## Cover Page

**Bipartisan Infrastructure Law (BIL) Battery Materials Processing and Battery Manufacturing**

**Funding Opportunity Announcement (FOA) Number: DE-FOA-0002678**

**Assistance Listing Number: 81.086**

Specific FOA Area of Interest being addressed:

**AOI 10: Commercial-scale Domestic Battery Component Manufacturing Open Topic**

**Project Title: Advanced Prelithiation and Lithium Anode Manufacturing Factory**

**Technical PoC:** [redacted] (b) (4) [redacted]

**Business PoC:** [redacted]

**Participating Organizations:** Applied Materials Inc. (CA, USA) **Prime Applicant**

[redacted]

(b) (4) [redacted]

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# Section I: Project Overview

## 1.1 Executive Summary / Abstract

Battery manufacturing has become critical to the global economy, driven by concerns about the climate crisis and energy independence. (Environmental Protection Agengy, 2022). Lithium-ion batteries (LIB) are now enabling the electrification of transportation and complementing solar and wind to de-carbonize the electric grid. While great battery innovation continues in the US, (Bloomberg NEF, 2019) <10% of the global midstream LIB manufacturing and supply chain is located here, which is a critical strategic gap for the US.

The US has an opportunity to take a leadership position in LIB manufacturing through the development of advanced anode technology: lithiated graphite and Si-based anodes and Li-metal anodes. Each anode type offers dramatic improvements in battery performance compared to today's baseline (See Fig.1). One of the most vexing barriers to bringing advanced anode technology to mass production is the need for a high-volume manufacturing solution for adding lithium to these anodes. Applied Materials, together with its partners, suppliers, and customers, propose to establish a **5+ GWh Advanced Prelithiation and Lithium Anode Manufacturing Factory**, to accelerate the manufacturing qualification of advanced anodes by US-based companies and stimulate a robust battery supply chain here in the US. This will give US companies an opportunity to come to market sooner with the competitive advantage of superior battery performance and gain associated market share.

(b) (4) [redacted] Applied has developed a high-volume manufacturing, scalable, Roll-to-Roll (R2R) solution that provides high quality, ultra-thin lithium for prelithiation of graphite and Si-based anodes and for the fabrication of lithium-metal anodes on copper. Leveraging a production proven R2R SmartWeb™ platform, the system integrates many technical innovations using Applied's expertise in vacuum deposition and high-volume manufacturing from our semiconductor and display organizations as well as new innovations for lithium handling and processing. These innovations are critical to achieving the high-quality lithium films, safe processing, and cost requirements for mass EV adoption. [redacted]

(b) (4) [redacted] Applied has the experience, partnerships, and ability to successfully establish this advanced lithium-ion battery anode manufacturing factory.

(b) (4) [redacted]

(b) (4) [redacted] Applied will also establish multiple partnerships with local organizations for workforce training, diversity hiring, STEM education, apprenticeships, and community engagement.

| | Anode Materials | | |
|---|---|---|---|
| Anode | 6 12.011 C Carbon | 14 28.085 Si Silicon | 3 6.941 Li Lithium |
| | Graphite / LFP | Graphite + Silicon | Lithium Anode |
| Ultra Thin Li (um) | 1-4 | 5-10 | 10-20 |
| Energy Density | +10% 260 Wh/kg | +30% 350 Wh/kg | +70% 450 Wh/kg |
| Power Density | 1100 W/l | 3000 W/l | 3000 W/l |
| Charge Rate | 80% 30 min | 100% 15 min | 100% in 15 min |
| Cycle Life | 14,000 | 1000 | 1000 |

Enabling Application: Grid Storage; EV; eVTOL

*Figure 1: Roadmap for next generation Li-battery anode technology for both vehicular and stationary energy storage needs and enabling potential new applications. The common factor is the need for ultra-thin Li metal to enable these advanced anodes.*

## 1.2 Project Overview

Applied Materials proposes to build a **~5 GWh lithium metal anode and lithium film manufacturing factory.** [redacted] (b) (4) [redacted] There are 3 cell designs which can take advantage of the ultra-thin Li films: graphite anodes, Si-based anodes, and Li-metal anodes.

- **Graphite Anodes:** Adding 2-3µm of Li directly to a graphite (Gr) anode during electrode manufacturing, a process called **prelithiation**, can increase the energy density of Gr-$LiFePO_4$ (LFP) or Gr-$LiCoO_2$ (LCO) cells and significantly extend cycle life. During the first cycle there is a loss of Li as high as 10%, a process called **first cycle irreversible lithium loss (FCILL).** [redacted] (b) (4) [redacted]
- **Silicon based Anodes**: Si based anodes (Si or $SiO_x$ blended with graphite, and pure Si) can increase energy density by >30% and enable faster charging (Energy Assurance, 2022) compared to graphite anodes. The FCILL for Si-based anodes, however, can vary between 10-40%. As with graphite anodes, prelithiation can fully offset the FCILL, thus enabling very high Si amounts to be used and maximizing energy density and fast charge benefits.
- **Lithium Metal Anodes**: Li-metal anodes, fabricated with an ultra-thin layer of Li metal on top of the copper current collector, can further increase energy density by >70% compared to current technology. (b) (4) [redacted] Li metal anodes can be used with liquid electrolytes to create a hybrid battery or integrated with solid electrolytes

to create an all-Solid-State Battery (SSB). Besides the high energy densities, some SSBs can achieve very high cycle life and can dramatically increase battery safety by eliminating the flammable liquid electrolyte.

**No Mass Production Solution Today**

Today, however, one of the most vexing barriers to bringing advanced anode cell designs to market is the lack of a high-volume manufacturing (HVM) solution for precisely adding Li uniformly across anode roll that meets the above performance requirements and others such as cost, yield, and safety. [redacted] Current rolled Li-metal films from extruded foils are limited by purity (contain impurities such as N, O, and C at 100 ppm level) (Katherine J. Harry, 2014) and by form factor (thicknesses 20-600 µm and widths typically <150 mm).

(b) (4) [redacted]

(b) (4) [redacted]

**Innovative Technology for High Volume Manufacturing**

Applied Materials, leveraging decades of experience in Vacuum Roll-to-Roll (R2R) processing, has developed a R2R deposition system [redacted]

(b) (4) [redacted]

**Customer Demand to 5 GWh and Beyond**

(b) (4) [redacted]

(b) (4) [redacted]

Customer demand grows each year as they go through their qualification phases. [redacted]

(b) (4) [redacted]

Manufacturing qualification of a new battery can take 4-5 years. Customers need access to an escalating amount of Li anodes and Li films throughout this time. [redacted]

(b) (4) [redacted]

[redacted]

**World-Class Talent and Expertise**

As a leading manufacturer of equipment for semiconductor and display industries, Applied has the depth and breadth of relationships, experience, and expertise needed to set up successful

(b) (4) lobal manufacturing operations. [redacted]

(b) (4)

## 1.3 Background

Breaking through the "graphite anode energy density ceiling" and enabling advance anode solutions will catapult US companies into battery manufacturing and supply chain leadership positions. Applied Materials, the world's largest provider of HVM equipment to semiconductor and display industries, has leveraged innovative technology to develop a vacuum deposition system that enables manufacturing of a critical component- high quality ultra-thin Li-metal anodes and films for advanced anodes.

### 1.3.1 History of Applied Materials

Established in 1967, and headquartered in Santa Clara, CA, Applied Materials, Inc. (NASDAQ: AMAT) is the world leader in providing materials engineering solutions and HVM equipment for Semiconductor, Display, Solar Photovoltaic, R2R processing, and related industries. We

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have the broadest technology manufacturing portfolio in our industry: CVD, evaporation, sputtering, etch, anneals, CMP, plasma etch, electroplating, ion implant, e-beam, and metrology. With >$23B in FY2021 revenue, >15k issued patents, and >27k employees worldwide, we are recognized as one of the most innovative companies in the world, For several years, our corporate R&D team has been exploring opportunities to leverage our expertise and develop HVM solutions for advanced energy storage applications. Our innovations will drive significant performance improvements and accelerate the adoption of next generation Si/$SiO_x$-anodes and Li-metal anodes.

### 1.3.2 Applied Materials R2R Products

The R2R product group (acquired in 2006), is based in Alzenau, Germany. Since shipping the first vacuum R2R system in 1955, 750+ installations have been serving all flexible substrate markets covering packaging, flexible electronics, security, decoration, flexible photovoltaics, and energy storage worldwide. Combining an unparalleled range of deposition technologies in the industry (b) (4) [redacted] with experience in handling a variety of flexible substrates [redacted] we are the leading supplier of state-of-the-art R2R vacuum deposition systems. Leveraging our extensive manufacturing experience and expanding into adjacent markets, we enable and serve new applications from lab to HVM scale.

### 1.3.3 SmartWeb®

[redacted]

(b) (4) [redacted]

[redacted]

### 1.3.4 Battery Group Developmental History

After initial years of exploratory work, in 2017 we identified vacuum R2R solution as a valuable technology for the battery industry. [redacted]

(b) (4) [redacted] Through this, we have identified a manufacturing path for Gr and Si-based

anode pre-lithiation and Li-metal anodes [redacted]

(b) (4) [redacted]

(Yuzhang Li e. a., 2017)(Svenja-K Otto e. a., 2021). [redacted]

(b) (4) [redacted]

## 1.4 Project Goals and Outcomes

The goal of the proposed factory is to enable US companies to qualify critical advanced anode technologies for HVM and get to market ahead of their competition, placing them in a global leadership position. [redacted]

(b) (4) [redacted] Applied Materials, and the US based materials producers who [redacted]artner with us, would establish our solutions in mass production and would thereby capture a strategic position in the global battery value chain.

### 1.4.1 Project Goals

[redacted]

[redacted]

(b) (4)

### 1.4.2 Outcomes

We will have qualified Si-based anodes and Li-metal anodes for HVM production across the US, resulting in several outcomes, as discussed in detail in section 2.1.1. [redacted]

- Secure domestic source of ultra-thin Li
- Reduced GHG via faster adoption of EVs by enabling advanced anode

[redacted]

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## 1.5 DOE Impact

The proposed factory plays a bridging role in the development of advanced anode for current and future cell architectures. For EVs, significant qualification tests are required at different levels (cell, module, pack, and vehicle) as part of governmental regulations (performance, safety, abuse, ageing etc.). [redacted]

(b) (4)

(b) (4) [redacted]

With the DOE support, we would be able to build the factory, aggregate demand across the entire US cell making industry, and provide GWh-scale equipment throughout the development process so that US-based participants can benefit from the quality and cost structure only obtainable at GWh scale.

(b) (4) [redacted] This grant would also bring together participants across the LIB value chain including OEMs, cell makers, startups, national labs, universities, and suppliers. Applied Materials and the US-based supply chain partners would establish our qualified solutions in mass production and thereby capture a strategic position in the global battery value chain [redacted]

(b) (4) [redacted]

## 1.6 Equity Plan: Quality Jobs and Community benefits

(b) (4) [redacted]

Applied Materials' Advanced Prelithiation and Li Anode factory will provide equitable [redacted]

(b) (4) [redacted] We will identify local workforce by partnering with local, regional, and state partners such as community colleges, local universities, and nearby HBCUs. Through our equity goals, we will ensure fairness in hiring and career

development, engage and strengthen our outreach for DACs, promote diversity across the supply chain, and partner with local tech companies to review industry rules that affect DACs.

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[redacted]

All training is coordinated centrally for our 27k+ employees worldwide and is aligned with common objectives through Applied Global University (AGU). Our PATHWAY program helps our employees create personalized learning journeys, while our technical talent receives additional specialized opportunities to develop knowledge and skills. In addition, our Environmental Health and Safety (EHS) policy commits our company to protect the environment and ensure the health and safety of our workers and the community.

# Section II: Technical Description, Innovation, and Impact

## 2.1 Relevance and Outcomes

*"You can't use 30-year-old technology for next generation Li-ion batteries. You need to leapfrog, and Applied Materials is developing the technology to do that."*

M. Stanley Whittingham, Nobel Laureate 2019, Chemistry

Despite foundational innovation in Li-ion battery technology, the US is currently behind many Asian countries in terms of LIB manufacturing and the associated supply chain. The US cannot take a leadership position by simply trying to manufacture 5–10-year-old battery technology. It must leverage the innovations that have been developed by our strong National Labs, Universities, startups, and established companies to manufacture state-of-the-art advanced batteries. Key performance improvements that companies are looking for in advanced batteries include energy density (Wh/Kg and Wh/L), power, charging time, cost ($/kWh) and safety. These improvements will accelerate the adoption of EVs in the market and consequently increase the market share and leadership of the companies who implement them first.

Historically, energy density improvements have been made on the cathode and separator components of the battery. Very little has been done on the anode, where graphite has been the material of choice for the past 30 years. Now, however, further improvements to the cathode and separator are limited. The graphite anode is constraining both the energy density and ability to support ultra-fast charging. As such, companies across the supply chain have been working on improved anode solutions, mostly focusing on one of three main approaches:

- **Prelithiated Graphite** 10% higher energy density (EV cell), 3x longer cycle life (energy storage cell): Graphite itself has a first cycle irreversible Li loss of about 10% depending on the type of graphite used. Often, the cathode has a similar loss, and thus it is not worth addressing. [redacted]

(b) (4)

- **Prelithiated Si-based anodes** >30% higher energy density, ultra-fast charge: Si-based anodes can increase energy density by >30% and enable ultra-fast battery charging. Si based anodes, however, inherently suffer from significant first cycle irreversible Li loss (FCILL) varying between 10-40%, depending on type and amount of Si used. During the first cycle, Li is consumed via SEI formation and from the formation of the irreversible $Li_4SiO_4$ phase (Hideharu Takezawa, 2013). **Prelithiation**—the process of adding Li to the anode—can offset FCILL, thus enabling very high Si amounts to be used and maximizing energy density and fast charge benefits.
- **Li-metal anodes** (fabricated with an ultra-thin layer of Li metal on top of a Cu current collector) can further increase energy density by >70% compared to current anode technology. An ultra-thin passivation layer (nm's thick) or other thin film can be deposited or grown on the Li surface to protect it during processing. Li-metal anodes can be used with liquid electrolytes to create a hybrid battery or integrated with solid electrolytes to create an all-Solid-State Battery (SSB). Besides the high energy densities, some SSBs can achieve very high cycle life and can dramatically increase battery safety by eliminating the flammable liquid electrolyte. [redacted]

(b) (4)

While all major battery manufacturers and their OEM partners are exploring solutions for prelithiation and lithium metal anodes, **no safe, cost-effective HVM solutions for ultra-thin layers or low doses of lithium currently exist in the market.** [redacted] By building this factory, Applied Materials can ensure that domestic partners will have secure access to the highest quality ultra-thin lithium films for advanced anodes [redacted]

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### 2.1.1 Outcomes

Securing a domestic source of ultra-thin lithium will have the following outcomes:

1. **Secure Domestic Source:** Currently, most thin Li metal anodes are sourced from Asia. Few domestic sources exist, and none are capable of high-volume manufacturing

(b) (4)

**duced GHG via faster adoption of EVs:** Key factors limiting the adoption of EVs include ited range, charge time, safety, and cost

(b) (4) [redacted]

**Increase Market Share of Domestic Battery Manufacturers and OEMs**: As noted previously, high performance batteries require a source of high quality ultra-thin Li in the anode, whether Si-based anodes or Li-metal anodes. The companies which are first to manufacture such batteries gain a critical competitive edge, capture market share, and secure leading positions in LIB manufacturing globally. [redacted]

(b) (4) [redacted]

[redacted]**US Supply Chain Growth and Expansion:** As Applied's ultra-thin Li anode and prelithiation films are qualified for mass production, both Applied's footprint in the LIB supply chain, as well as that of our partners and suppliers, will grow [redacted] While this far exceeds the factory proposed here, it underscores the incredible growth opportunity as this technology takes off [redacted]

(b) (4) [redacted]

5. [redacted] Through our equity goals, we will ensure fairness in hiring and career development [redacted] and will engage with [redacted] local institutions and organizations:

- Workforce development councils for training

- Colleges, community colleges, and universities, especially HBCUs for hiring, training, curriculum development, apprenticeship programs etc.
- Schools and nonprofit organizations focused on student success, including STEM
- Local credit unions for better financial access
- Engage the local community through regional giving, charity, and volunteering programs. We will identify and adopt best practices and monitor progress throughout.

## 2.2 Feasibility

**Ready to Scale**

(b) (4) [redacted] The validation work was done on a production proven high volume manufacturing roll to roll platform and consistently met or exceeded the customer requirements. Customer demand far exceeds our current capacity to manufacture and now is the right time to scale to GWh levels.

**Background**

Since 2010, Applied has been investigating at how we can leverage technologies developed in our semi, display, solar, and roll-to-roll divisions to help the LIB industry [redacted]

(b) (4) [redacted] Based on these results for both anode types, we began to invest in an HVM solution for ultra-thin Li.

**Roll-to-Roll Platform and Lithium Deposition Chamber**

(b) (4) [redacted]

**Lithium Delivery Validation**

[redacted]

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[redacted]

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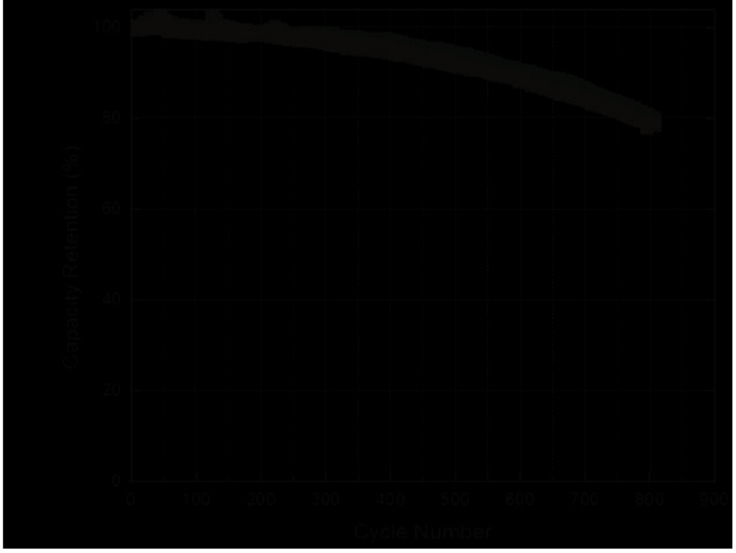


[redacted]

(BatPaC Model Software, 2021)

[redacted]

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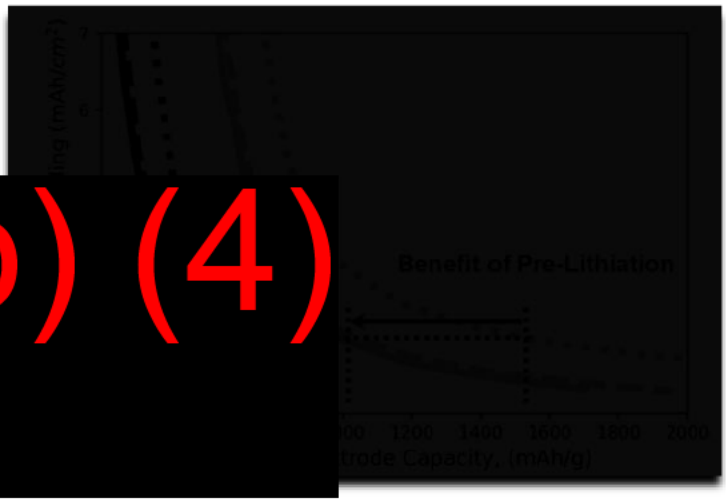


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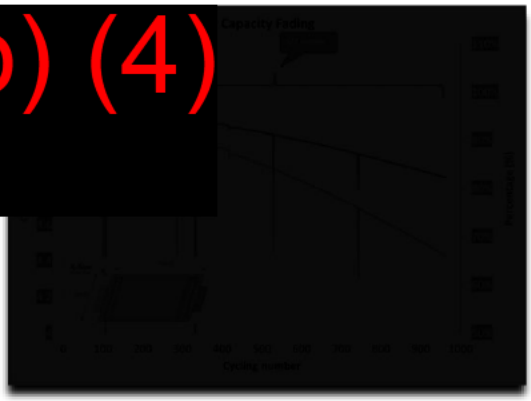

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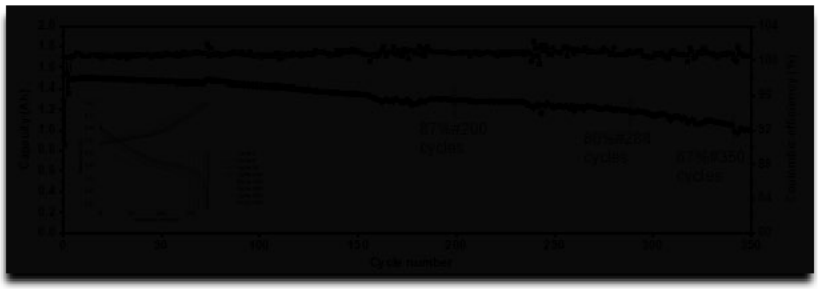

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(b) (4) [redacted]

### 2.2.2 Attracting and retaining qualified workforce

Applied has four major manufacturing and development centers, and our global HQ is in the US. We invest in our employees by offering competitive rewards, compensation, and benefits and measuring employee inclusion and engagement, along with more traditional performance drivers and taking a strategic approach to talent pipeline development. [redacted]

(b) (4) [redacted]

(b) (4) [redacted]

We create growth and development opportunities that support an engaged and inclusive workforce that can propel our business into the future. All training is coordinated centrally for our 27k+ employees worldwide and is aligned with common objectives through Applied Global University (AGU). The business units and functions provide technical and job-specific training, and the corporate level provides more general professional, management, and leadership training. In addition, our Environmental Health and Safety (EHS) policy commits our company to protect the environment and ensure the health and safety of our workers and the community.

## 2.3 Innovation and Impacts

### 2.3.1 Current State-of-the-Art

Since the introduction of Li-ion technology by Sony Corporation in 1991, gravimetric energy density (Wh/kg) of the LIB cells has improved by ~6% per year, along with significant advancements in cathode, electrolyte, and separator. As the graphite anode has not changed significantly over 3 decades, the current LIB density has reached its ceiling, and further advancements are needed to push it higher and pave the way for a low-carbon future. While an advance anode would improve battery densities significantly (~30-70% or 350-500 Wh/Kg), mass production is held back by lack of viable HVM options for Li deposition that meets performance and safety parameters at GWh-scale.

### 2.3.2 Current Alternate Paths for Prelithiation

As noted previously, cell manufacturers are investigating the addition of Si to the graphite anode to increase energy density. The introduction of Si brings the challenge of FCILL and thus the need to prelithiate the anode (Jim P. Zheng, 2022). [redacted]

(b) (4)

- [redacted]

(b) (4)

While feasibility studies have been conducted on all these approaches by various cell makers across the globe for 10+ years, very little progress has been made toward HVM implementation. No cell maker, to our best knowledge, has developed a solution that meets the most critical requirements of battery performance tradeoffs: cost, performance, safety, and ability to scale to HVM.

(b) (4)

### 2.3.3 Current Alternate Paths for Lithium Metal Anodes

For Li-metal anode, the options for cell manufacturers are even more limited. The most common approach has been Li-foil produced by extrusion/rolling to ~20 µm.

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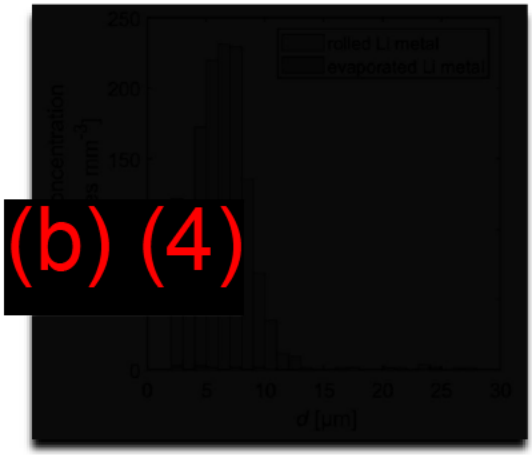


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[redacted]

[redacted]

### 2.3.4 Advantages of Applied Materials' Lithiation Technology

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[redacted]

### 2.3.5 Lithium Deposition System Innovations

[redacted]

(b) (4)

[redacted]

(b) (4)

[redacted]

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**High Throughput Web Handling**

Applied's roll-to-roll group has over 50 years of experience [redacted]

**Safety**

The Li deposition process is designed to be operated safely with no exposure of Li to the operator. [redacted]

(b) (4) [redacted]

**Summary**

The battery industry is looking for a safe and reliable, scalable, cost-effective HVM solution for ultra-thin lithium. Leveraging Applied's innovation strengths, we have developed a unique solution to the key challenges facing Li [redacted] The process and equipment are now ready for GWh scaling and doing so promises to put the US in the leadership position as envisioned in the Bipartisan Infrastructure Law (BIL).

# Section III: Workplan and Market Transformation Plan

## 3.1 Project Objectives

The goal of the proposed factory is to enable US companies to qualify critical advanced anode technologies for HVM [redacted]

(b) (4) [redacted]

### 3.1.1 Project Goals

[redacted]

(b) (4)

### 3.1.2 Outcomes

**[[**We will have qualified Si-based anodes and Li-metal anodes for HVM production across the US, resulting in several outcomes, as discussed in detail in section 2.1.1. In summary:

- Secure domestic source of ultra-thin Li
- Reduced GHG via faster adoption of EVs by enabling advanced anode

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## 3.2 Technical Scope Summary

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(b) (4)

## 3.3 WBS and Task Description / Milestones / Go / No Go Decision Point Summary

**The Work Breakdown Structure is found in the chart below, beginning on page 36**

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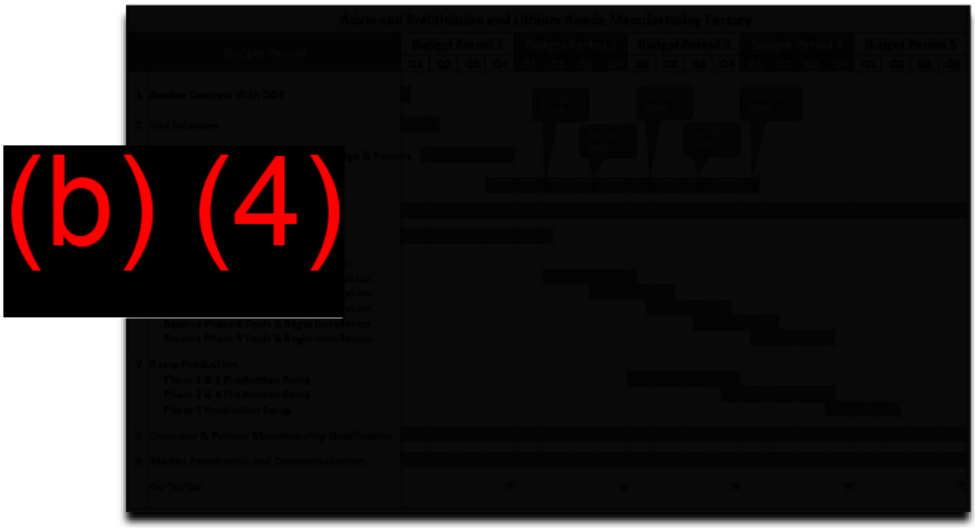


[redacted]

## 3.6 Buy American Requirements for Infrastructure Projects

[redacted] Applied is committed to procuring building construction materials produced in the United States. In limited circumstances, if the required materials are unavailable, Applied will seek the appropriate waiver and approvals from DOE.

## 3.7 Project Management

[redacted]

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[redacted]

The Applied Materials team brings to the table a unique perspective and breadth and depth of experience borne from the successes in taking technology ideas from the Lab to the Fab in the competitive semiconductor and display industries. Applied has been working with the battery industry worldwide to identify advanced LIB manufacturing equipment opportunities [redacted]

### [redacted]

[redacted]

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### 3.7.3 Project Risk Management and Project Plan Changes

Project teams are encouraged to anticipate and identify issues early and communicate often to brainstorm solutions and develop back-up plans to mitigate risks. Decisions on changes to Tasks, Sub-tasks, Milestones, Deliverables, Timelines are expected to be made in consultation amongst the collaborating partners and with important inputs and guidance from DOE Program Management team, always keeping an ear out to the changing customer and market requirements to make the commercial operation a success.

### 3.7.4 Project Team Communication

Sub-contract negotiations with project partners will be initiated in parallel with award negotiations to provide sufficient time to execute required agreements [redacted] Applied has set aside sufficient Program Management resources to handle coordination and communication with multiple partners regarding all aspects of the project (Technical, Business, and Financial).

### [redacted]

[redacted]

(b) (4)

[redacted]

(b) (4)

[redacted]

**Superior Solution for HVM and Safe Processing**

While all major battery manufacturers and their OEM partners are exploring Si-based and Li-metal anode solutions in accordance with USABC (USABC, n.d.)and EUCAR goals (EUCAR, 2020), no safe, cost-effective, HVM solutions for ultra-thin Li, which enable these advanced anodes, currently exist in the market. [redacted]

(b) (4)

[redacted]

[redacted]

(b) (4)

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

(b) (4)

[redacted]

(b) (4)

# Section IV: Technical Qualifications and Resources

## 4.1 The Team - Team Members and Resources

Applied Materials has assembled a team of [redacted] experts in advanced battery manufacturing as well as the supply chain for this project. This section provides a brief description of the capabilities, technical expertise and manufacturing experience of the Applied team and collaborating partners and respective roles and interdependencies in the project.

### 4.1.1 Applied Materials Inc. (Prime Applicant)

Established in 1967, headquartered in Santa Clara, California, with fiscal 2021 revenue of $23.1B (NASDAQ: AMAT), Applied Materials is the world's largest provider of equipment to the semiconductor and display manufacturing industries. [redacted]

(b) (4)

**Customer Validation and Manufacturing Qualification Partners**

Applied will work with multiple US based customers and partners through manufacturing qualification of prelithiated and Li-metal anodes for volume production of advanced cells. [redacted]

(b) (4)

[redacted]

(b) (4)

[redacted]

(b) (4)

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

(b) (4)

[redacted]

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(b) (4)

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[redacted]

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[redacted]

**Statement of Project Objectives**

**Advanced Prelithiation and Lithium Anode Manufacturing Factory**

[redacted]

## A. PROJECT OBJECTIVES

1. To build a 5+ GWh factory [redacted] (b) (4) [redacted] The facility will have an annual production of 25M m2, which is approximately 5GWh, depending on customer cell loading.

2. To work with our domestic and international partners to accelerate manufacturing qualification of our lithium solutions for mass production. [redacted]

[redacted] To strengthen the US lithium-ion supply chain [redacted]

   [redacted]

   e. [redacted]

4. To create direct high-quality jobsand [redacted]

5. Establish multiple partnerships with local organizations for workforce training, diversity hiring, STEM education, curriculum development, apprentice programs, community engagement in DACs etc.

[redacted] (b) (4) [redacted]

[redacted]

## B. TECHNICAL SCOPE SUMMARY

**Budget Period 1 (BP-1):** Finalize agreements, secure building, and begin building improvements [redacted]nstruction.

(b) (4)

[redacted]

**Budget Period 2 (BP-2):** Begin equipment installation and qualification.

[redacted]

**Budget Period 3 (BP-3):** Start production ramp and partner manufacturing qualifications.

[redacted]

**Budget Period 4 (BP-4):** Complete construction, installation, qualification and begin commercialization activities [redacted]

**Budget Period 5 (BP-5):** Complete production ramp.

[redacted]

## C. TASKS TO BE PERFORMED

**All Budget Periods**

**Task 0.0 – Overall project management and planning:**

The recipient will perform project management activities to include project planning and control, subcontractor control, financial management, data management, management of supplies and/or equipment, risk management, and reporting as required to successfully achieve the overall objectives of the project.

**Task 0.1 – Kick-off meeting:**

The recipient will participate in a project kickoff meeting with the DOE within 30 days of project initiation. Objectives, goals, and expectations of the factory & DOE grant will be clearly aligned in this meeting.

(b) (4)

Budget Period 1: Finalize agreements, secure building, and begin building improvements & construction.

**Task 1.1.0 – Contract agreements with project partners:**

The recipient will negotiate and finalize project technical merits, objectives and deliverables, project plan, budget, go-no decisions, equity plan, & cost share

**Task 1.2.0 – Site selection:**

The recipient will select and secure site and building for the factory. Collect requirements for factory site, identify and survey sites, down select site, work with local governments, authorities, and local communities, negotiate and sign building lease.

**Task 1.3.0 to 1.3.4 – Building design, permits & construction:**

Prepare factory technical space design for building improvements and execute necessary upgrades

(b) (4)

Finalize design and Obtain Initial construction permits

Begin upgrade of building space with necessary improvements to setup manufacturing facility to process anode materials. Factory space will be divided in dry room, non-dry room, Lithium bunker, parts cleaning facilities, and office space.

**Task 1.4.0 – Staffing and equity plan:**

Begin implementation of staffing plan incorporating equity goals. Establish multiple partnerships with local organizations for workforce training, diversity hiring, STEM education, curriculum development, apprentice programs, community engagement in DACs etc.

Begin hiring factory staff as needed [redacted] to fullfill program objectives.

Create framework, with input from local stakeholders, for Community Benefit plan based on priority areas of need [redacted]

**Task 1.5.0 – Equipment selection for factory:**

The recipient will gather production requirements, identify equipment and components required, develop detailed technical specifications and requirements for each equipment [redacted] and place order for equipment.

(b) (4) [redacted]

**Task 1.8.1 and 1.8.2 –partner manufacturing qualification:**

Define all necessary stages of LMF production and translate inputs and outputs into GREET; Test and implement advanced metrology and shelf-life studies for Li metal films.

[redacted]

(b) (4) [redacted]

[redacted]

[redacted]

(b) (4)

| Milestone | Type | Description |
|---|---|---|
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |

(b) (4)

Budget Period 2: Begin equipment installation and qualification.

**Task 2.3.0 – Building design, permits & construction:**

Construction Phase of the factory will be divided in five Phases. Completion of each Phase will permit installation of two Li deposition equipment, supporting peripherals, and other supporting equipment [redacted] Dry room will be constructed with Li fire suppression systems for installation of Li deposition tools. [redacted]

**Task 2.3.1 – Complete construction of Bay 1 & 2:**

**Task 2.3.2 – Complete construction of Bay 3 & 4:**

(b) (4)

**Task 2.4.0 – Continue with staffing and equity plan implementation from task 1.4.0:**

[redacted]

Invite employees to engage in giving activities and volunteerism that can positively impact DACs by sharing relevant information.

**Task 2.5.0 – Select equipment for factory & place orders:**

(b) (4) Continue task from task 1.5.0. Select remaining equipment for factory & place orders. Task ends in BP 2.

The recipient will gather production requirements, identify equipment and components required, develop detailed technical specifications and requirements for each equipment [redacted] and place order for equipment.

**2.6.0 – Factory tool installation & qualification:**

Recipient will begin installing and qualifying equipment for production in 5 Phases synced with construction Phases.

Each Phase will include installation of two Li deposition tools, supporting [redacted] equipment as necessary. Upon receipt of each equipment set, they will be hooked up to facilities(install cable trays, transformers, power and signal cables, hoses, exhaust pipes, etc.), and anchored seismically. All safety interlocks will be integrated and tested before releasing them for functional test. Upon satisfactory completion of HW tests and safety approval they will be released for unit process testing (Li deposition test). All equipment unit processes will be qualified, integrated into production workflow, and handed over to production.

**Task 2.6.1 – Receive Phase 1 tools and begin installation:**

**Task 2.6.2 – Receive Phase 2 tools and begin installation:**

**Task 2.8.0 – Continue partner manufacturing qualification from task 1.8.0:**

Work with partners to qualify manufacturing process. R2R sampling from the factory.

**Task 2.8.1 and 2.8.2 - partner manufacturing qualification**

Deploy GREET to evaluate LCA of LMF for a hot-spot study and complete sensitivity analysis of variables conducted for LMF-controlled parameters.

Advanced metrology and shelf life of Li metal film. [redacted]

(b) (4) [redacted]

| Milestone | Type | Description |
|---|---|---|
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |

[redacted]

(b) (4) [redacted]

Budget Period 3: Start production ramp and partner manufacturing qualifications.

**Task 3.3.0 – Continue construction from task 2.3.0:**

**Task 3.3.1 – Complete construction of Bay 5 & 6:**

**Task 3.3.2 – Complete construction of Bay 7 & 8:**

**Task 3.4.0 – Continue with staffing and equity plan implementation from task 1.4.0:**

Launch charitable grantmaking program to address community needs in DACs through semi-annual grant process.

**Task 3.6.0 – Continue tool installation and qualification from task 2.6.0:**

**Task 3.6.1 – Receive Phase 3 tools and begin installation:**

**Task 3.6.2 – Receive Phase 4 tools and begin installation:**

**Task 3.7.0 – Production Ramp:**

The recipient will begin to ramp production of released tools in this Phase. Recipient will take necessary steps (implement best known methods, upgrades, and execute continuous improvement plans) to optimize output of the equipment.

**Task 3.7.1 – Complete production ramp of Phase 1 & 2 tool to 8M m² annual run rate:**

**Task 3.8.0 –Continue customer & partner manufacturing qualification from task 1.8.0 & 2.8.0:**

(b) (4) [redacted]

Refine model and document all effort. Report written regarding the environmental impacts of the LMF process and its associated batteries. Advanced metrology and shelf life studies continued. Perform large capacity B cell qualification. [redacted]

[redacted]

[redacted]

| Milestone | Type | Description |
|---|---|---|
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |

(b) (4)

Budget Period 4: Complete construction, installation, qualification and begin commercialization activities.

**Task 4.3.0 – Continue construction from task 2.3.0 & 3.3.0:**

**Task 4.3.1 – Complete construction of Bay 9 & 10:**

**Task 4.4.0 – Continue with staffing and equity plan implementation from task 1.4.0:**

Gather input from stakeholders including local leaders regarding company and its role in the community.

**Task 4.6.0 – Continue tool installation and qualification from task 2.6.0 & 3.6.0:**

**Task 4.6.1 – Receive Phase 5 tools and begin installation:**

**Task 4.7.0 – Continue ramp from task 3.7.0:**

**Task 4.7.1 – Complete production ramp of Phase 3 & 4. Ramp production of Phase 1-4 tools to 16M $m^2$ annual run rate:**

**Task 4.8.0 – Continue partner manufacturing qualifications from task 1.8.0 - 3.8.0:**

**Task 4.8.1 – Close our engagements with partners, including final reports; work on advanced metrology will continue.**

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|---|---|---|
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## Budget Period 5: Complete production ramp.

**Task 5.4.0 – Continue with staffing and equity plan implementation from task 1.4.0:**

Monitor and report progress on Community Benefit Plan implementation.

**Task 5.4.1 - Continue with staffing and equity plan implementation from task 1.4.0:**

Finish creation of high-quality, regular, full-time jobs, and establishment of multiple partnerships with local organizations.

**Task 5.7.0 – Continue ramp from task 3.7.0 & 4.7.0:**

**Task 5.7.1 – Complete production ramp of Phase 5:**

**Task 5.8.0 – Continue partner manufacturing qualifications from task 1.8.0 - 4.8.0:**

(b) (4)

[redacted]

| Milestone | Type | Description |
|---|---|---|
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |

(b) (4)

## End of Program Goals

By the end of the project, we will have achieved:

- The construction of a facility housing our lithium deposition systems and supporting equipment [redacted].
- The qualification of advanced anode in this [redacted]
- The establishment of supplier quality [redacted]

(b) (4)

- The creation of high-quality, regular, full-time jobs [redacted]
- The establishment of multiple partnerships with local organizations for workforce training, diversity hiring, STEM education, curriculum development, apprentice programs, community engagement in DACs etc.

# I. GENERAL

*This volume shall be submitted with the original proposal and must be found acceptable prior to contract negotiations and award. The Environmental Volume shall provide, in detail, all information as outlined in the following sections.*

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## A. ENVIRONMENTAL INFORMATION DESCRIBING THE PROJECT AND THE PROJECT SITE(S).

*This section of the Environmental Volume shall contain a detailed, self-contained description that summarizes the proposed action, its alternatives, and, most importantly, the existing environment. It shall be prepared in the following format.*

### 1. Summary

*This section shall contain a succinct summary of the proposed project and its potential environmental, safety, health, and socioeconomic impacts. A brief description of any construction and operation activities, including the duration and schedule shall also be provided. The summary shall focus on both beneficial and detrimental impacts, as well as any major risks associated with constructing, operating, maintaining, and dismantling/disposing of the proposed test facility, if applicable.*

### 2. Proposed Project and Its Alternatives

a) Proposed Project

*This section shall discuss the objectives of the proposed project, and shall describe the proposed site, system, and/or process. It shall also describe the work to be performed, the schedule, associated requirements (e.g., land, natural resources), and any changes that will be necessary to the existing site, system, or process.*

*The description shall include a project site plan and topographic map of the area. Any off-site facility requirements shall also be identified in this section.*

Applied Materials, Inc. (NASDAQ: AMAT) headquartered in California's Silicon Valley, is a market leader in the semiconductor, flat panel display, and roll-to-roll industries. Applied Materials offers leading edge materials engineering solutions used to produce virtually every new chip and advanced display in the world.

Applied Materials plans to set up an Advanced Prelithiation and Lithium Anode Manufacturing Facility to accelerate the transition of Li-ion Batteries to next-generation and to enable the development of a robust battery component supply-chain in the U.S. **Applied Materials will continue to use its CA facility located at 555 E. California Avenue, Sunnyvale CA as a bridge to generate deposited Li samples to be provided to partners and customers for evaluation qualification, while the manufacturing facility site is selected and [redacted] and becomes operational in the first half of the project (2023-2025). The proposed activity is a continuation of work that is currently permitted and ongoing using already installed equipment.** Applied Materials will upgrade and optimize lithium deposition equipment utilizing existing facilities at the site.

(b) (4) [redacted] The manufacturing location site address and the required Environmental Questionnaire and Environmental Information Volume will be provided upon final site selection in the next few months.

Other than normal city services such as the water supply, sanitary sewer system, electrical power, nitrogen gas supply, natural gas supply, and stormwater drains there are no other offsite facility requirements.

[redacted]

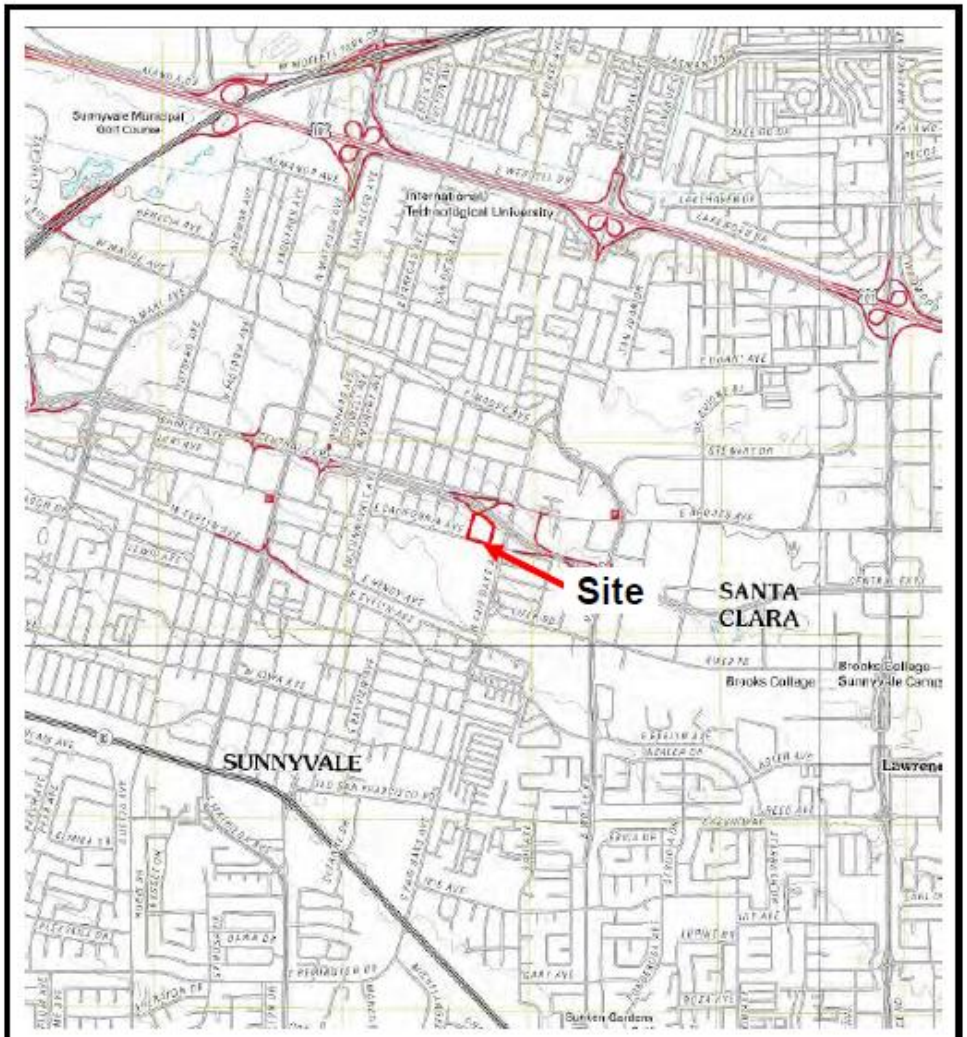
Location

The Subject Property is located on the northern side of East California Avenue, in Sunnyvale, Santa Clara County, California in an Industrial Zoned area. [redacted]

(b) (4)

[redacted]

**Applied Materials Bldg.75, 555 E California Avenue, Sunnyvale, CA 94086-5147**




ERM

**SITE LOCATION MAP**
**Project Reference: AMAT SITE**
**555 East California Avenue**
**Sunnyvale, CA**

Figure
**1**

(b) (4)

[redacted]

Approximate Subject Property Boundary
Approximate Boundary of the Westinghouse Electric Superfund Site
Source: Aerial Google EarthPro 2016, Parcel Map EDR, 2016

N

ERM

**SITE VICINITY MAP- AMAT SITE**
**555 East California Avenue**
**Sunnyvale, California**

Figure **3**

b) Alternatives to Proposed Project

*A complete description of likely alternatives to the project, including a "no action" alternative, shall be provided. The description shall address technology-specific aspects of the action, such as process design configurations, and site-specific considerations, such as alternative waste disposal sites, etc.*

Applied Materials does not currently have any plans for alternatives to continuation of the project work described above in support of the manufacturing facility to be located and built elsewhere (TBD).

## 3. Existing Environment - Please refer to the attached Phase I ESA Report for this section

*This section shall discuss the existing environment at the project location(s). The principal proposer and all proposed subcontractors shall discuss the following:*

**a)** Land Use

*This section shall provide a description of the affected land area and its dimensions; a discussion of current land usage (e.g., farming, industrial, etc.); and descriptions of nearby pipelines and transmission lines, as well as transportation access (rail, road, barge, etc.)*

(b) (4) [redacted] The surrounding land use is primarily residential, commercial and light-industrial in nature.

[redacted]

b) Atmospheric Conditions/Air Quality

*This section shall identify the air quality control regions where the project is located; and describe the local climate and existing air quality conditions in the immediate vicinity of the proposed site.*

.

c) Hydrologic Conditions/Water Quality

*This section shall identify any watersheds and downstream drainage, surface and groundwater quality (nearby aquifers and the depth of groundwater) in the project area, existing floodplains, unique aquatic habitats, recreational areas, public water supplies; describe any constraints on water availability imposed by treaties, court decree, state and Federal water laws; and identify existing wastewater treatment and/or disposal facilities*

(b) (4)

d) Geologic/Soil Conditions

*This section shall describe the topographic stability (e.g., formations and/or faulting), the productivity of soil, any unique soil species, and the soil's susceptibility to erosion.*

(b) (4)

It is important to note that groundwater flow direction can be influenced locally and regionally by the presence of local wetland features, surface topography, recharge and discharge areas, horizontal and vertical inconsistencies in the types and location of subsurface soils, and proximity to water pumping wells.

e) Vegetation and Wildlife Resources

*This section shall describe any indigenous flora and fauna, state and Federally listed endangered or threatened species and their habitats, and sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.*

Approximately 90 percent of the Subject Property is paved and/or covered by the Site building. The area is not known to have any endangered or threatened species of flora or fauna, their habitats or sensitive habitats.

f) Socioeconomic Conditions

*This section shall discuss the population in the project area, and shall describe the employment and labor mix.*

The information below is from the City of San Jose, Data USA website:

"In 2019, San Jose, CA had a population of 1.02M people with a median age of 37.4 and a median household income of $115,893. Between 2018 and 2019 the population of San Jose, CA declined from 1.03M to 1.02M, a −0.809% decrease and its median household income grew from $113,036 to $115,893, a 2.53% increase. San Jose, CA is home to a population of 1.02M people, from which 82.6% are citizens.

The 5 largest ethnic groups in San Jose, CA are Asian (Non-Hispanic) (37.6%), White (Non-Hispanic) (25%), White (Hispanic) (17.5%), Other (Hispanic) (10.4%), and Two+ (Non-Hispanic) (3.14%). 59.1% of the households in San Jose, CA speak a non-English language at home as their primary language.

82.6% of the residents in San Jose, CA are U.S. citizens The most common foreign languages spoken in San Jose, CA are Spanish (214,745 speakers), Vietnamese (101,854 speakers), and Chinese (Incl. Mandarin, Cantonese) (79,793 speakers).

Males in California have an average income that is 1.26 times higher than the average income of females, which is $64,688. The income inequality in California (measured using the Gini index) is 0.497, which is higher than the national average.

The economy of San Jose, CA employs 542,000 people (2019). The largest industries in San Jose, CA are Manufacturing (88,904 people), Professional, Scientific, & Technical Services (81,707 people), and Health Care & Social Assistance (65,213 people), and the highest paying industries are Information ($121,466), Management of Companies & Enterprises ($120,565), and Professional, Scientific, & Technical Services ($115,384.

The most common job groups, by number of people living in San Jose, CA, are Management Occupations (68,227 people), Computer & Mathematical Occupations (53,774 people), and Office & Administrative Support Occupations (47,451 people).

In 2019, the median property value in San Jose, CA was $999,900, and the homeownership rate was 55.2%. Most people in San Jose, CA drove alone to work, and the average commute time was 30.3 minutes. The average car ownership in San Jose, CA was 2 cars per household."

g) Historic/Cultural Resources

*The section shall describe any historic and/or cultural places in the project area, as well as archeological sites.*

There are no known historic or cultural places in the project site.

There are no known archeological sites on the property.

h) Visual Resources

*This section shall describe any scenic vistas or existing aesthetic landscaping in the project area.*

The project is in an ordinary industrial, residential, commercial urban environment with no scenic vistas associated with or affected by the project. There is no existing aesthetic landscaping in the project area.

i) Health and Safety Factors

*This section shall discuss current emissions (toxic and non-toxic), effluents, and noise levels at the project area.*

At the Applied Materials site, the project would involve the use and handling of Lithium metal. Lithium is a reactive metal and has flammable and toxic properties when reacting in its solid or liquid form. AMAT has expertise in handling this material in our B75. We have a permitted, ~3000 sf dry room with a state of the art fire suppression system. Our equipment has been engineered to the specific requirements of NFPA 484. We have best practices in place for handling the materials including procedures, PPE, and industrial hygiene controls. Our engineers and scientists are trained and have many years of hands-on experience with lithium metal handling and deposition onto various substrates. For lithium metal surface protection, CO2 will be flooded into at atmospheric pressure and pumped out of the process chamber with appropriate interlocks and sensor alarms. [redacted] If this project requires the addition of new chemistries to AMAT B75 that introduce additional hazards, a comprehensive design review will occur and will include permits, engineering controls, procedures, and PPE. The EQ will be updated accordingly.

(b) (4)

## B. ENVIRONMENTAL IMPACTS OF THE WORK TO BE PERFORMED.

*This section of the Environmental Volume shall describe the anticipated environmental impacts from the project. It shall describe all impacts and consequences of the project (at the selected site[s] and the alternative site[s], if appropriate). The existing environment (described in Section A.3) shall be evaluated in terms of the potential impacts from any construction, operation/testing, and disposition activities. Any mitigative measures that will address these impacts shall also be identified.*

*The description shall address the environmental categories listed below. Please ensure that all direct, indirect, short-term, and long-term impacts resulting from project activities are identified clearly.*

### 1. Land Use

*This section shall describe land use impacts from any construction and operation activities; waste disposal problems (for non-toxic, toxic, and/or hazardous substances); and effluent discharges requiring the development of settling ponds.*

No change in current land use is expected as a result of this project. The land use will generally be similar to the current land use. Ordinary light industrial facility construction activities will occur onsite. There will be no major excavations, settling ponds, changes in site drainage, particulate emissions, noise, or effluent discharges resulting from either the construction or land use. Solid and hazardous wastes will be disposed in accordance with federal, state, and local regulations with no onsite disposal. Most of the equipment upgrade activities will occur inside the building or on the roof. At this time, no physical changes to the building structure are planned as part of this project.

Project activities will be conducted over the next five years. Applied will acquire any additional local permits (Fire, Hazmat) and renewals for the installation and operation of equipment for the project.

## 2. Atmospheric Conditions/Air Quality

*This section shall discuss projections in air quality changes; estimated process emissions (e.g., stack emissions); construction emissions from land disturbance or the operation of machinery/equipment, solid waste disposal operations, coal handling, etc.; and the source, emission rate, duration, and frequency of all emissions.*

The project would involve the use and handling of Lithium metal. Lithium is a reactive metal and has flammable and toxic properties when reacting in its solid or liquid form. AMAT has expertise in handling this material in our B75. We have a permitted dry-room with a state of the art fire suppression system. Our equipment has been engineered to the specific requirements of NFPA 484. We have best practices in place for handling the materials including procedures, PPE, and industrial hygiene controls. Our engineers and scientists are trained and have many years of hands-on experience with lithium metal handling and deposition onto various substrates. For lithium metal surface protection, CO2 will be flooded into at atmospheric pressure and pumped out of the process chamber with appropriate interlocks and sensor alarms. [redacted] If this project requires the addition of new chemistries to AMAT B75 that introduce additional hazards, a comprehensive design review will occur and will include permits, engineering controls, procedures, and PPE. The EQ will be updated accordingly.

(b) (4) [redacted] If additional chemistries are introduced, they will be reviewed to make sure the correct permits and engineering controls are implemented to ensure air emissions are controlled.

Project activities will be conducted over the next five years. Applied will acquire any additional local permits (Fire, Hazmat) and renewals for the installation and operation of equipment for the project.

The project will not generate any significant amounts of ozone depleting substances.

## 3. Hydrologic Conditions/Water Quality

*This section shall describe any changes in groundwater/surface water quality and quantity, stream diversion resulting from construction, runoff from storage piles (source, discharge rate, discharge*

*frequency and duration), leachates from waste disposal sites; and wastewater treatment and discharges.*

The facility is not in a floodplain.

Applied Materials operations will not affect groundwater sources, groundwater quality, and will not affect any existing groundwater conditions.

## 4. Geologic/Soil Conditions

*This section shall describe any subsidence that might be caused by construction; any possible erosion, stream diversion, floodplain and wetland intrusion, and any increase or decreases in soil permeability and filtration.*

No excavations are planned as part of the project. That excavation will not affect any geologic conditions onsite. A qualified Civil Engineer participates in the design effort to ensure that no physical changes onsite affect surface drainage or soil conditions.

## 5. Vegetation and Wildlife Resources

*This section shall describe any impacts to indigenous flora and fauna, state and Federally listed endangered species and their habitats, and sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.*

The project will not affect any indigenous flora or fauna. There are no Federally listed endangered species of their habitats onsite or in the immediate vicinity (with 1,000 feet). There are no ecologically sensitive terrains in the immediate vicinity and the site is not a wetlands or nesting area for any migratory species of birds.

## 6. Socioeconomic Conditions

*This section shall describe any increases/decreases in labor requirements or changes in labor mix.*

The project may require hiring a small number of additional staff to support operations. It is expected to have a positive impact on local employment. It is expected that the addition of employee and contractors will have a negligible impact on local traffic, and minimal detrimental impact overall because the region has been designed to accommodate the expected traffic for lab operations, supply trucks, parking, and ordinary personal vehicles.

No other major impacts are expected or planned. The nearby residential districts will not be affected by the Applied Materials operations. There are no K-12 schools in the vicinity.

The areas of the facility and neighborhood were intentionally zoned by the City of San Jose for Industrial Use and Residential zones, respectively, anticipating the use of hazardous substances by industrial users.

## 7. Historic/Cultural Resources

*This section shall describe any disturbance to historical or archaeological sites caused by construction, interference with Native American tribal or other religious practices or sites; impacts on local community character.*

There are no known historical or archaeological characteristics or resources onsite that would be affected by the project.

## 8. Visual Resources

*This section shall describe any impacts to scenic vistas or existing aesthetic landscaping.*

The physical changes onsite will be in accordance with the City of Sunnyvale Planning Department guidelines for visual aspects and the work will be accomplished under permits to meet those requirements. Permits will be obtained where necessary to meet the local ordinances.

There are no scenic vistas associated with the site. The property is located in an ordinary urban environment and is surrounded by other buildings.

## 9. Health and Safety Factors

*This section shall discuss occupational hazards of project activities; exposure to toxic/hazardous substances; and increases in ambient noise, odor, and heat.*

The project would involve the use and handling of Lithium metal. Lithium is a reactive metal and has flammable and toxic properties when reacting in its solid or liquid form.

(b) (4) [redacted] controls are implemented to ensure air emissions are controlled.

Project activities will be conducted over the next five years. Applied will acquire any additional local permits (Fire, Hazmat) and renewals for the installation and operation of equipment for the project.

The project will not generate any significant amounts of ozone depleting substances.

Unspecified amounts of metals, mylar, plastics, and wiring will be used in the project area including

A variety of small amounts of laboratory chemicals including mineral acids and bases, metal salts, lithium compounds, and organometallic compounds will be used and disposed as hazardous wastes. [redacted]

**Hazards**: The project will involve the use and handling of metallic lithium, inert gases. All such handling will occur in service, chemical storage or lab areas, and within the interior Research and Development building. The hazardous materials storage, handling and project activities that involve these materials would pose no risk to the public. All hazardous materials would be managed in accordance with federal, state, and local environmental regulations.

**Mitigations**: The facility poses a negligible risk to the General Public as a result of onsite activities or offsite consequences. Applied has expertise in handling this material in our B75. We have a permitted dry-room with a state of the art fire suppression system. Our equipment has been engineered to the specific requirements of NFPA 484. We have best practices in place for handling the materials including procedures, PPE, and industrial hygiene controls. Our engineers and scientists are trained and have many

years of hands-on experience with lithium metal handling and deposition onto various substrates. For lithium metal surface protection, CO2 will be flooded into at atmospheric pressure and pumped out of the process chamber with appropriate interlocks and sensor alarms. [redacted] If this project requires the addition of new chemistries to AMAT B75 that introduce additional hazards, a comprehensive design review will occur and will include permits, engineering controls, procedures, and PPE. The EQ will be updated accordingly.

**10. Solid and Hazardous Wastes**

(b) (4)

*This section shall describe any and all waste material that is generated from project activities. This description shall include the source/type of any and all wastes produced (e.g., fly ash, bottom ash, scrubber sludge, etc.), and the approximate weight, density, and volume of the waste, and its method of disposal, location, and any permitting requirements necessary.*

All of our waste will be considered RCRA waste. [redacted]

**11. Impacts on Regional or Local Plans**

*This section shall describe any impacts to regional or local plans for fuel, water resources, solid waste, land, air quality, and labor force; commitment of resources and opportunities to reuse and recycle resources (wastes, water).*

The project is not expected to have any significant impact on regional or local land use plans or local resources.

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## C. POTENTIAL LIABILITY TO DOE OF EXISTING CONDITIONS AT THE SITE(S).

*This section shall discuss any potential conditions for exposing the DOE to previous liability. It should detail any previous research, development, construction, and/or demonstration testing that could potentially have impacts on the existing project site(s) and therefore, the proposed project.*

Applied will minimize and effectively prevent liability to both Applied Materials and the DOE by maintaining an effective Environmental, Health and Safety Program, in compliance with the company's environmental permits. A system of routine daily and weekly inspections and corrective actions where needed is already in place.

When the project ends, the equipment and materials for the project will be evaluated to determine the best course of action. This may include repurposing, recycling, disposal as hazardous waste, decontamination, storage, or disposal in landfill. Applied will follow our standard protocol for declaring and evaluating used equipment, and this process will include the process team, safety, environmental, facilities, engineering and others as needed.

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## D. ABILITY TO MEET COMPLIANCE REQUIREMENTS AT THE SITE(S).

*This section shall identify all of the environmental laws and regulations (Federal, state, and local) for which compliance would be necessary. It should include but should not be limited to the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, Toxic Substance Control Act, Water Pollution Control Act, Clean Air Act, and Occupational Safety and Health Act. Any necessary permits, manifest, etc., shall be discussed.*

*The proposer's strategy for meeting all compliance requirements shall be discussed in detail. Identify the best available control technology and feasible practices for compliance with Federal air, land use, and water quality statutes. In addition, whether the proposed site is in attainment or non-attainment with current standards shall be discussed.*

Applied Materials maintains a comprehensive compliance calendar to manage compliance with applicable local, state, and federal environmental and safety regulations. In addition, our operations are regularly reviewed against the compliance calendar to ensure that any changes to process are captured and there are no gaps. Li-ion battery related development at Applied goes back a dozen years. The team has developed expertise and training for safe storage, handling and processing of related hazardous materials, including cathode, anode, electrolytes and Li metal.

## E. EXPERIENCE AND APPROACH TO THE IDENTIFICATION AND RESOLUTION OF ENVIRONMENTAL ISSUES.

*This section of the Environmental Volume shall consist of a discussion of the following areas:*

1. *All directly related education/experience of key project members in each of the following areas:*
   - *Air quality management*

Applied Materials' environmental management team has over 60 years of regulatory and compliance experience meeting applicable local, state, and federal regulations around air quality management. Each facility is assigned a Environmental Engineer that reviews and signs off on any new installation and use to ensure that air quality compliance is assured prior to starting the equipment. Applied Materials also maintains a vigorous change management program (MoC) to ensure that changes to systems are evaluated against air quality requirements.

   - *Surface water and ground water management*

The same Environmental management responsible for air quality management is response for surface water and ground water management. We have a vigorous storm water management program, including storm drains that are only opened during active rain events. We have a strong audit, review, and management program as well as employee and contractor education program to ensure that materials are disposed of properly and no materials are disposed of to the ground.

   - *Solid and liquid waste management and disposal practices*

Applied Materials utilizies a 3rd party disposal vendor who ensures that all solid and liquid waste is managed appropriately and in compliance with applicable local, state, and federal disposal requirements. The program includes labelling, identification, packaging, profiling, manifests, shipping and disposal. This vendor is overseen by our Facilities team with compliance oversight from our EHS department.

- *Noise, land use, ecological resources, archaeological, cultural, and historical resources management*

Applied Materials meets or exceeds local requirements for municipal installations, including requirements for noise, land use, and ecological, archaelogical, cultural, and historical resources.

- *Environmental permit applications, amendments, and renewals*

Applied Materials maintains a comprehensive compliance calendar to manage compliance with applicable local, state, and federal EHS regulations. In addition, Applied has a process to address EHS concerns related to our operations. These are regularly reviewed against the compliance calendar to ensure that any changes to process are captured and to avoid compliance gaps.

*2 The offeror's experience in addressing and resolving environmental concerns during the performance of past projects of similar size and complexity including the obtaining of necessary permits.*

Applied Materials' environmental management team has over 60 years of regulatory and compliance experience meeting local, state, and federal regulations around air quality management. Each facility is assigned an Environmental Engineer that reviews and signs off on any new installation and use to ensure that air quality compliance is assured prior to starting the quipment. Applied Materials also maintains a vigous change management program (MoC) to snure that changes to systems are evaluated agianst air quality requirements.

*3 Any of the offeror's existing written environmental policies, procedures, or plans currently in place and considered essential to the conduct of the offeror's commercial business operation.*

Each facility is assigned an Environmental Engineer that reviews and signs off on any new installation and use to ensure that air quality compliance is assured prior to starting the quipment. Applied Materials also maintains a vigous change management program (MoC) to ensure that changes to systems are evaluated agianst air quality requirements. In addition to this we also have a Chemical Authorization system which requires Safety and Environmental approval prior to bringing new chemicals on site. Together these program help to ensure that environmental concerns are met. As a global company with R&D and manufacturing sites across several countries and several states within the US, Applied Materials has vast experience addressing local regulations. The annual general and specific safety training requirements include recertifications for employees and contractors.

Note: This document may be used as a tool to develop responses to the questions in the online version of the EQ-1. The online version of the EQ-1 must still be completed.

If you use this form, you can cut and paste the responses into the online version of the EQ-1 in the PMC.

You may want to save your completed document for future reference.

DOE F 540
(04-2017)

OMB Number 1910-5175
Exp. 11/30/2020

# OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

## ENVIRONMENTAL QUESTIONNAIRE

(To be completed **on-line only** at: https://www.eere-pmc.energy.gov/NEPA.aspx unless you are instructed otherwise by EERE.)

| SECTION I. PROJECT SUMMARY | |
|---|---|
| NEPA Control Number: | 2678-1530 |
| Project Title: | Advanced Prelithiation and Lithium Anode Manufacturing Facility |
| Recipient: | Applied Materials, Inc. (Applied) |
| (b) (4) Other Participants (Subrecipients, Contractors, etc.): | [redacted] |
| FOA Number: | DE-FOA-0002678 |
| FOA Title: | Bipartisan Infrastructure Law (BIL) Battery Materials Processing and Battery Manufacturing |
| Award Number: | Click here to enter text. |
| DOE Technology Office Point of Contact: | Click here to enter text. |
| DOE Grants Management Specialist: | Click here to enter text. |

## SECTION II. BACKGROUND AND INSTRUCTIONS

Pursuant to the U.S. Department of Energy's National Environmental Policy Act (NEPA) implementing regulations (10 C.F.R. Part 1021), the Office of Energy Efficiency and Renewable Energy (EERE) is required to evaluate the potential environmental impact of projects that it is considering for funding. EERE must determine at the earliest possible time whether any proposed project qualifies for a categorical exclusion under 10 C.F.R. § 1021.410 or will require further environmental review within an environmental assessment or an environmental impact statement.

**You are required to answer the questions below for the project as a whole, including all work to be performed by the Recipient, its subrecipients and contractors, including any work outside of the United States. You may not limit your responses to work performed by the Recipient only unless instructed to do so by EERE.** In completing this questionnaire, you must provide specific information regarding the nature of your proposed project, including information on its size, operations, and the types and quantities of air emissions, wastewater discharges, solid wastes, land disturbances, etc. You should identify the location(s) of the proposed project and describe the activities that would occur at each location.

The form should be completed and signed by the Principal Investigator for the project or another member of your organization who has sufficient knowledge of the project to answer the questions truthfully and accurately.

Failure to fully and adequately complete this form will delay EERE's environmental review of your proposed project. Please note that false statements or misrepresentations may result in civil and/or criminal penalties under 18 U.S.C. § 1001.

BURDEN DISCLOSURE STATEMENT

Public reporting burden for this collection of information is estimated to average 60 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of Information Resources Management Policy, Plans, and Oversight, AD-241-2-GTN, Paperwork Reduction Project (1910-1800), U.S. Department of Energy, 1000 Independence Avenue S.W., Washington, D.C. 20585; and to the Office of Management and Budget (OMB), Paperwork Reduction Project (1910-1800), Washington, D.C. 20503.

## SECTION III. PROJECT EVALUATION

**1a. In the box below, please provide a brief summary of the proposed project activities. Describe physical activities, not goals and objectives. Specify if this project is part of a larger project or connected to another project.**

Example: The proposed project activities include the design, development, fabrication, and field testing of advanced biomass harvesting equipment. Design, development, and fabrication activities would occur at our research and development facility adjacent to our manufacturing plant in Dearborn, Michigan. Equipment testing would occur in various agricultural fields in the surrounding area over a two-year period.

(b) (4)

*Explanation:* During the proposed five year project (~2023 - 2028), Applied Materials will install and optimize lithium deposition equipment for high volume manufacturing of advanced lithiated anode and Li-metal anode for electric vehicle batteries and related energy storage applications. [redacted] Applied will continue to use its CA facility located at 555 California Avenue, Sunnivale, CA as a bridge to generate deposited Li samples to be provided to partners and customers for evaluation qualification, while the manufacturing facility site is selected, built and becomes operational in the first half of the project (2023-2025). [redacted] The manufacturing location site address and the required Environmental Questionnaire and Environmental Information Volume will be provided upon final site selection in the next few months.

**1b. Is there other Federal government involvement outside of EERE in any aspect of this project (e.g., funding, permitting, technical assistance, project located on Federally administered land)?**

**Yes** ☐ | **No** ☒

*If you checked "Yes," please list the agency, describe the nature of its involvement, and provide a point of contact at the agency, if known.*

| *Explanation:* N/A |
|---|

**1c. Is the proposed project limited exclusively to intellectual, academic, or analytical activities?**

Intellectual, academic, and analytical activities include, but are not limited to:

- Literature searches and information gathering
- Data analysis
- Computer modeling
- Analytical reviews
- Conceptual design
- Feasibility studies
- Document preparation
- Data dissemination
- Paper studies

*You must answer "No" to this question if the proposed project involves any laboratory research and/or development, physical experiments, pilot-scale projects, demonstration projects, field tests, land-disturbance, construction, or similar activities.*

**Yes** ☐ | **No** ☒

***If you checked "Yes," proceed directly to Section IV (Certification) and complete the information and signatures as requested. If you checked "No," you must complete the entire questionnaire.***

**2a. Is the project fully defined at this point (i.e., all sites and activities are known)?**

**Yes** ☒ | **No** ☐

*If you checked "No," please describe those sites and/or activities/tasks that are yet to be defined and complete the remainder of the questionnaire to the best of your knowledge.*

| *Explanation:* N/A |
|---|

**2b. In the chart below, please describe the following four types of identifying information concerning project activities to be performed:**

**(1) each location where work would be performed, including address or coordinates, names of facilities, and whether this is a Recipient, Subrecipient, or Contractor location;**
**(2) the nature of the location (e.g., urban, industrial, suburban, agricultural, university campus, manufacturing facility) and the current condition and/or use of the site;**
**(3) the types of activities to be conducted at that location;**
**(4) land administration (e.g., BLM, USFWS, DOD, state, private).**

| *(1)*<br>***List all Locations Where Project Activities Would Occur (Facility Name and Address or Coordinates) and Indicate Recipient, Subrecipient, or Contractor*** | *(2)*<br>***Nature of Location and Current Condition/Use*** | *(3)*<br>***Activities to be Performed at Each Location*** | *(4)*<br>***Land Administration*** |
|---|---|---|---|
| **Example 1:**<br>Smith Laboratory (recipient)<br>1234 College Lane<br>Baltimore, MD<br>XYZ Corporation (subrecipient)<br>1232 Industrial Drive<br>Golden, CO | Smith Laboratory – Dedicated University Laboratory Facility<br>XYZ Corporation – Manufacturing Facility in Industrial Park | Activities would include design and fabrication of a gallium-nitrate battery at XYZ Corporation's battery manufacturing facility using existing equipment. The battery would then undergo testing including battery charge/discharge cycling at Smith Laboratory. Data analysis would also occur at Smith Laboratory. (Task1) | Smith Laboratory – State property<br>XYZ Corporation – Private property |
| **Example 2:**<br>Capital High School (recipient)<br>1234 Eagle Lane<br>Golden, CO<br>Lat. 39.7405,<br>Long. -105.167 | High school property in a suburban environment that has been previously disturbed and is owned by the City. | Activities would include the installation of a 50 kW wind turbine adjacent to the football stadium. The final height for the turbine would not exceed 140 feet (hub height) or 170.6 feet (maximum blade height) with a blade radius of 31.5 feet. There is an airport 15 miles away from project site location. (Task 2) | City |
| **Example 3:**<br>Coastal University (recipient)<br>555 Study Drive<br>Bay Harbor, SC<br>Bay Harbor Pier<br>Bay Harbor, SC | Coastal University – Dedicated University Laboratory Facility<br>Bay Harbor Pier – Existing boat launch/dock area of pier—currently utilized by Coastal University for marine studies. | Bird and bat environmental monitoring and data analysis. A model XYZ anabat passive recording device would be installed at the Bay Harbor Pier on an existing platform. This would be used for 12 months and data would be remotely downloaded monthly. The University has a current access and use agreement from Bay Harbor City to conduct research at this location. Data would be analyzed at the Coastal University Laboratory Facility. (Task 3) | City owned and operated pier. |
| **Example 4:**<br>Recipient's geothermal leases in Buffalo Valley, Pershing and Lander Counties<br>Nevada<br>NAD 83<br>Lat. 40.36 N<br>Long. -117.38 W | Federal leases located on BLM-managed lands and private leases held by the recipient. | Magnetotelluric (MT) survey, 2 meter soil probe survey, seismic survey, temperature gradient (TG) well drilling program (~10 wells) followed by slim well confirmation drilling (~2 wells). Maps showing the locations of the MT, 2 meter soil probe, and seismic surveys have been uploaded into the Project Management Center. Locations of TG and slim wells will be provided once locations have been determined based on the results of the survey work. (Task 4) | BLM (Battle Mountain and Winnemucca District Offices) and private |

| *(1)* *List all Locations Where Project Activities Would Occur (Facility Name and Address or Coordinates) and Indicate Recipient, Subrecipient, or Contractor* | *(2)* *Nature of Location and Current Condition/Use* | *(3)* *Activities to be Performed at Each Location* | *(4)* *Land Administration* |
|---|---|---|---|
| Applied Materials, Inc. (Recipient); B-75, 555-557 E. California Avenue, Sunnyvale, CA 94086 | Applied Materials Class F Occupancy Laboratory in Industrial Zoned area (b) (4) | Applied Materials will install and optimize lithium deposition and transfer equipment for high volume manufacturing of advanced Prelithiated and Lithium metal anodes for electric vehicle batteries. [redacted] | Applied Materials leased space – Privately owned property in Santa Clara County, CA |
| Applied Materials, Inc. (Recipient); Manufacturing site selection in early stage – to be completed before award agreement | Looking for Class H Occupancy, Manufacturing sites. [redacted] (b) (4) | Activities would include setting up advanced prelithiation and Li-metal anode manufacturing, testing, characterization, metrology and QC lab, [redacted] and optimizing high volume manufacturing ultra-lithium deposition and transfer anode process for sampling to customers and project partners for manufacturing qualification of advanced batteries | TBD – Environmental Questionnaire will be updated after final site selection decision with related agreements in place. |

| | | | | |
|---|---|---|---|---|
| [redacted] (b) (4) | [redacted] | [redacted] | [redacted] | |
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**2c. In the box below, please identify and describe: (1) any known or potential health and safety hazards to the public or project workers that may result from or are associated with your proposed project; and (2) any efforts that would be taken to mitigate these hazards. <u>Describe individually for each site discussed in Question 2b.</u>**

Example (Hazards): The project would involve the use and handling of various hazardous materials, including metals and industrial solvents. All such handling would occur in-lab, and our organization is dedicated to proper hazardous material handling and disposal practices, so the project activities that involve these materials would pose no risk to the public. All hazardous materials would be managed in accordance with Federal, state, and local environmental regulations.

Example (Mitigation): Existing corporate health and safety policies and procedures would be followed, including employee training, proper protective equipment, engineering controls, monitoring, and internal assessments. Additional policies and procedures would be implemented as necessary as new health and safety risks are identified. This would help ensure compliance with applicable health and safety regulations, and minimize health and safety risks to employees and the public.

*Explanation:* At the Applied Materials site, the project would involve the use and handling of lithium metal. Lithium is a reactive metal and has flammable and toxic properties when reacting in its solid or liquid form. Applied has expertise in handling this material in our B75. We have a permitted ~3000 sf dryroom with a state of the art fire suppression system. Our equipment has been engineered to the specific requirements of NFPA 484. We have best practices in place for handling the materials

including proecedures, PPE, and industrial hygiene controls. Our engineers and scientists are trained and have many years of hands-on experience with lithium metal handling and deposition onto various substrates. For lithium metal surface protection, CO2 will be flooded into at atmospheric pressure and pumped out of the process chamber with appropriate interlocks and sensor alarms. [redacted] If this project requires the [redacted]ddition of new chemistries to [redacted] B75 that introduce additional hazards, a comprehensive design review will occur and will include permits, engineering controls, procedures, and PPE. The EQ will be updated accordingly.

(b) (4)

**2d. In the box below, please identify and describe any of the following that would be associated with the proposed project. <u>Describe individually for each site discussed in Question 2b.</u>**

**(1) any physical modification of existing facilities or construction of new facilities (this does NOT include modification to equipment, only facilities);**
**(2) ground disturbing activities;**
**(3) any change in the use, mission, or operation of existing facilities;**
**(4) installation or deployment of equipment outdoors including the area of disturbance, what currently exists at the site, the dimensions of the installation, any associated infrastructure, etc.**

Example 1: Physical modification of existing facilities and ground disturbing activities -To accommodate testing facilities necessary for the project, the current testing facility would have to be expanded by approximately 4,500 square feet.

Example 2: Change in use of existing facility - A room within our facility that has served as a dedicated wind tunnel would be modified to serve as an environmental test chamber. This would require the adaptation of the chamber's construction to partition off part of the room and seal it to allow generated environmental fluctuations within.

Example 3: Installation of equipment outdoors and ground disturbing activities - The proposed turbine location is on school property located in a previously disturbed area south of the existing school building and near the high school athletic facilities and fields. East of the school are two golf courses; south and north are single family residential neighborhoods; and to the west are two public park properties. There are wooded areas located on the school property to the south and west. The foundation of the wind turbine would be approximately 25 square feet with an additional 5 square feet of disturbance during construction. The foundation would be approximately 10-15 feet in depth. There would be a minor, temporary land disturbance adjacent to the proposed site for crane work and the tower staging area. Existing roads would be used to access the project location.

*Explanation:* N/A. None anticipated at this time.

**2e. In the box below, please identify and describe any existing, modifications to, or new permits, licenses, or authorizations that would be required to perform project activities (such as environmental permits, operating permits, or drilling permits). <u>Describe individually for each site discussed in Question 2b.</u>**

Example 1: The project would generate small amounts of effluent waste which will be discharged into the Potomac River, requiring our organization to secure the requisite discharge permit pursuant to state and Federal regulations.

Example 2: The project activities would be conducted for the next three years. We would be required to replace our current solid waste disposal permit with an updated permit that may alter the nature of what and how we are permitted to dispose of solid waste.

Example 3: The project activities would take place in marine navigable waters and would require permits from the U.S. Coast Guard and the U.S. Army Corps of Engineers.

*Explanation:* Project activities will be conducted over the next five years. Applied will acquire any additional local permits (Fire, Hazmat) and renewals for the installation and operation of equipment for the project.

**2f. In the box below, please list the estimated quantities of materials to be used (e.g., feedstock, chemicals, water) and produced by the project (e.g., biofuel). Describe individually for each site discussed in Question 2b.**

*Explanation:* Per the fire code and existing permits, Applied is allowed up to 100 pounds of lithium inside of our dry room and controlled areas. This limit will be maintained with the new work. [redacted] The facility has up to date permits for the gases.

(b) (4)

**2g. In the box below, please quantify, to the extent possible, all emissions into the ambient air resulting from project activities. Indicate if the project site is within an attainment or non-attainment area. Describe air emissions individually for each site discussed in Question 2b.**

Note: Potential emissions include, but are not limited to, greenhouse gas emissions, particulate matter, and airborne pollutants. Sources of emissions can include stationary sources, such as boilers, process heaters, generators, and/or solvent usage, or mobile sources such as vehicles. It is presumed that every project would result in some emissions being released into the ambient air, so applicants answering "none" must explain why no emissions would be released. Non-attainment areas are designated parts of the country where air pollution levels persistently exceed the national ambient air quality standards. See 42 U.S.C. 7501(2).

*Explanation:* With our current lithium work, we are seeing low levels of [redacted] being generated when we clean parts or perform maintenance. Low non-flammable percentages of [redacted] are also formed. We control these emissions with ventilation and dilution. If additional chemistries are introduced, they will be reviewed to make sure the correct permits and engineering controls are implemented to ensure air emissions are controlled.

**2h. In the box below, please describe: (1) all non-hazardous wastes that would be generated by the proposed project including recycled materials, and (2) the method of their disposal. Describe individually for each site discussed in Question 2b.**

Note: It is presumed that every project would generate solid wastes, so applicants answering "none" must explain why no waste would be generated. Non-hazardous waste is any garbage, refuse or trash, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. See 40 C.F.R. § 261.2.

*Explanation:* All of our waste will be considered RCRA waste. We have dedicated waste streams to include pure copper recycling, LiOH liquid, and lithium containing materials submerged in mineral oil. Our hazardous waste steward, [redacted] maintains the manifests and regulatory paperwork.

(b) (4)

3. **Is the proposed project near, or does it involve, any of the following resources? Please indicate below any and all resources that could be affected by any project activities.** (See Attachment 1 to the Environmental Questionnaire for resource definitions.)

☐ a. Historical, archeological, or cultural resources (includes listed and eligible resources over 50 years old or of cultural significance)

☐ b. Threatened or endangered species (whether proposed or listed by state or Federal governments), including their habitat

☐ c. Marine mammals or essential fish habitat

☐ d. Floodplains or wetlands

☐ e. Tribal lands or resources of Tribal interest/sensitivity

☐ f. Ocean resources (e.g., coral reefs)

☐ g. Land resources (e.g., tundra, rainforests)

☐ h. Coastal zones

☐ i. Migratory birds, or Golden or Bald Eagles

☐ j. Areas having a special designation (e.g., Federal and state designated wilderness areas, national parks, national natural landmarks, wild and scenic rivers, state and Federal wildlife refuges, and marine sanctuaries)

☐ k. Prime farmland, unique farmland, or other farmland of statewide or local importance

☐ l. Special sources of water (e.g., sole source aquifers)

*If you checked any boxes above, provide a detailed description of: (1) the resources that could be affected, and (2) how project activities may affect those resources.*

*Explanation:* None of the above will be affected.

4. **Does the proposed project involve any of the following activities or areas of concern? Please indicate below any and all activities or areas of concern that exist in the vicinity of your project, are required for your project, or could affect your project.** (See Attachment 1 for definitions of each activity or area of concern.)

☐ a. Clearing or excavation

☐ b. Dredge and/or fill

☐ c. Pre-existing contamination

☐ d. Pesticide use

☐ e. Asbestos or lead-based paint

☐ f. Polychlorinated biphenyls (PCBs)

☐ g. Navigable air space

☐ h. Underground storage tanks

☐ i. Underground extraction/injection

☐ j. Use of a non-renewable resource

*If you checked any boxes above, provide a detailed description of: (1) each activity or area of concern, and (2) the effects of each activity or area of concern on your project and/or the surrounding area.*

*Explanation:* No.

5. **Would the proposed project have the potential to result in impacts to the surrounding community? Please indicate below all areas of concern that exist in the vicinity of your project, are required for your project, or could affect your project.**

☐ a. Visual impacts

☐ b. Populations of low income or minorities (Environmental Justice)

☐ c. Changes in local employment

☐ d. Changes in local traffic patterns or density

☐ e. New transportation access

☐ f. New utility lines or right-of-ways

☐ g. Other impacts

*If you checked any boxes above, please provide a detailed description of: (1) the communities affected, and (2) what effects the project would have.*

*Explanation:* No.

6. **Would the proposed project use, result in, or require the management, storage, transport, or disposal of radioactive, toxic, or hazardous chemicals, waste, or other materials that require special handling?**

   Note: Hazardous chemicals and materials include those which, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may increase the risk of mortality or pose a substantial threat to human health or the environment when improperly stored, transported, disposed of, or otherwise managed.

**Yes** ☐ | **No** ☒

*If you checked "Yes," please provide a detailed description of: (1) the materials; (2) approximate quantity of each; (3) their role in the project; and (4) storage, transport, and disposal procedures for each material.*

*Explanation:* All of our waste will be considered RCRA waste. We have dedicated waste streams to include pure copper recycling, LiOH liquid, and lithium containing materials submerged in mineral oil. Our hazardous waste steward, [redacted] maintains the manifests and regulatory paperwork.

7. **Would the proposed project involve the use or development of recombinant DNA or genetically engineered microorganisms, plants, animals, or similar technologies?**

**Yes** ☐ | **No** ☒

*If you checked "Yes," please provide a detailed description of: (1) the genetic modifications, (2) the safety procedures in place for their handling and use over the course of the project, and (3) how they would be disposed of at the project's conclusion.*

| *Explanation:* N/A |
|---|

**8. Does the project involve the use of any nanoscale materials or nanotechnology?**

Note: Nanotechnology is defined as research and technology development at the atomic, molecular, or macromolecular levels using a length scale of approximately one to one hundred nanometers in any dimension; the creation and use of structures, devices and systems that have novel properties and functions because of their small size; or the ability to control or manipulate matter on an atomic scale.

**Yes** ☐ | **No** ☒

*If you checked "Yes," please describe: (1) the nanoscale materials used, (2) potential risks those materials may pose, and (3) how they would be disposed of.*

| *Explanation:* N/A |
|---|

**9. Is there any public opposition concerning any of the project activities?**

**Yes** ☐ | **No** ☒

*If you checked "Yes," please describe the nature of the opposition and any actions you may have taken or plan to take to address it.*

| *Explanation:* N/A |
|---|

**10. Would the project involve activities or deployments into marine/freshwater aquatic environments?**

**Yes** ☐ | **No** ☒

*If you checked "Yes," please provide a detailed description of: (1) the proposed activities or deployment, (2) where and when these activities would occur, and (3) what permit/authorizations have been or would be acquired for this activity.*

| *Explanation:* N/A |
|---|

**11. Would the proposed project result in a discharge of any type of wastewater, pollutant, or contaminant, including thermal discharges, to a sewer system, stormwater system, soils, retention ponds, or any water resources (e.g., surface water, including lakes, rivers, creeks, and wetlands; and ground water)?**

Note: Under Federal law, the term "pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.

See 33 U.S.C. § 1362(6). The term "contaminant" means any physical, chemical, biological, or radiological substance or matter in water. See 42 U.S.C. § 300f(6).

**Yes ☐ | No ☒**

*If you checked "Yes", please quantify and characterize the wastewater or pollutants and provide a detailed description of the: (1) wastewater, pollutants, or contaminants to be released; and (2) the water resources that may be affected.*

| *Explanation:* N/A |
|---|

**12. Would the proposed project have the potential to generate noise impacts to adjacent communities, employees working at the project site, wildlife, and/or sensitive receptors including hospitals, schools, daycare facilities, and elderly housing?**

**Yes ☐ | No ☒**

*If you checked "Yes", please provide a description of: (1) the receptors that may be impacted and their estimated distance from the project activities, (2) the level of noise generated (in A-weighted decibels (dbA)) to each receptor, and (3) anticipated duration.*

| *Explanation:* N/A |
|---|

**13. Please provide a detailed description of how the project would be decommissioned, including the disposition of equipment and materials.**

| *Explanation:* When the project ends, the equipment and materials for the project will be evaluated to determine the best course of action. This may include repurposing, recycling, disposal as hazardous waste, decontamination, storage, or disposal in landfill. Applied will follow our standard protocol for declaring and evaluating used equipment, and this process will include the process team, safety, environmental, facilities, engineering and others as needed. |
|---|

## SECTION IV. CERTIFICATION

I hereby certify that I am authorized to submit, and I do so hereby submit, the information in this questionnaire on behalf of the Recipient named below. I certify that the information provided herein is accurate and complete as of the date shown below. I understand that false statements or misrepresentations may result in civil and/or criminal penalties under 18 U.S.C. § 1001. If I receive any information that would indicate that any of the above-referenced answers are no longer correct or complete, I agree to notify EERE immediately. If it is necessary for EERE to modify the information I provide, EERE will request that I recertify the revised form.

| | |
|---|---|
| Name | [redacted] (b) (6) |
| Title | [redacted] |

| | |
|---|---|
| Recipient | Applied Materials, Inc. |
| Signature | An electronic signature is required when this form is completed online in the PMC. |
| Date | 06/29/2022 |

**EERE ENVIRONMENTAL QUESTIONNAIRE**
**ATTACHMENT 1**

**Definitions for Question 3 –Resources***

**Historical, Archeological, or Cultural Resources**. The National Historic Preservation Act; the Historic Sites, Buildings and Antiquities Act; the American Indian Religious Freedom Act; and the Archeological Recovery Act provide for the preservation of sites, buildings, structures, or objects of historic, archeological, or architectural significance designated by Indian, Federal, state, or local governments or listed or eligible for listing on the National Register of Historic Places. The Archeological Resources Protection Act, Antiquities Act, and Native American Graves Protection and Repatriation Act also apply if the proposed project is on Federal and tribal land. This item should be checked "yes" if a proposed project is in an area that meets any of the above, or if an archeological survey has not been performed. Provide documentation of any consultation or State Historic Preservation Officer determination letters if available. If this information is not available or a survey has not been conducted recently, DOE may require such a survey to be conducted prior to any proposed project implementation.

**Threatened/Endangered (T/E) Species and/or Critical Habitat.** The Endangered Species Act provides for protection of animals, birds, fish, plants, and other living organisms that are in danger of extinction. A list of T/E species is provided in 50 C.F.R. Part 17. Consultations with the U.S. Department of Interior Fish and Wildlife Service (FWS), National Marine Fisheries Services (NMFS), and the corresponding state agency should be documented. This item should be checked "yes" if any state- or Federally-listed or proposed threatened or endangered species or critical habitat is located in the proposed project area, or could be indirectly affected by the proposed project. If the status of T/E species at the proposed project location is unknown, please contact the local or state office of the FWS or NMFS to obtain a listing of potential species and habitats found in the area.

**Floodplains**. Floodplains are lowlands adjoining inland and coastal waters with a 1 percent or greater chance of inundation in any given year. Indicate "yes" if the proposed project location is in or adjacent to a floodplain area. If documentation is available noting the floodplain boundaries, please provide a copy. Appropriate documentation of the 100 year floodplain [or 500 year floodplain for critical actions**] boundaries include: Flood Insurance Rate Maps or Flood Hazard Boundary Maps prepared by the Federal Emergency Management Agency (FEMA) of the U.S. Department of Homeland Security. Executive Order 11988 Floodplain Management requires Federal agencies to avoid incompatible development in floodplains, and consider the conformance of the proposed project to floodplain standards, potential effects of the proposed projects on floodplains, and potential effects of floodplain modifications on other local properties and improvements.

** Critical actions as defined in the Implementing Guidelines to Executive Order 11988 are activities for which chance of flooding is too great.

**Wetlands**. Wetlands are areas inundated by surface or groundwater with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction, [10 C.F.R. 1022.4]. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflow, mudflats, and natural ponds. Man-made ponds can qualify as wetlands if invasion of appropriate flora or fauna has occurred. Appropriate documentation of presence or absence of wetlands within the area of project effect includes: FWS National Wetlands Inventory; U.S. Department of Agriculture Soil Conservation Service Local Identification Maps; U.S. Geological Service (USGS) Local Identification Maps; USGS Topographic Maps; state wetland inventories; and regional or local government sponsored wetland and land use inventories. Executive Order 11990 Protection of Wetlands requires Federal agencies to consider the effects of proposed projects on wetlands, and to avoid, to the extent possible, destruction and modification of wetlands. If the status of land in or around the proposed project location is unknown, please contact the state or local U.S. Army Corps of Engineer's office.

**Coastal Zones**. Coastal zones are the coastal waters and adjacent shore lands of the Great Lakes, and the Atlantic, Pacific, and Arctic Oceans, Gulf of Mexico, and Long Island Sound. The term "coastal state" includes the states bordering on those bodies, plus Puerto Rico, the Virgin Islands, Guam, the Commonwealth of Northern Mariana Islands, and the Trust Territories of the Pacific Islands and American Samoa. Coastal states have authority regarding actions, which directly affect coastal zones, in accordance with the Department of Commerce regulations promulgated under the Coastal Zone Management Act. Federal activities and Federal development projects must be consistent with state coastal zone management (CZM) programs to the maximum extent possible. Federal activities are those performed by or on behalf of a Federal agency in the exercise of its statutory responsibilities. Indicate "yes" if the proposed project is located in a coastal zone State or is in the vicinity of a coastal zone State. If a consistency determination has been obtained, or a written "negative determination" (indicating that a consistency determination is not required) please provide a copy. See 15 C.F.R. 930.

**Migratory Birds, Golden or Bald Eagles.** Other Federal and state laws that protect wildlife species include the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Examples of protected migratory birds include Canadian geese and great blue herons. This item should be checked "yes" if the proposed project may directly or indirectly impact any of these species or their habitats. If the status of other protected species is unknown in the proposed project location, please contact the local or state office of the FWS to obtain a listing of potential species and habitats found in the area.

**Areas Having a Special Designation.** Various Federal laws restrict the ability of Federal agencies to aid developments affecting national wilderness areas, national memorial parks, national parks, national monuments, national primitive areas, national preserves, national recreational areas, national wild and scenic rivers, national grasslands, national wildlife refuges, national forests, national lakeshore or seashore, and national trails. Indicate "yes" if any of these areas of special environmental or natural significance is located in close proximity to the proposed project location and describe the specific special designation.

**Prime Farmland, Unique Farmland, or Other Farmland of Statewide or Local Importance.** The Farmland Protection Policy Act requires Federal agencies to consider ways to lessen the effects of proposed projects that convert or adversely affect prime farmland which is not currently classified or designated for future urban development or water storage. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. Prime farmland also includes land that possesses the above characteristics, but is being used currently to produce livestock and timber. Prime farmland does not include lands designated for future urban development, such as land that has been identified for commercial, industrial, or residential development by zoning code, ordinance, or a comprehensive land use plan [7 U.S.C. 4201(c)(1)]. The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) field office serving the area can provide assistance in determining whether a proposed location or site meets the definition of prime farmland. Form AD 1006, the Farmland Conversion Impact Rating Form, available at NRCS offices, should be used for this purpose.

**Special Sources of Water.** Through the Safe Drinking Water Act, EPA and states designate Critical Aquifer Protection Areas and Sole or Principal Source Aquifers, and State-Designated Wellhead Protection Areas in accordance with 42 U.S.C. 300h-6(b), 42 U.S.C. 300h-3(e), and 42 U.S.C. 300h-7(e), respectively. Such areas are accorded special protection to assure the quality and availability of public water supplies. Indicate "yes" if the proposed project is located in an area designated for protection (e.g., is included in an area wide groundwater quality protection plan), or would constitute a potential source of contamination within an existing or expected wellhead protection area serving a public water supply. If aquifer designations are not known for the proposed project area, contact the environmental protection office for the State.

* Definitions and requirements are subject to regulatory changes.

**Definitions for Question 4 – Activities or Areas of Concern***

**Clearing or Excavation.** Clearing or excavation refers to the removal of vegetation, soil, sediments, or disturbance of land surfaces and subsurface including cutting, burning, digging, grading, filling, or blasting. Provide the estimated area to be affected, the quantity of material to be added or removed, and the planned disposition of spoils. Describe the potential for runoff or erosion, any control techniques to be employed, and the distance to nearby surface water bodies, including wetlands.

**Dredge and/or Fill.** Dredge and/or fill are the excavation of material from waters of the United States. Filling is the discharge of material into waters of the United States to change the bottom elevation. Waters of the United States are all interstate waters, and intrastate lakes, rivers, streams, mudflats, wetlands, sloughs, plays, or natural ponds. These activities include "ocean dumping" as regulated under Sections 102 and 103 of the Clean Water Act, construction of dams, dikes, piers, or others that could alter the course of waters of the United States. Also included is any shore activity with the potential for runoff to waters of the United States. If available, include documentation of appropriate consultation(s), e.g., with the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act or Sections 9 and 10 of the Rivers and Harbors Act; and with EPA [40 C.F.R. Parts 220-233].

**Pre-Existing Contamination.** Indicate if the proposed project will disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment. Quantify and characterize such pre-existing substances, including whether they are present above background or regulatory levels. Also quantify the volume of contaminated materials (e.g. soil, sediment, groundwater, debris, etc.) which would require transport to a properly permitted treatment, storage, or disposal facility as the result of the proposed project.

**Pesticide Use.** A pesticide is a substance intended for preventing, destroying, repelling, or mitigating any type of pest including insects, rodent, nematode, fungus, or weed, and any substance intended for use as a plant regulator, defoliant, or desiccant. While the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) imposes no requirements on private applicators, commercial pesticide applicators must be certified by the state or U.S. EPA. Additionally, FIFRA requires that certain pesticides known as “restricted use pesticides” (listed in 40 C.F.R. 152.175) to only be applied by certified applicators. If either commercial or private pesticide application or the utilization of restricted use pesticides is anticipated, indicate "yes". If a private application is anticipated, document measures to be undertaken to assure safe storage, use, and disposal.

**Asbestos.** If the proposed project includes demolition or renovation of an existing building, you must determine if asbestos is present. Common asbestos-containing building materials may include but are not limited to floor tile, mastics, wall board, joint compound, acoustic ceiling tiles, thermal insulation, spray-on fire proofing, glazing, caulking, roof flashing, and felts. Demolition and renovation activities that may impact asbestos containing building materials are regulated by the U.S. Occupational Health and Safety Administration (OSHA) through the Asbestos in Construction Standard and asbestos air emissions from asbestos abatements are regulated by the EPA as a hazardous air pollutant under the Clean Air Act (CAA). Include a description of measures to be undertaken to comply with asbestos removal requirements of 29 C.F.R. 1926.1100 and 40 C.F.R. 61 (Subpart M).

**Polychlorinated Biphenyls (PCBs).** PCBs are a family of man-made organic chemicals that were domestically manufactured from 1929 until banned in 1979 due to their toxicity and persistence in the environment. Given their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were largely used as dielectric and coolant fluids in transformers, capacitors, electric motors, etc. Manufacture, processing, transport, use, marking, storage, and disposal of PCBs are regulated by EPA [40 C.F.R. Part 761] in accordance with the Toxic Substances Control Act. Some states also regulate PCBs as hazardous waste. If the proposed project involves replacement or removal of capacitors, transformers, voltage regulators, circuit breakers, switches, cables, electromagnets, or other electrical equipment, presence or absence of PCBs should be ascertained. A "yes" indication should be supported with information on the anticipated concentration and quantity of PCB oil, and the intended method/location of disposal.

**Navigable Air Space.** The U.S. Department of Transportation Federal Aviation Administration (FAA) regulates objects which invade navigable air space or otherwise constitute an obstruction to air navigation, and determines whether such activities constitute a navigation hazard. Indicate "yes" if the proposed project involves construction or alteration more than 200 feet above ground level, any construction or alteration in instrument approach areas, and other construction or alteration identified in 14 C.F.R. 77.13. Document notification of the appropriate Manager, Air Traffic Division, of the FAA Regional Office for the area within which the construction or alteration will be located. Copies of FAA Form 7460-1 Notice of Proposed Construction or Alteration may be obtained from the regional FAA office or electronically through FAA's website.

**Underground Storage Tanks**. Indicate "yes" if 10 percent or more of tank volume (including the volume of underground pipes) will be beneath surface of the ground. Indicate if installation, use, or removal of underground storage tanks is anticipated, and whether tank use is/was for storage/collection of hazardous waste, heating oil, other petroleum or petroleum-based substances, stormwater, or wastewater. Describe any leak detection/monitoring methods to be used for storage of hazardous waste or regulated petroleum products like gasoline or diesel.

**Underground Extraction/Injection.** Underground extraction/injection is the subsurface emplacement of fluids through a bored, drilled, or driven well, or through a dug well where the depth of the well is greater than the largest surface dimension. If the proposed project involves construction or use of an injection well, indicate "yes," and describe the class of the well as defined in 40 C.F.R. 146.5, the type and quantity of contaminants (e.g., waste disposal, hydrocarbon or mineral extraction) and whether the injection involves an exempt aquifer as defined in 40 C.F.R. 146.4.

**Use of a Non-Renewable Resource.** Non-renewable resources are naturally occurring substances (e.g., metals, minerals, fossil fuels) that are in limited supply and cannot be replaced or regenerated. The exhaustion or threatened exhaustion of such resources could have significant ramifications. Indicate "yes" if the proposed project would involve a resource that is in limited supply.

* Definitions and requirements are subject to regulatory changes.