporation precludes stockholder action by written consent.

Amendment of Certificate of Incorporation or Bylaws

The DGCL provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or bylaws, unless a corporation's certificate of incorporation or bylaws, as the case may be, requires a greater percentage. Our Bylaws may be amended or repealed by a majority vote of our board of directors or by the affirmative vote of the holders of at least 66 2/3% of the votes which all our stockholders would be entitled to cast in any annual election of directors. In addition, the affirmative vote of the holders of at least 66 2/3% of the votes which all our stockholders would be entitled to cast in any election of directors will be required to amend or repeal or to adopt any provisions inconsistent with any of the provisions of our Certificate of Incorporation described above.

The foregoing provisions of our Certificate of Incorporation and our Bylaws could discourage potential acquisition proposals and could delay or prevent a change in control. These provisions are intended to enhance the likelihood of continuity and stability in the composition of our board of directors and in the policies formulated by our board of directors and to discourage certain types of transactions that may involve an actual or threatened change of control. These provisions are designed to reduce our vulnerability to an unsolicited acquisition proposal. The provisions also are intended to discourage certain tactics that may be used in proxy fights. However, such provisions could have the effect of discouraging others from making tender offers for our shares and, as a consequence, they also may inhibit fluctuations in the market price of our shares of common stock that could result from actual or rumored takeover attempts. Such provisions also may have the effect of preventing changes in our management or delaying or preventing a transaction that might benefit you or other minority stockholders.

Exclusive Forum

Our Certificate of Incorporation provides that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware be the sole and exclusive forum for: (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of fiduciary duty owed by any director, officer, agent, or other employee or stockholder of our company to us or our stockholders, (3) any action asserting a claim arising pursuant to any provision of the DGCL, our Certificate of Incorporation or our Bylaws or as to which the DGCL confers jurisdiction on the Court of Chancery of the State of Delaware, or (4) any action asserting a claim governed by the internal affairs doctrine, in each case subject to such Court of Chancery having personal jurisdiction over the indispensable parties named as defendants therein. It will further provide that, unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States of America shall, to the fullest extent permitted by law, be the sole and exclusive forum for the resolutions of any complaint asserting a cause of action arising under the Securities Act. The exclusive forum clauses described above shall not apply to suits brought to enforce a duty or liability created by the Exchange Act or any other claim for which the federal courts have exclusive jurisdiction. Although we believe these provisions benefit us by providing increased consistency in the application of applicable law in the types of lawsuits to which they apply, the provisions may have the effect of discouraging lawsuits against our directors and officers. The enforceability of similar choice of forum provisions in other companies' certificates of incorporation has been challenged in legal proceedings and there is uncertainty as to whether a court would enforce such provisions. In addition, investors cannot waive compliance with the federal securities laws and the rules and regulations thereunder. It is possible that, in connection with any applicable action brought against us, a court could find the choice of forum provisions contained in our Certificate of Incorporation to be inapplicable or unenforceable in such action. Any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock shall be deemed to have notice of and consented to the forum provisions in our Certificate of Incorporation.

Limitations of Liability and Indemnification

The DGCL authorizes corporations to limit or eliminate the personal liability of directors to corporations and their stockholders for monetary damages for breaches of directors' fiduciary duties, subject to certain exceptions. Our Certificate of Incorporation includes a provision that eliminates the personal liability of directors for monetary damages to the corporation or its stockholders for any breach of fiduciary duty as a director, except to the extent such exemption from liability or limitation thereof is not permitted under the DGCL. The effect of these provisions is to eliminate the rights of us and our stockholders, through stockholders' derivative suits on our behalf, to recover monetary damages from a director for breach of fiduciary duty as a director, including breaches resulting from grossly negligent behavior. However, exculpation does not apply to any breaches of the director's duty of loyalty, any acts or omissions not in good faith or that involve intentional misconduct or knowing violation of law, any authorization of dividends or stock redemptions or repurchases paid or made in violation of the DGCL, or for any transaction from which the director derived an improper personal benefit.

Our Bylaws generally provide that we must indemnify and advance expenses to our directors and officers to the fullest extent authorized by the DGCL. We also are expressly authorized to carry directors' and officers' liability insurance providing indemnification for our directors, officers and certain employees for some liabilities. We believe these indemnification and advancement provisions and insurance are useful to attract and retain qualified directors and executive officers.

The limitation of liability, indemnification and advancement provisions in our Certificate of Incorporation and our Bylaws may discourage stockholders from bringing a lawsuit against directors for breach of their fiduciary duty. These provisions also may have the effect of reducing the likelihood of derivative litigation against directors and officers, even though such an action, if successful, might otherwise benefit us and our stockholders. In addition, your investment may be adversely affected to the extent we pay the costs of settlement and damage awards against directors and officers pursuant to these indemnification provisions.

There is currently no pending material litigation or proceeding involving any of our directors, officers or employees for which indemnification is sought.

We have entered into indemnification agreements with each of our directors and executive officers, under which we have agreed to indemnify our directors and officers to the fullest extent permitted by law, including indemnification against expenses and liabilities incurred in legal proceedings to which the director or officer was, or is threatened to be made, a party by reason of the fact that such director or officer is or was a director, officer, employee or agent of our company, provided that such director or officer acted in good faith and in a manner that the director or officer reasonably believed to be in, or not opposed to, the best interest of our company. The indemnification agreements also set forth certain procedures, presumptions and remedies that will apply in the event of a claim for indemnification thereunder.

Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors or executive officers, we have been informed that in the opinion of the SEC such indemnification is against public policy and is therefore unenforceable.

DESCRIPTION OF DEBT SECURITIES

The following description summarizes the material terms and provisions of the debt securities that we may offer under this prospectus. We may issue debt securities from time to time, in one or more series, as either senior or subordinated debt or as senior or subordinated convertible debt. While the terms we have summarized below will apply generally to any debt securities we may offer under this prospectus, the applicable prospectus supplement or free writing prospectus will describe the specific terms of any debt securities offered through that prospectus supplement or free writing prospectus. The terms of any debt securities we offer under a prospectus supplement or free writing prospectus may differ from the terms we describe below. Unless the context requires otherwise, whenever we refer to the “indentures,” we also are referring to any supplemental indentures that specify the terms of a particular series of debt securities.

We will issue any senior debt securities under the senior indenture that we will enter into with the trustee named in the senior indenture. We will issue any subordinated debt securities under the subordinated indenture that we will enter into with the trustee named in the subordinated indenture. We have filed forms of these documents as exhibits to the registration statement, of which this prospectus forms a part, and supplemental indentures and forms of debt securities containing the terms of the debt securities being offered will be filed as exhibits to the registration statement, of which this prospectus forms a part, or will be incorporated by reference from reports that we file with the SEC.

The indentures will be qualified under the Trust Indenture Act of 1939, as amended (the “Trust Indenture Act”). We use the term “trustee” to refer to either the trustee under the senior indenture or the trustee under the subordinated indenture, as applicable.

The following summary of material provisions of the senior debt securities, the subordinated debt securities and the indentures is subject to, and qualified in their entirety by reference to, all of the provisions of the indenture applicable to a particular series of debt securities. We urge you to read the applicable prospectus supplement and any related free writing prospectuses related to the debt securities that we may offer under this prospectus, as well as the complete applicable indenture that contains the terms of the debt securities. Except as we may otherwise indicate, the terms of the senior indenture and the subordinated indenture are identical.

General

We will describe in the applicable prospectus supplement or free writing prospectus the terms of the series of debt securities being offered, including as applicable:

- the title;
- the principal amount being offered, and if a series, the total amount authorized and the total amount outstanding;
- any limit on the amount that may be issued;
- whether or not we will issue the series of debt securities in global form, and, if so, the terms and who the depository will be;
- the maturity date;
- whether and under what circumstances, if any, we will pay additional amounts on any debt securities held by a person who is not a United States person for tax purposes, and whether we can redeem the debt securities if we have to pay such additional amounts;
- the annual interest rate, which may be fixed or variable, or the method for determining the rate and the date interest will begin to accrue, the dates interest will be payable and the regular record dates for interest payment dates or the method for determining such dates;
- whether or not the debt securities will be secured or unsecured, and the terms of any secured debt;
- the terms of the subordination of any series of subordinated debt;
- the place where payments will be payable;
- restrictions on transfer, sale or other assignment, if any;
- our right, if any, to defer payment of interest and the maximum length of any such deferral period;

- the date, if any, after which, the conditions upon which, and the price at which, we may, at our option, redeem the series of debt securities pursuant to any optional or provisional redemption provisions and the terms of those redemption provisions;
- the date, if any, on which, and the price at which we are obligated, pursuant to any mandatory sinking fund or analogous fund provisions or otherwise, to redeem, or at the holder's option, to purchase, the series of debt securities and the currency or currency unit in which the debt securities are payable;
- whether the indenture will restrict our ability or the ability of our subsidiaries to:
 - o incur additional indebtedness;
 - o issue additional securities;
 - o create liens;
 - o pay dividends or make distributions in respect of our capital stock or the capital stock of our subsidiaries;
 - o redeem capital stock;
 - o place restrictions on our subsidiaries' ability to pay dividends, make distributions or transfer assets;
 - o make investments or other restricted payments;
 - o sell or otherwise dispose of assets;
 - o enter into sale-leaseback transactions;
 - o engage in transactions with stockholders or affiliates;
 - o issue or sell stock of our subsidiaries;
 - o effect a consolidation or merger;
- whether the indenture will require us to maintain any interest coverage, fixed charge, cash flow-based, asset-based or other financial ratios;
- a discussion of material or special United States ("U.S.") federal income tax considerations applicable to the debt securities;
- information describing any book-entry features;
- provisions for a sinking fund purchase or other analogous fund, if any;
- the applicability of the provisions in the indenture on discharge;
- whether the debt securities are to be offered at a price such that they will be deemed to be offered at an "original issue discount" as defined in paragraph (a) of Section 1273 of the Internal Revenue Code of 1986, as amended;
- the denominations in which we will issue the series of debt securities, if other than denominations of \$1,000 and any integral multiple thereof;
- the currency of payment of debt securities if other than U.S. dollars and the manner of determining the equivalent amount in U.S. dollars; and
- any other specific terms, preferences, rights or limitations of, or restrictions on, the debt securities, including any additional events of default or covenants provided with respect to the debt securities, and any terms that may be required by us or advisable under applicable laws or regulations or advisable in connection with the marketing of the debt securities.

Conversion or Exchange Rights

We will set forth in the applicable prospectus supplement or free writing prospectus the terms on which a series of debt securities may be convertible into or exchangeable for our common stock, our preferred stock or other securities (including securities of a third-party). We will include provisions as to whether conversion or exchange is mandatory, at the option of the holder or at our option. We may include provisions pursuant to which the number of shares of our common stock, our preferred stock or other securities (including securities of a third-party) that the holders of the series of debt securities receive would be subject to adjustment.

Consolidation, Merger or Sale

Unless we provide otherwise in the prospectus supplement or free writing prospectus applicable to a particular series of debt securities, the indentures will not contain any covenant that restricts our ability to merge or consolidate, or sell, convey, transfer or otherwise dispose of all or substantially all of our assets. However, any successor to or acquirer of such assets must assume all of our obligations under the indentures or the debt securities, as appropriate and must be a corporation organized and validly existing under the laws of any U.S. domestic jurisdiction. If the debt securities are convertible into or exchangeable for other securities of ours or securities of other entities, the person with whom we consolidate or merge or to whom we sell all of our property must make provisions for the conversion of the debt securities into securities that the holders of the debt securities would have received if they had converted the debt securities before the consolidation, merger or sale.

Events of Default under the Indenture

Unless we provide otherwise in the prospectus supplement or free writing prospectus applicable to a particular series of debt securities, the following are events of default under the indentures with respect to any series of debt securities that we may issue:

- if we fail to pay interest when due and payable and our failure continues for 30 days and the time for payment has not been extended;
- if we fail to pay the principal, premium or sinking fund payment, if any, when due and payable at maturity, upon redemption or repurchase or otherwise, and the time for payment has not been extended;
- if we fail to observe or perform any other covenant contained in the debt securities or the indentures, other than a covenant specifically relating to another series of debt securities, and our failure continues for 60 days after we receive notice from the trustee or holders of at least 25% in aggregate principal amount of the outstanding debt securities of the applicable series; and
- if specified events of bankruptcy, insolvency or reorganization occur.

We will describe in each applicable prospectus supplement or free writing prospectus any additional events of default relating to the relevant series of debt securities.

If an event of default with respect to debt securities of any series occurs and is continuing, the trustee or the holders of at least 25% in aggregate principal amount of the outstanding debt securities of that series, by notice to us in writing, and to the trustee if notice is given by such holders, may declare the unpaid principal due and payable immediately.

The holders of a majority in principal amount of the outstanding debt securities of an affected series may waive any default or event of default with respect to the series and its consequences, except defaults or events of default regarding payment of principal, premium, if any, or interest, unless we have cured the default or event of default in accordance with the indenture. Any waiver shall cure the default or event of default.

Subject to the terms of the indentures, if an event of default under an indenture shall occur and be continuing, the trustee will be under no obligation to exercise any of its rights or powers under such indenture at the request or direction of any of the holders of the applicable series of debt securities, unless such holders have offered the trustee reasonable indemnity or security satisfactory to it against any loss, liability or expense. Subject to the terms of the indentures, the holders of a majority in principal amount of the outstanding debt securities of any series will have the right to direct the time, method and place of conducting any proceeding for any remedy available to the trustee, or exercising any trust or power conferred on the trustee, with respect to the debt securities of that series, provided that:

- the direction so given by the holder is not in conflict with any law or the applicable indenture; and
- subject to its duties under the Trust Indenture Act, the trustee need not take any action that might involve it in personal liability or might be unduly prejudicial to the holders not involved in the proceeding.

Subject to the terms of the indentures, a holder of the debt securities of any series will have the right to institute a proceeding under the indentures or to appoint a receiver or trustee, or to seek other remedies if:

- the holder has given written notice to the trustee of a continuing event of default with respect to that series;
- the holders of at least 25% in aggregate principal amount of the outstanding debt securities of that series have made written request to the trustee to institute proceedings, and such holders have offered reasonable indemnity to the trustee or security satisfactory to it against any loss, liability or expense or to be incurred in compliance with instituting the proceeding as trustee; and
- the trustee does not institute the proceeding, and does not receive from the holders of a majority in aggregate principal amount of the outstanding debt securities of that series other conflicting directions within 60 days after the notice, request and offer.

These limitations do not apply to a suit instituted by a holder of debt securities if we default in the payment of the principal, premium, if any, or interest on, the debt securities, or other defaults that may be specified in the applicable prospectus supplement or free writing prospectus.

We expect to periodically file statements with the trustee regarding our compliance with specified covenants in the indentures.

Modification of Indenture; Waiver

Subject to the terms of the indenture for any series of debt securities that we may issue, we and the trustee may enter into one or more supplemental indentures, without the consent of any holders, with respect to the following specific matters:

- to evidence the succession of another person to our company and the assumption by any such successor of our covenants;
- to add our covenants or to surrender any right or power therein conferred upon us;
- to add any additional events of default;
- to add to or change any of the provisions of the indenture to provide that bearer securities may be registrable as to principal, to change or eliminate any restrictions on the payment of principal or premium or make-whole amount, if any, or interest on bearer securities, to permit bearer securities to be issued in exchange for registered securities, to permit bearer securities to be issued in exchange for bearer securities of other authorized denominations or to permit or facilitate the issuance of securities in uncertificated form, provided that any such action shall not adversely affect the interests of the holders of securities of any series or any related coupons in any material respect;
- to change or eliminate any of the provisions of the indenture, provided that any such change or elimination shall become effective only when there is no securities outstanding of any series created prior to the execution of such supplemental indenture which is entitled to the benefit of such provision;
- to secure the securities;
- to establish the form or terms of securities of any series and any related coupons as permitted or contemplated in the indentures;
- to evidence and provide for the acceptance of appointment by a successor trustee with respect to the securities of one or more series and to add to or change any of the provisions of the indenture as shall be necessary to provide for or facilitate the administration of the trusts by more than one trustee;
- to cure any ambiguity, to correct or supplement any provision which may be defective or inconsistent with any other provision, or to make any other provisions with respect to matters or questions arising under the indenture which shall not be inconsistent with the provisions of the indentures, provided such provisions shall not adversely affect the interests of the holders of securities of any series or any related coupons in any material respect;
- to supplement any of the provisions of the indenture to such extent as shall be necessary to permit or facilitate the defeasance and discharge of any series of securities per the indentures; provided that any such action shall not adversely affect the interests of the holders of securities of such series and any related coupons or any other series of securities in any material respect;
- to make provisions with respect to holders' rights of conversion with respect to any series of securities.

In addition, under the indentures, the rights of holders of a series of debt securities may be changed by us and the trustee with the written consent of the holders of at least a majority in aggregate principal amount of the outstanding debt securities of each series that is affected. However, subject to the terms of the indenture for any series of debt securities that we may issue or as otherwise provided in the prospectus supplement or free writing prospectus applicable to a particular series of debt securities, we and the trustee may make the following changes only with the consent of each holder of any outstanding debt securities affected:

- extending the stated maturity of the series of debt securities;
- reducing the principal amount, reducing the rate of or extending the time of payment of interest, or reducing any premium payable upon the redemption or repurchase of any debt securities; or
- reducing the percentage of debt securities, the holders of which are required to consent to any amendment, supplement, modification or waiver.

Discharge

Each indenture provides that, subject to the terms of the indenture and any limitation otherwise provided in the prospectus supplement or free writing prospectus applicable to a particular series of debt securities, we can elect to be discharged from our obligations with respect to one or more series of debt securities.

In order to exercise our rights to be discharged, we must deposit with the trustee money or government obligations sufficient to pay all the principal of, any premium and interest on, the debt securities of the series on the dates payments are due. This discharge may occur only if, among other things, we have delivered to the trustee an opinion of counsel stating that all conditions precedent provided for in the indenture relating to the discharge have been complied with.

Form, Exchange and Transfer

We plan to issue the debt securities of each series only in fully registered form without coupons and, unless we otherwise specify in the applicable prospectus supplement or free writing prospectus, in denominations of \$1,000 and any integral multiple thereof. We may issue debt securities of a series in temporary or permanent global form and as book-entry securities that will be deposited with, or on behalf of, The Depository Trust Company or another depository named by us and identified in a prospectus supplement or free writing prospectus with respect to that series.

At the option of the holder, subject to the terms of the indentures and the limitations applicable to global securities described in the applicable prospectus supplement or free writing prospectus, the holder of the debt securities of any series can exchange the debt securities for other debt securities of the same series, in any authorized denomination and of like tenor and aggregate principal amount.

Subject to the terms of the indentures and the limitations applicable to global securities set forth in the applicable prospectus supplement or free writing prospectus, holders of the debt securities may present the debt securities for exchange or for registration of transfer, duly endorsed or with the form of transfer endorsed thereon duly executed if so required by us or the security registrar, at the office of the security registrar or at the office of any transfer agent designated by us for this purpose. Unless otherwise provided in the debt securities that the holder presents for transfer or exchange, we will make no service charge for any registration of transfer or exchange, but we may require payment of any taxes or other governmental charges.

We will name in the applicable prospectus supplement or free writing prospectus the security registrar, and any transfer agent in addition to the security registrar, that we initially designate for any debt securities. We may at any time designate additional transfer agents or rescind the designation of any transfer agent or approve a change in the office through which any transfer agent acts, except that we will be required to maintain a transfer agent in each place of payment for the debt securities of each series.

If we elect to redeem the debt securities of any series, we will not be required to:

- issue, register the transfer of, or exchange any debt securities of that series during a period beginning at the opening of business 15 days before the day of mailing of a notice of redemption of any debt securities that may be selected for redemption and ending at the close of business on the day of the mailing; or
- register the transfer of or exchange any debt securities so selected for redemption, in whole or in part, except the unredeemed portion of any debt securities we are redeeming in part.

Information Concerning the Trustee

The trustee, other than during the occurrence and continuance of an event of default under an indenture, undertakes to perform only those duties as are specifically set forth in the applicable indenture. Upon an event of default under an indenture, the trustee must use the same degree of care as a prudent person would exercise or use in the conduct of his or her own affairs.

Subject to this provision, the trustee is under no obligation to exercise any of the powers given it by the indentures at the request of any holder of debt securities unless it is offered reasonable security and indemnity against the costs, expenses and liabilities that it might incur.

Payment and Paying Agents

Unless we otherwise indicate in the applicable prospectus supplement or free writing prospectus, we will make payment of the interest on any debt securities on any interest payment date to the person in whose name the debt securities, or one or more predecessor securities, are registered at the close of business on the regular record date for the interest.

We will pay principal of and any premium and interest on the debt securities of a particular series at the office of the paying agents designated by us, except that unless we otherwise indicate in the applicable prospectus supplement or free writing prospectus, we will make interest payments by check that we will mail to the holder or by wire transfer to certain holders. Unless we otherwise indicate in the applicable prospectus supplement or free writing prospectus, we will designate the corporate trust office of the trustee as our sole paying agent for payments with respect to debt securities of each series. We will name in the applicable prospectus supplement or free writing prospectus any other paying agents that we initially designate for the debt securities of a particular series. We will maintain a paying agent in each place of payment for the debt securities of a particular series.

All money we pay to a paying agent or the trustee for the payment of the principal of or any premium or interest on any debt securities that remains unclaimed at the end of two years after such principal, premium or interest has become due and payable will be repaid to us, and the holder of the debt security thereafter may look only to us for payment thereof.

Governing Law

We expect the indentures and the debt securities to be governed by and construed in accordance with the laws of the State of New York, except to the extent that the Trust Indenture Act is applicable.

Ranking of Debt Securities

The subordinated debt securities will be subordinate and junior in priority of payment to certain of our other indebtedness to the extent described in a prospectus supplement or free writing prospectus. The subordinated indenture does not limit the amount of subordinated debt securities that we may issue. It also does not limit us from issuing any other secured or unsecured debt.

The senior debt securities will rank equally in right of payment to any of our other senior unsecured debt. The senior indenture does not limit the amount of senior debt securities that we may issue. It also does not limit us from issuing any other secured or unsecured debt.

Existing Long-Term Debt

On March 7, 2024, Quantum Leap Energy LLC, or “QLE,” our wholly owned subsidiary, issued convertible notes payable in the aggregate principal amount of \$21,063,748 and, on June 5, 2024, QLE issued additional convertible notes payable in the aggregate principal amount of \$5,494,395 (collectively, the “Convertible Notes”). The Convertible Notes are payable on demand on March 7, 2029 and bear an annual interest rate of 6% for the period beginning on the date of issuance and ending on March 7, 2025 and 8% thereafter. If QLE consummates an initial public offering or a direct listing of the common equity of QLE, the Convertible Notes convert into common equity at a price per share equal to 80% of the per share IPO price or the per share reference price in such direct listing, as applicable, subject to a valuation cap. Upon an equity financing of QLE with aggregate gross proceeds to QLE of at least US\$20 million, the Convertible Notes convert into the shares to be issued in that qualified financing event at a price per share equal to 80% of the share price issued subject to a valuation cap. Upon a corporate transaction, the noteholders may elect to receive either 1.5x the principal and accrued interest balance in cash or convert into common shares. The Convertible Notes are general unsecured obligations of QLE. We are not a guarantor of the Convertible Notes. The Convertible Notes are subordinate in right of payment to all current and future indebtedness of QLE for borrowed money to banks, commercial finance lenders or other institutions regularly engaged in the business of lending money (whether or not such indebtedness is secured).

DESCRIPTION OF WARRANTS

The following description summarizes the material terms and provisions of the warrants that we may offer under this prospectus. While the terms summarized below will apply generally to any warrants that we may offer, we will describe the particular terms of any series of warrants in more detail in the applicable prospectus supplement or free writing prospectus, which may specify different or additional terms. Specific warrant agreements and warrant certificates related to warrants offered under this prospectus and any applicable prospectus supplement or free writing prospectus will contain additional important terms and provisions and will be incorporated by reference into the registration statement, of which this prospectus forms a part, from reports that we file with the SEC.

General

We may issue warrants for the purchase of common stock, preferred stock and/or debt securities in one or more series. We may issue warrants independently or together with common stock, preferred stock and/or debt securities, and the warrants may be attached to or separate from these securities. We plan to evidence each series of warrants by warrant certificates that we will issue under a separate warrant agreement. We will enter into the warrant agreement with a warrant agent. We will indicate the name and address of the warrant agent in the applicable prospectus supplement relating to a particular series of warrants.

We will describe in the applicable prospectus supplement the terms of the series of warrants, including as applicable:

- the offering price, currency, and aggregate number of warrants offered;
- the designation and terms of the securities with which the warrants are issued and the number of warrants issued with each such security or each principal amount of such security;
- the date on and after which the warrants and the related securities will be separately transferable;
- in the case of warrants to purchase debt securities, the principal amount of debt securities purchasable upon exercise of one warrant and the price at, and currency in which, this principal amount of debt securities may be purchased upon such exercise;
- in the case of warrants to purchase common stock or preferred stock, the number of shares of common stock or preferred stock, as the case may be, purchasable upon the exercise of one warrant and the price at which these shares may be purchased upon such exercise;
- the effect of any merger, consolidation, sale or other disposition of our business on the warrant agreement and the warrants;
- the terms of any rights to redeem or call the warrants; any provisions for changes to or adjustments in the exercise price or number of securities issuable upon exercise of the warrants; the periods during which, and places at which, the warrants are exercisable;
- the manner of exercise;
- the dates on which the right to exercise the warrants will commence and expire;
- the manner in which the warrant agreement and warrants may be modified;
- the material U.S. federal income tax consequences of holding or exercising the warrants;
- the terms of the securities issuable upon exercise of the warrants; and
- any other specific terms, preferences, rights or limitations of or restrictions on the warrants.

DESCRIPTION OF UNITS

The following description summarizes the material terms and provisions of the units that we may offer under this prospectus. We may issue units comprised of shares of common stock, shares of preferred stock, debt securities and warrants in any combination. We may issue units in such amounts and in as many distinct series as we deem appropriate under one or more unit agreements to be entered into between us and a bank or other financial institution, as a unit agent. The specific terms of any series of units offered will be described in the applicable prospectus supplement or free writing prospectus, and such terms may differ from the general description presented below. If we issue units, forms of unit agreements and unit certificates relating to such units will be incorporated by reference into this registration statement, of which this prospectus forms a part, from reports that we file with the SEC.

General

Each unit that we may issue will be issued so that the holder of the unit is also the holder of each security included in the unit. Thus, the holder of a unit will have the rights and obligations of a holder of each included security. The unit agreement, under which a unit is issued may provide that the securities included in the unit may not be held or transferred separately, at any time or at any time before a specified date.

The applicable prospectus supplement may describe:

- the designation and terms of the units and of the securities comprising the units, including whether and under what circumstances those securities may be held or transferred separately;
- the identity of any unit agent for the units, if applicable, and of any other depositaries, execution or paying agents, transfer agents, registrars or other agents;
- any additional terms of the governing unit agreement, as applicable;
- the price or prices at which such units will be issued;
- the material U.S. federal income tax considerations relating to the units;
- any provisions for the issuance, payment, settlement, transfer or exchange of the units or of the securities comprising the units; and
- any other terms of the units and of the securities comprising the units.

The provisions described in this section, as well as those described under “*Description of Capital Stock*,” “*Description of Debt Securities*” and “*Description of Warrants*” will apply to the securities included in each unit, to the extent relevant and as may be updated in any prospectus supplements.

PLAN OF DISTRIBUTION

We may sell these securities directly to one or more investors. We may also sell these securities through agents designated from time to time or to or through underwriters or dealers. We may sell these securities through “at the market” offerings, within the meaning of Rule 415(a)(4) of the Securities Act, to or through a market maker or into an existing trading market, on an exchange or otherwise. The applicable prospectus supplement and any related free writing prospectus will describe the terms of the offering of the securities, including, to the extent applicable:

- the name or names of any agents, underwriters or dealers;
- the purchase price of the securities being offered and the net proceeds we will receive from the sale;
- any over-allotment options under which underwriters may purchase additional securities from us;
- any agency fees or underwriting discounts and other items constituting agents’ or underwriters’ compensation;
- any discounts or concessions allowed or reallocated or paid to dealers; and
- any securities exchanges or markets on which such securities may be listed.

We may distribute the securities from time to time in one or more transactions at:

- a fixed price or prices, which may be changed from time to time;
- market prices prevailing at the time of sale;
- prices related to such prevailing market prices; or
- negotiated prices.

Agents and Underwriters

We may designate agents who agree to use their reasonable efforts to solicit purchases of our securities for the period of their appointment or to sell our securities on a continuing basis. We will name any agent involved in the offering and sale of securities and we will describe any fees or commissions we will pay the agent in the applicable prospectus supplement.

If we use underwriters for a sale of securities, the underwriters will acquire the securities for their own account. The underwriters may resell the securities in one or more transactions, including negotiated transactions, at a fixed public offering price or at varying prices determined at the time of sale. The obligations of the underwriters to purchase the securities will be subject to the conditions set forth in the applicable underwriting agreement. Subject to certain conditions, the underwriters will be obligated to purchase all the securities of the series offered if they purchase any of the securities of that series. We may change from time to time any public offering price and any discounts or concessions the underwriters allow or reallocate or pay to dealers. We may use underwriters with whom we have a material relationship. We will name any underwriter involved in the offering and sale of securities, describe any discount or other compensation and describe the nature of any material relationship in any applicable prospectus supplement. Only underwriters we name in the prospectus supplement will be underwriters of the securities offered by that prospectus supplement.

Underwriters, dealers and agents that participate in the distribution of the securities may be underwriters as defined in the Securities Act, and any discounts or commissions they receive from us and any profit on their resale of the securities may be treated as underwriting discounts and commissions under the Securities Act. We will identify in the applicable prospectus supplement any underwriters, dealers or agents and will describe their compensation.

We may have agreements with the underwriters, dealers and agents to indemnify them against specified civil liabilities related to offerings under this prospectus, including liabilities under the Securities Act, or contribution with respect to payments that the agents or underwriters may make with respect to these liabilities. Underwriters, dealers and agents may engage in transactions with or perform services for us in the ordinary course of their businesses.

Trading Markets and Listing of Securities

Unless otherwise specified in the applicable prospectus supplement, each class or series of securities will be a new issue with no established trading market, other than our common stock, which is currently listed on the Nasdaq Stock Market. We may elect to list or qualify for trading any other class or series of securities on any securities exchange or other market, but we are not obligated to do so. It is possible that one or more underwriters may make a market in a class or series of securities, but the underwriters will not be obligated to do so and may discontinue any market making at any time without notice. We cannot give any assurance as to the liquidity of the trading market for any of the securities.

At-the-Market Offerings

To the extent that we make sales through one or more underwriters or agents in at-the-market offerings, we will do so pursuant to the terms of a sales agency financing agreement or other at-the-market offering arrangement between us and the underwriters or agents. If we engage in at-the-market sales pursuant to any such agreement, we will issue and sell our securities through one or more underwriters or agents, which may act on an agency basis or a principal basis. During the term of any such agreement, we may sell securities on a daily basis in exchange transactions or otherwise as we agree with the underwriters or agents. Any such agreement will provide that any securities sold will be sold at prices related to the then prevailing market prices for our securities. Therefore, exact figures regarding proceeds that will be raised or commissions to be paid cannot be determined at this time. Pursuant to the terms of the agreement, we may agree to sell, and the relevant underwriters or agents may agree to solicit offers to purchase blocks of our common stock or other securities. The terms of any such agreement will be set forth in more detail in the applicable prospectus supplement.

Stabilization Activities

Any underwriter may engage in over-allotment, stabilizing transactions, short covering transactions and penalty bids in accordance with Regulation M under the Exchange Act. Over-allotment involves sales in excess of the offering size, which create a short position. Stabilizing transactions permit bids to purchase the underlying security so long as the stabilizing bids do not exceed a specified maximum. Short covering transactions involve purchases of the securities in the open market after the distribution is completed to cover short positions. Penalty bids permit the underwriters to reclaim a selling concession from a dealer when the securities originally sold by the dealer are purchased in a covering transaction to cover short positions. Those activities may cause the price of the securities to be higher than it would otherwise be. If commenced, the underwriters may discontinue any of these activities at any time.

Passive Market Making

Any underwriter who is a qualified market maker on the Nasdaq Stock Market may engage in passive market making transactions in securities listed on the Nasdaq Stock Market in accordance with Rule 103 of Regulation M, during the business day prior to the pricing of the offering, before the commencement of offers or sales of the securities. A passive market maker must comply with applicable volume and price limitations and must be identified as a passive market maker. In general, a passive market maker must display its bid at a price not in excess of the highest independent bid for such security. If all independent bids are lowered below the passive market maker's bid, however, the passive market maker's bid must then be lowered when certain purchase limits are exceeded.

LEGAL MATTERS

Unless otherwise indicated in the applicable prospectus supplement, the validity of any common stock, preferred stock, debt securities, warrants or units offered under this prospectus and any supplement hereto will be passed upon for us by Blank Rome LLP.

EXPERTS

The consolidated balance sheets of ASP Isotopes Inc. and Subsidiaries as of December 31, 2024 and 2023, and the related consolidated statements of operations and comprehensive loss, changes in stockholders' equity, and cash flows for each of the years then ended, have been audited by EisnerAmper LLP, independent registered public accounting firm, as stated in their report which is incorporated herein by reference. Such financial statements have been incorporated herein by reference in reliance on the report of such firm given upon their authority as experts in accounting and auditing.

The consolidated statement of financial position of Renergen Limited ("Renergen") as of February 28, 2025 and February 29, 2024, the related consolidated statement of profit or loss and other comprehensive loss, consolidated statement of changes in equity, and consolidated statement of cash flows for each of the years then ended, have been audited by BDO South Africa Incorporated, independent registered public accounting firm, as stated in their report which is incorporated herein by reference, which report contains a material uncertainty explanatory paragraph regarding Renergen's ability to continue as a going concern. Such financial statements have been incorporated by reference herein in reliance on the report of such firm given upon their authority as experts in accounting and auditing.

INFORMATION INCORPORATED BY REFERENCE

SEC rules permit us to incorporate information by reference into this prospectus and any applicable prospectus supplement. This means that we can disclose important information to you by referring you to another document filed separately with the SEC. The information incorporated by reference is considered to be part of this prospectus and any applicable prospectus supplement, except for information superseded by information contained in this prospectus or the applicable prospectus supplement itself or in any subsequently filed incorporated document. This prospectus and any applicable prospectus supplement incorporate by reference the documents set forth below that we have previously filed with the SEC (other than information in such documents that is deemed to be furnished and not filed). These documents contain important information about us and our business and financial condition.

- Our Annual Report on Form 10-K for the year ended December 31, 2024, filed with the SEC on [March 31, 2025](#), and as amended by that Form 10-K/A filed with the SEC on [April 30, 2025](#);
- Our Quarterly Report on Form 10-Q for the quarter ended March 31, 2025, filed with the SEC on [May 20, 2025](#);
- Our Quarterly Report on Form 10-Q for the quarter ended June 30, 2025, filed with the SEC on [August 14, 2025](#);
- Our Current Reports on [Form 8-K](#) filed with the SEC on [April 15, 2025](#), [May 20, 2025](#), [May 22, 2025](#), [May 27, 2025](#), [May 28, 2025](#), [June 2, 2025](#), [June 4, 2025](#), [June 11, 2025](#), [July 11, 2025](#), [July 17, 2025](#), [July 24, 2025](#), [July 25, 2025](#), [July 28, 2025](#), [July 30, 2025](#), [August 8, 2025](#), [August 15, 2025](#), [September 8, 2025](#), [September 22, 2025](#), [September 29, 2025](#), [October 3, 2025](#) and [October 14, 2025](#); and
- The description of the Company's common stock contained in [Exhibit 4.1](#) incorporated by reference into our Annual Report on Form 10-K filed with the SEC on March 31, 2025, including any amendments or reports filed for the purpose of updating such description.

All documents that we file (other than information in such documents that is deemed to be furnished and not filed) pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act on or after the date of this prospectus and prior to the termination of the offering of any of the securities covered under this prospectus shall be deemed to be incorporated by reference into this prospectus and will automatically update and supersede the information in this prospectus, the applicable prospectus supplement and any previously filed documents.

Any statement contained herein or in a document incorporated or deemed to be incorporated by reference into this prospectus or the applicable prospectus supplement shall be deemed to be modified or superseded for purposes of this prospectus and such applicable prospectus supplement to the extent that a statement contained in such applicable prospectus supplement, or in any other subsequently filed document which also is or is deemed to be incorporated by reference into this prospectus and such applicable prospectus supplement, modifies or supersedes such earlier statement. Any statement so modified or superseded shall not be deemed, except as so modified or superseded, to constitute a part of this prospectus or such applicable prospectus supplement.

Documents incorporated by reference are available from us without charge, excluding all exhibits.

Prospective investors may obtain documents incorporated by reference into this prospectus and the applicable prospectus supplement at no cost by requesting them in writing or by telephone from us at our executive offices at:

ASP Isotopes Inc.
601 Pennsylvania Avenue NW
South Building, Suite 900
Washington, D.C. 20004
(202) 756-2245
Attention: Corporate Secretary

You may also access these documents, free of charge, on the SEC's website at www.sec.gov or on our website at www.aspisotopes.com. Information contained on, or that can be accessed through, the SEC's website or our website is not part of and is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.

WHERE YOU CAN FIND MORE INFORMATION

As permitted by SEC rules, this prospectus omits certain information that is included in the registration statement, of which this prospectus forms a part, and its exhibits. Since this prospectus may not contain all of the information that you may find important, we urge you to review the full text of these documents. If we have filed a contract, agreement or other document as an exhibit to the registration statement, of which this prospectus forms a part, please read the exhibit for a more complete understanding of the document or matter involved. Each statement in this prospectus, including statements incorporated by reference as discussed above, regarding a contract, agreement or other document is qualified in its entirety by reference to the actual document.

We are subject to the information reporting requirements of the Exchange Act and, in accordance with these requirements, we file annual, quarterly and current reports, proxy statements, information statements, and other information with the SEC. You may read and copy any materials we file with the SEC at the SEC's website at www.sec.gov or on our website at www.aspisotopes.com. Information contained on, or that can be accessed through, the SEC's website or our website is not part of and is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.

\$ of Shares

Common Stock



PROSPECTUS SUPPLEMENT

Cantor

Lucid Capital Markets

October , 2025
