OMB Number: 4040 0004
Expiration Date: 03/31/2012

Application for Federal Assistance SF-424

*** 1. Type of Submission:**
- [ ] Preapplication
- [x] Application
- [ ] Changed/Corrected Application

*** 2. Type of Application:**
- [x] New
- [ ] Continuation
- [ ] Revision

* If Revision, select appropriate letter(s):

* Other (Specify):

* 3. Date Received: Completed by Grants.gov upon submission.

4. Applicant Identifier:

5a. Federal Entity Identifier:

* 5b. Federal Award Identifier:

State Use Only:

6. Date Received by State:

7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name: Lilac Solutions, Inc.

* b. Employer/Taxpayer Identification Number (EIN/TIN): [redacted] (b) (4)

* c. Organizational DUNS: [redacted] (b) (4)

d. Address:

* Street1: 1700 20th St.

Street2:

* City: Oakland

County/Parish: Alameda

* State: California

Province:

* Country: USA: UNITED STATES

* Zip / Postal Code: 94607-1639

e. Organizational Unit:

Department Name:

Division Name:

f. Name and contact information of person to be contacted on matters involving this application:

Prefix: Mr.

* First Name: David

Middle Name:

* Last Name: Gelinas

Suffix:

Title: Chief Financial Officer

Organizational Affiliation:

* Telephone Number: [redacted] (b) (6)

Fax Number:

* Email: david.gelinas@lilacsolutions.com

Application for Federal Assistance SF-424

9. Type of Applicant 1: Select Applicant Type:

Small Business

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

Department of Energy

11. Catalog of Federal Domestic Assistance Number:

81.086

CFDA Title:

Conservation Research and Development

*** 12. Funding Opportunity Number:**

DE-FOA-0002678

* Title:

Department of Energy (DOE)Office of Manufacturing and Energy Supply Chains (MESC) and Office of Energy Efficiency and Renewable Energy (EERE) Bipartisan Infrastructure Law (BIL) Battery Materials Processing and Battery Manufacturing (AOI 5)

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

Add Attachment | Delete Attachment | View Attachment

*** 15. Descriptive Title of Applicant's Project:**

Unlocking U.S. Lithium Production through Innovative Separation Processing

Attach supporting documents as specified in agency instructions.

Add Attachments | Delete Attachments | View Attachments

Application for Federal Assistance SF-424

16. Congressional Districts Of:

* a. Applicant: CA-013
* b. Program/Project: NV-002

Attach an additional list of Program/Project Congressional Districts if needed.

NV-004, UT-001, UT-002 | Add Attachment | Delete Attachment | View Attachment

17. Proposed Project:

* a. Start Date: 01/01/2023
* b. End Date: 12/31/2027

18. Estimated Funding ($):

* a. Federal	50,000,000
* b. Applicant	129,300,000
* c. State	
* d. Local	
* e. Other	
* f. Program Income	
* g. TOTAL	179,300,000

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

- [ ] a. This application was made available to the State under the Executive Order 12372 Process for review on _____.
- [ ] b. Program is subject to E.O. 12372 but has not been selected by the State for review.
- [x] c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)**

- [ ] Yes
- [x] No

If "Yes", provide explanation and attach

Add Attachment | Delete Attachment | View Attachment

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

- [x] ** I AGREE

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix:	
* First Name:	David
Middle Name:	
* Last Name:	Snydacker
Suffix:	Ph.D
* Title:	Chief Executive Officer
* Telephone Number:	[redacted] (b) (6)
Fax Number:	
* Email:	david@lilacsolutions.com
* Signature of Authorized Representative:	DocuSigned by: David Henry Snydacker C92B52C806EF42E...
* Date Signed:	6/10/2022

Completed by Grants.gov upon submission.

August 2005

U.S. DEPARTMENT OF ENERGY

FINANCIAL ASSISTANCE CERTIFICATIONS AND ASSURANCES FOR USE WITH SF 424

Applicant: Lilac Solutions, Inc.

Solicitation No.: **DE-FOA-0002678**

The following certifications and assurances must be completed and submitted with each application for financial assistance. The name of the person responsible for making the certifications and assurances must be typed in the signature block on the forms.

Certifications Regarding Lobbying; Debarment, Suspension and Other Responsibility Matters; and Drug Free Workplace Requirements

DOE F 1600.5, Assurance of Compliance Nondiscrimination in Federally Assisted Programs

CERTIFICATIONS REGARDING LOBBYING; DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS; AND DRUG FREE WORKPLACE REQUIREMENTS

Applicants should refer to the regulations cited below to determine the certification to which they are required to attest. Applicants should also review the instructions for certification included in the regulations before completing this form. Signature of this form provides for compliance with certification requirements under 10 CFR Part 601 "New Restrictions on Lobbying," 10 CFR Part 606 "Governmentwide Debarment and Suspension (Nonprocurement) and 10 CFR Part 607 "Governmentwide Requirements for Drug-Free Workplace (Grants)." The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of Energy determines to award the covered transaction, grant, or cooperative agreement.

1. LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

2. ADDITIONAL LOBBYING REPRESENTATION

Applicant organizations which are described in section 501(c)(4) of the Internal Revenue Code of 1986 and engage in lobbying activities after December 31, 1995, are not eligible for the receipt of Federal funds constituting an award, grant, or loan.

As set forth in section 3 of the Lobbying Disclosure Act of 1995 as amended, (2 U.S.C. 1602), lobbying activities are defined broadly to include, among other thins, contacts on behalf of an organization with specified employees of the Executive Branch and Congress with regard to Federal legislative, regulatory, and program administrative matters.

Check the appropriate block:

The applicant is an organization described in section 501(c)(4) of the Internal Revenue Code of 1986? ☐ Yes ☒ No

If you checked "Yes" above, check the appropriate block:

The applicant represents that after December 31, 1995 it ☐ has ☐ has not engaged in any lobbying activities as defined in the Lobbying Disclosure Act of 1995, as amended.

3. DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust

statutes or commission of embezzlement, theft, forgery, bribery; falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

4. DRUG-FREE WORKPLACE

This certification is required by the Drug-Free Workplace Act of 1988 (Pub.L. 100-690, Title V, Subtitle D) and is implemented through additions to the Debarment and Suspension regulations, published in the Federal Register on January 31, 1989, and May 25, 1990.

ALTERNATE I (GRANTEES OTHER THAN INDIVIDUALS)

(1) The grantee certifies that it will or will continue to provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(b) Establishing an ongoing drug-free awareness program to inform employees about:

(1) The dangers of drug abuse in the workplace;
(2) The grantee's policy of maintaining a drug-free workplace;
(3) Any available drug counseling, rehabilitation, and employee assistance programs; and
(4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will:

(1) Abide by the terms of the statement; and
(2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace not later than five calendar days after such conviction;

(e) Notifying the agency, in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(f) Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted:

(1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State or local health, law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug- free workplace through implementation of paragraphs (a),(b),(c),(d),(e), and (f).

(2) The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance: (Street address, city, county, state, zip code)

1700 20th St., Oakland, CA 94607

☐ Check if there are workplaces on file that are not identified here.

ALTERNATE II (GRANTEES WHO ARE INDIVIDUALS)

(1) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant.

(2) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to every grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

5. SIGNATURE

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above certifications.

Name of Applicant: Lilac Solutions, Inc.

Printed Name and Title of Authorized Representative: David Snydacker, Ph.D., Chief Executive Officer

David Henry Snydacker
SIGNATURE

6/30/2022
DATE

DOE F 1600.5
(06-94)
All Other Editions are Obsolete

OMB Control No.
1910-0400

U.S. Department of Energy

Assurance of Compliance

Nondiscrimination in Federally Assisted Programs

OMB Burden Disclosure Statement

Public reporting burden for this collection of information is estimated to average 15 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, Records Management Division, HR-422 - GTN, Paperwork Reduction Project (1900-0400), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget (OMB), Paperwork Reduction Project (1900-0400), Washington, DC 20503.

Lilac Solutions, Inc. (Hereinafter called the "Applicant")

HEREBY AGREES to comply with Title VI of the Civil Rights Act of 1964 (Pub. L.88-352), Section 16 of the Federal Energy Administration Act of 1974 (Pub.L.93-275), Section 401 of the Energy Reorganization Act of 1974 (Pub.L.93-438), Title IX of the Education Amendments of 1972, as amended (Pub.L.92-318, Pub.L.93-568, and Pub.L.94-482), Section 504 of the Rehabilitation Act of 1973 (Pub.L.93-112), the Age Discrimination Act of 1975 (Pub.L.94-135), Title VIII of the Civil Rights Act of 1968 (Pub.L.90-284), the Department of Energy Organization Act of 1977 (Pub.L.95-91), and the Energy Conservation and Production Act of 1976, as amended (Pub.L.94-385) and Title 10, Code of Federal Regulations, Part 1040. In accordance with the above laws and regulations issued pursuant thereto, the Applicant agrees to assure that no person in the United States shall, on the ground of race, color, national origin, sex, age, or disability, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity in which the Applicant receives Federal assistance from the Department of Energy.

Applicability and Period of Obligation

In the case of any service, financial aid, covered employment, equipment, property, or structure provided, leased, or improved with Federal assistance extended to the Applicant by the Department of Energy, this assurance obligates the Applicant for the period during which Federal assistance is extended. In the case of any transfer of such service, financial aid, equipment, property, or structure, this assurance obligates the transferee for the period during which Federal assistance is extended. If any personal property is so provided, this assurance obligates the Applicant for the period during which it retains ownership or possession of the property. In all other cases, this assurance obligates the Applicant for the period during which the Federal assistance is extended to the Applicant by the Department of Energy.

Employment Practices

Where a primary objective of the Federal assistance is to provide employment or where the Applicant's employment practices affect the delivery of services in programs or activities resulting from Federal assistance extended by the Department, the Applicant agrees not to discriminate on the ground of race, color, national origin, sex, age, or disability, in its employment practices. Such employment practices may include, but are not limited to, recruitment advertising, hiring, layoff or termination, promotion, demotion, transfer, rates of pay, training and participation in upward mobility programs; or other forms of compensation and use of facilities.

Subrecipient Assurance

The Applicant shall require any individual, organization, or other entity with whom it subcontracts, subgrants, or subleases for the purpose of providing any service, financial aid, equipment, property, or structure to comply with laws cited above. To this end, the subrecipient shall be required to sign a written assurance form, however, the obligation or both recipient and subrecipient to ensure compliance is not relieved by the collection or submission of written assurance forms.

Data Collection and Access to Records

The Applicant agrees to compile and maintain information pertaining to programs or activities developed as a result of the Applicant's receipt of Federal assistance from the Department of Energy. Such information shall include, but is not limited to, the following: (1) the manner in which services are or will be provided and related data necessary for determining whether any persons are or will be denied such services on the basis of prohibited discrimination; (2) the population eligible to be served by race, color, national origin, sex, age, and disability; (3) data regarding covered employment including use or planned use of bilingual public contact employees serving beneficiaries of the program where necessary to permit effective participation by beneficiaries unable to speak or understand English; (4) the location of existing or proposed facilities connected with the program and related information adequate for determining whether the location has or will have the effect of unnecessarily denying access to any person on the basis of prohibited discrimination; (5) the present or proposed membership by race, color, national origin, sex, age, and disability, in any planning or advisory body which is an integral part of the program; and (6) any additional written data determined by the Department of Energy to be relevant to its obligation to assure compliance by recipients with laws cited in the first paragraph of this assurance.

DOE F 1600.5
(06-94)
All Other Editions are Obsolete

OMB Control No.
1910-0400

The Applicant agrees to submit requested data to the Department of Energy regarding programs and activities developed by the Applicant from the use of Federal assistance funds extended by the Department of Energy, Facilities of the Applicant (including the physical plants, building, or other structures) and all records, books, accounts, and other sources of information pertinent to the Applicant's compliance with the civil rights laws shall be made available for inspection during normal business hours on request of an officer or employee of the Department of Energy specifically authorized to make such inspections. Instructions in this regard will be provided by the Director, Office of Civil Rights, U.S. Department of Energy.

This assurance is given in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts (excluding procurement contracts), property, discounts or other Federal assistance extended after the date hereto, to the Applicants by the Department of Energy, including installment payments on account after such data of application for Federal assistance which are approved before such date. The Applicant recognizes and agrees that such Federal assistance will be extended in reliance upon the representation and agreements made in this assurance and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, the successors, transferees, and assignees, as well as the person(s) whose signature appears below and who are authorized to sign this assurance on behalf of the Applicant.

Applicant Certification

The Applicant certifies that it has complied, or that, within 90 days of the date of the grant, it will comply with all applicable requirements of 10 C.F.R. § 1040.5 (a copy will be furnished to the Applicant upon written request to DOE).

Designated Responsible Employee

David Snydacker, Ph.D., CEO
Name and Title (Printed to Typed)

(b) (6)
Telephone Number

David Henry Snydacker
Signature

6/30/2022
Date

Lilac Solutions, Inc.
Applicant's Name

Telephone Number

1700 20th St.
Address:

Oakland, CA 94607

6/30/2022
Date

Authorized Official:
President, Chief Executive Officer
or Authorized Designee

David Snydacker, Ph.D., Chief Executive Officer
Name and Title (Printed to Typed)

Telephone Number

David Henry Snydacker
Signature

6/30/2022
Date

Instructions and Summary

Award Number: 2678-1564

Award Recipient: Lilac Solutions, Inc.

Date of Submission:

Form submitted by:

(May be award recipient or sub-recipient)

page contains trade secrets, confidential, proprietary, or privileged information exempt from public

Please read the instructions on each worksheet tab before starting. If you have any questions, please ask your EERE contact!
Do not modify this template or any cells or formulas!

1. If using this form for award application, negotiation, or budget revision, fill out the blank white cells in workbook tabs a. hrough j. with total project costs. If using this form for invoice submission, fill out tabs a. hrough j. with total costs for just the proposed invoice and fill out tab k. per the instructions on that tab.
2. Blue colored cells contain instructions, headers, or summary calculations and should not be modified. Only blank white cells should be populated.
3. Enter detailed support for the project costs identified for each Category line item within each worksheet tab to autopopulate the summary tab.
4. The total budget presented on tabs a. through i. must include both Federal (DOE) and Non-Federal (cost share) portions.
5. All costs incurred by the preparer's sub-recipients, vendors, and Federal Research and Development Centers (FFRDCs), should be entered only in sec ion f. Contractual. All other sections are for the costs of the preparer only.
6. Ensure all entered costs are allowable, allocable, and reasonable in accordance with he administrative requirements prescribed in 2 CFR 200, and the applicable cost principles for each entity type: FAR Part 31 for For-Profit entities; and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal enti ies.
7. Add rows as needed throughout tabs a. hrough j. If rows are added, formulas/calculations may need to be adjusted by the preparer. Do not add rows to the Instructions and Summary tab. If your project contains more than five budget periods, consult your EERE contact before adding additional budget period rows or columns.
8. ALL budget period cost categories are rounded to the nearest dollar.

BURDEN DISCLOSURE STATEMENT

Public reporting burden for this collection of information is estimated to average 24 hours 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 (1910-5162), U.S. Department of Energy 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget, Paperwork Reduction Project (1910-5162), Washington, DC 20503.

SUMMARY OF BUDGET CATEGORY COSTS PROPOSED

The values in this summary table are from entries made in subsequent tabs, only blank white cells require data entry

Section A - Budget Summary

(b) (4)

	Federal	Cost Share			Total Costs	Cost Share %	Proposed Budget Period Dates
Budget Period 1							1/1/2023 - 12/31/2023
Budget Period 2							1/1/2024 - 12/31/2024
Budget Period 3							1/1/2025 - 12/31/2025
Budget Period 4							1/1/2026 - 12/31/2026
Budget Period 5							1/1/2027 - 12/31/2027
Total							

Section B - Budget Categories

CATEGORY	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Total Costs	% of Project	Comments (as needed)
a. Personnel								
b. Fringe Benefits								We are not proposing Fringe as part of this project application.
c. Travel								
d. Equipment								
e. Supplies								
f. Contractual								
Sub-recipient	$250,000	$250,000	$250,000	$250,000	$250,000	$1,250,000		
Vendor								
FFRDC	$389,514	$345,065	$100,000	$356,421	$0	$1,191,000		
Total Contractual								
g. Construction								
h. Other Direct Costs								
Total Direct Costs								
i. Indirect Charges								We are not proposing Indirects as part of this project application.
Total Costs								

Additional Explanation (as needed):

This entire page contains trade secrets, confidential, proprietary, or privileged information exempt from public disclosure.

Detailed Budget Justification

a. Personnel

INSTRUCTIONS - PLEASE READ!!!

1. List project costs solely for employees of the entity completing this form. All personnel costs for subrecipients and vendors must be included under f. Contractual.
2. All personnel should be identified by position title and not employee name. Enter the amount of time (e.g., hours or % of time) and the base pay rate and the total direct personnel compensation will automatically calculate. Rate basis (e.g., actual salary, labor distribution report, state civil service rates, etc.) must also be identified.
3. If loaded labor rates are utilized, a description of the costs the loaded rate is comprised of must be included in the Additional Explanation section below. DOE must review all components of the loaded labor rate for reasonableness and unallowable costs (e.g. fee or profit).
4. If a position and hours are attributed to multiple employees (e.g. Technician working 4000 hours) the number of employees for that position title must be identified.
5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Position Title	Budget Period 1			Budget Period 2			Budget Period 3			Budget Period 4			Budget Period 5			Project Total Hours	Project Total Dollars	Rate Basis
		Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 1	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 2	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 3	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 4	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 5			
1	Sr. Engineer (EXAMPLE!!!)	2000	$85.00	$170,000	200	$50.00	$10,000	200	$50.00	$10,000	200	$50.00	$10,000	200	$50.00	$10,000	2400	$190,000	Actual Salary
2	Technicians (2)	4000	$20.00	$80,000	0	$0.00	$0	0	$0.00	$0	0	$0.00	$0	0	$0.00	$0	4000	$80,000	Actual Salary
0.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Rate based on current actual pay rates for this position.
0.0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Rate based on current actual pay rates for this position.
01.05.02	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Rate based on current actual pay rates for this position.
02.04.03	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Rate based on current actual pay rates for this position.
03.03.02	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Rate based on current actual pay rates for this position.
04.03.01	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Rate based on current actual pay rates for this position.
05.03.01

a. Personnel

INSTRUCTIONS - PLEASE READ!!!

1. List project costs solely for employees of the entity completing this form. All personnel costs for subrecipients and vendors must be included under f. Contractual.
2. All personnel should be identified by position title and not employee name. Enter the amount of time (e.g., hours or % of time) and the base pay rate and the total direct personnel compensation will automatically calculate. Rate basis (e.g., actual salary, labor distribution report, state civil service rates, etc.) must also be identified.
3. If loaded labor rates are utilized, a description of the costs the loaded rate is comprised of must be included in the Additional Explanation section below. DOE must review all components of the loaded labor rate for reasonableness and unallowable costs (e.g. fee or profit).
4. If a position and hours are attributed to multiple employees (e.g. Technician working 4000 hours) the number of employees for that position title must be identified.
5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Position Title	Budget Period 1			Budget Period 2			Budget Period 3			Budget Period 4			Budget Period 5			Project Total Hours	Project Total Dollars	Rate Basis
		Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 1	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 2	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 3	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 4	Time (Hrs)	Pay Rate ($/Hr)	Total Budget Period 5			
05.03.01	[redacted]																		Rate based on current actual pay rates for this position.
02.04.03																			Rate based on current actual pay rates for this position.
03.03.02																			Rate based on current actual pay rates for this position.
04.03.01																			Rate based on current actual pay rates for this position.
05.03.01																			Rate based on current actual pay rates for this position.
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(b) (4)

a. Personnel

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01.02.01	[redacted]																		Actual Salary, 3% yearly escalation
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(b) (4)

Detailed Budget Justification

a. Personnel

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5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Position Title	Budget Period 1			Budget Period 2			Budget Period 3			Budget Period 4			Budget Period 5			Project Total Hours	Project Total Dollars	Rate Basis
		Time (Hrs)	Pay Rate	Total Budget Period 1	Time (Hrs)	Pay Rate	Total Budget Period 2	Time (Hrs)	Pay Rate	Total Budget Period 3	Time (Hrs)	Pay Rate	Total Budget Period 4	Time (Hrs)	Pay Rate	Total Budget Period 5			
02.03.01	[redacted]																		Actual Salary, 3% yearly escalation
02.03.01	[redacted]																		Actual Salary, 3% yearly escalation
02.03.01	[redacted]																		Actual Salary, 3% yearly escalation
02.03.01	[redacted]																		Actual Salary, 3% yearly escalation
02.03.01	[redacted]																		Actual Salary, 3% yearly escalation
02.03.01	[redacted]																		Actual Salary, 3% yearly escalation
02.03.02	[redacted]																		Actual Salary, 3% yearly escalation
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02.05.01	[redacted]																		Actual Salary, 3% yearly escalation
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03.02.02	[redacted]																		Actual Salary, 3% yearly escalation
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a. Personnel

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05.02.01	[redacted] (b) (4)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Actual Salary, 3% yearly escalation
05.02.01	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Actual Salary, 3% yearly escalation
05.02.01	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Actual Salary, 3% yearly escalation
	[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	

Escalation

Direct Labor Rates are escalated by 3% per year starting in Budget Period 2, based on the U.S. Department of Labor (DOL) Bureau of Labor Statistics (BLS) Employment Cost Index (ECI). COMPANY used the most recent percentage from the Employment Cost Index (ECI) as published by the DOL BLS for private industry workers, Table 9. Employment Cost Index for wages and salaries, for private industry workers, by occupational group and industry category under "Goods Producing Industries" for the 12-months ending March, 2022 (https://www.bls.gov/news.release/eci.toc.htm). This index indicates a 4.4% increase year over year, however, COMPANY is holding the factor at 3%.

The DOL BLS ECI is a quarterly measure of the change in the cost of labor, free from the influence of employment shifts among occupations and industries. The ECI is particularly well suited as a vehicle to adjust wage rates to keep pace with what is paid by employers for two reasons. First, it is comprehensive. It includes not only wages and salaries but also employer costs for employee benefits and covers nearly all employees in the civilian (non-Federal) economy. Second, it measures the "pure" change in labor costs; that is, it is not affected by changes in relative employment of industries and occupations with different wage and compensation levels.

b. Fringe Benefits

INSTRUCTIONS - PLEASE READ

1. Fill out the table below by position title. If all employees receive the same fringe benefits, you can show "Total Personnel" in the Labor Type column instead of listing out all position titles.
2. The rates and how they are applied should not be averaged to get one fringe cost percentage. Complex calculations should be described/provided in the Additional Explanation section below.
3. The fringe benefit rates should be applied to all positions, regardless of whether those funds will be supported by Federal Share or Recipient Cost Share.
4. Each budget period is rounded to the nearest dollar.

Labor Type	Budget Period 1			Budget Period 2			Budget Period 3			Budget Period 4			Budget Period 5			Total Project
	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	
EXAMPLE Sr. Engineer	$170,000	20%	$34,000	$10,000	20%	$2,000	$10,000	20%	$2,000	$10,000	20%	$2,000	$10,000	20%	$2,000	$38,000
			$0			$0			$0			$0			$0	$0
			$0			$0			$0			$0			$0	$0
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			$0			$0			$0			$0			$0	$0
Total:	**$0**		**$0**	**$0**		**$0**	**$0**		**$0**	**$0**		**$0**	**$0**		**$0**	**$0**

A federally approved fringe benefit rate agreement, or a proposed rate supported and agreed upon by DOE for estimating purposes is required at the time of award negotiation if reimbursement for fringe benefits is requested. Please check (X) one of the options below and provide the requested information if not previously submitted.

A fringe benefit rate has been negotiated with, or approved by, a federal government agency. A copy of the latest rate agreement is/was included with the project application.*

There is not a current federally approved rate agreement negotiated and available.**

*Unless the organization has submitted an indirect rate proposal which encompasses the fringe pool of costs, please provide the organization's benefit package and/or a list of the components/elements that comprise the fringe pool and the cost or percentage of each component/element allocated to the labor costs identified in the Budget Justification (Form EERE 335.1).

**When this option is checked, the entity preparing this form shall submit an indirect rate proposal in the format provided in the Sample Rate Proposal at https://www.energy gov/eere/funding/downloads/sample-indirect-rate-proposal-and-profit-compliance-audit, or a format that provides the same level of information and which will support the rates being proposed for use in the performance of the proposed project.

We are not proposing Fringe as part of the Project Application

c. Travel

INSTRUCTIONS - PLEASE READ!!!

1. Identify Foreign and Domestic Travel as separate items. Examples of Purpose of Travel are subrecipient site visits, DOE meetings, project mgmt. meetings, etc. Examples of Basis for Estimating Costs are past trips, travel quotes, GSA rates, etc.
2. All listed travel must be necessary for performance of the Statement of Project Objectives.
3. Only travel that is directly associated with this award should be included as a direct travel cost to the award.
4. Federal travel regulations are contained within the applicable cost principles for all entity types.
5. Travel costs should remain consistent with travel costs incurred by an organization during normal business operations as a result of the organizations written travel policy. In absence of a written travel policy, organizations must follow the regulations prescribed by the General Services Administration.
6. Columns E, F, G, H, I, J, and K are per trip.
7. The number of days is inclusive of day of departure and day of return.
8. Recipients should enter City and State (or City and Country for International travel) in the Depart from and Destination fields.
9. Each budget period is rounded to the nearest dollar.

SOPO Task #	Purpose of Travel	Depart From	Destination	No. of Days	No. of Travelers	Lodging per Traveler	Flight per Traveler	Vehicle per Traveler	Per Diem Per Traveler	Cost per Trip	Basis for Estimating Costs
	Domestic Travel	**Budget Period 1**									
1	**EXAMPLE!!!** Visit to PV manufacturer			2	2	$250	$500	$100	$160	$2,020	Current GSA rates
01.02.04	Visit to NV1 Site	Oakland, CA	Reno, NV	14	60	$1,750	$500	$0	$840	$185,400	5 months, 12 travellers/month
01.03.03	Visit to UT2 Site	Oakland, CA	Salt Lake City, UT	14	12	$1,750	$500	$0	$840	$37,080	1 months, 12 travellers/month
01.05.02	1/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	7 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.02	2/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	8 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.02	3/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	9 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.02	4/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	10 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.01	5/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	11 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.01	6/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	12 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.01	7/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	13 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate

c. Travel

INSTRUCTIONS - PLEASE READ!!!

1. Identify Foreign and Domestic Travel as separate items. Examples of Purpose of Travel are subrecipient site visits, DOE meetings, project mgmt. meetings, etc. Examples of Basis for Estimating Costs are past trips, travel quotes, GSA rates, etc.
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6. Columns E, F, G, H, I, J, and K are per trip.
7. The number of days is inclusive of day of departure and day of return.
8. Recipients should enter City and State (or City and Country for International travel) in the Depart from and Destination fields.
9. Each budget period is rounded to the nearest dollar.

SOPO Task #	Purpose of Travel	Depart From	Destination	No. of Days	No. of Travelers	Lodging per Traveler	Flight per Traveler	Vehicle per Traveler	Per Diem Per Traveler	Cost per Trip	Basis for Estimating Costs
	Domestic Travel	**Budget Period 1**									
01.05.03.02	8/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	14 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.02	9/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	15 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.02	10/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	16 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.02	11/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	17 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
01.05.03.02	12/1/2023 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	7	7	$1,500	$0	$117	$1,120	$19,157	18 travelers/month, 7 days of travel per month allocated. Current GSA rates used for per-diem. 3 travelers per car estimated, with $50/day estimated rental rate
										$0	
	International Travel										
										$0	
	Budget Period 1 Total									**$452,360**	
	Domestic Travel	**Budget Period 2**									
02.05.01	Visit to NV1 Site	Oakland, CA	Reno, NV	14	60	$1,750	$500	$0	$840	$185,400	5 months, 12 travellers/month
02.01.01	Visit to UT2 Site	Oakland, CA	Salt Lake City, UT	14	108	$1,750	$500	$0	$840	$333,720	9 months, 12 travellers/month
02.02.01	Visit to NV2 Site	Oakland, CA	Reno, NV	14	12	$1,750	$500	$0	$840	$37,080	Site Visits
02.03.01	Visit to UT1 Site	Oakland, CA	Salt Lake City, UT	14	12	$1,750	$500	$0	$840	$37,080	Site Visits
02.04.02	1/1/2024 Travel from Oakland, CA headquarters to Fernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.02	2/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.02	3/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.02	4/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.03	5/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.03	6/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.03	7/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.03	8/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.03	9/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.06	10/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.06	11/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
02.04.06	12/1/2024 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.

c. Travel

INSTRUCTIONS - PLEASE READ!!!

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7. The number of days is inclusive of day of departure and day of return.
8. Recipients should enter City and State (or City and Country for International travel) in the Depart from and Destination fields.
9. Each budget period is rounded to the nearest dollar.

SOPO Task #	Purpose of Travel	Depart From	Destination	No. of Days	No. of Travelers	Lodging per Traveler	Flight per Traveler	Vehicle per Traveler	Per Diem Per Traveler	Cost per Trip	Basis for Estimating Costs
	Domestic Travel	**Budget Period 1**									
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 2 Total									**$823,560**	
	Domestic Travel	**Budget Period 3**									
03.01.01	Visit to NV2 Site	Oakland, CA	Reno, NV	14	8	$1,750	$500	$0	$840	$24,720	Site Visits
03.02.02	Visit to UT1 Site	Oakland, CA	Salt Lake City, UT	14	8	$1,750	$500	$0	$840	$24,720	Site Visits
03.03.02	1/1/2025 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
03.03.02	2/1/2025 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
03.03.02	3/1/2025 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
03.03.02	4/1/2025 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
03.03.02	5/1/2025 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
03.03.02	6/1/2025 Travel from Oakland, CA headquarters toFernley, NV construction site	Oakland CA	Fernley, NV	24	19	$250	$500	$100	$160	$19,190	19 travelers/month, 24 days of travel per month allocated.
										$0	
	International Travel										
										$0	
	Budget Period 3 Total									**$164,580**	
	Domestic Travel	**Budget Period 4**									
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 4 Total									**$0**	
	Domestic Travel	**Budget Period 5**									
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 5 Total									**$0**	
	PROJECT TOTAL									**$1,440,500**	

Proposed travel costs are estimated in accordance with "Travel and Per Diem" and as set forth in the Federal Travel Regulations prescribed by General Services Administration and when applicable, Standardized Regulations Section 925 – Maximum Travel Per Diem Allowances for Foreign Areas – prescribed by the Department of State and are based on estimates of the destinations, frequencies, and duration of travel required for optimal performance of mission objectives. When actual travel dates are unknown the surrogate date for estimating purposes will be one week from the day the estimate is prepared.
Based on FAR 31.205-46(b), air travel costs are quoted at the lowest fare available to COMPANY during normal business hours at the time the proposal was prepared. Lodging, meals, and incidental expenses are based on the current maximum, combined per diem rates published by the Federal Government in the Federal Travel Regulations prescribed by General Services Administration and when applicable, Standardized Regulations Section 925 – Maximum Travel Per Diem Allowances for Foreign Areas – prescribed by the Department of State.
The estimate is inclusive of all taxes and fees including check bag fees each way for domestic travel. All travel costs will be reimbursed at cost plus applicable indirect rates. Client-initiated change fees will be invoiced as incurred.

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
3 4 5	EXAMPLE Thermal shock chamber	2	$70 000	$140 000	Vendor Quote - Attached	Reliability testing of PV modules- Task 4.3
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(b) (4)

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
[redacted]	[redacted] (b) (4)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
[redacted]	[redacted] (b) (4)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(b) (4)

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
[redacted]						
[redacted]						
[redacted]						

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						

(b) (4)

d. Equipment

INSTRUCTIONS - PLEASE READ

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
				Budget Period 1		
[redacted]						
				$0		
				$0		
	Budget Period 2 Total			$49 044 692		
				Budget Period 3		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 3 Total			$0		
				Budget Period 4		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 4 Total			$0		
				Budget Period 5		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 5 Total			$0		
	PROJECT TOTAL			$106,059,254		

(b) (4)

Additional Explanation (as needed):

e. Supplies

INSTRUCTIONS - PLEASE READ

1. Supplies are generally defined as an item with an acquisition cost of $5,000 or less and a useful life expectancy of less than one year. Supplies are generally consumed during the project performance. Please refer to the applicable Federal regulations in 2 CFR 200 for specific supplies definitions and treatment.
2. List all proposed supplies below, providing a basis of costs (e.g. vendor quotes, catalog prices, prior invoices, etc.). Briefly justify the need for the Supplies as they apply to the Statement of Project Objectives. Note that Supply items must be direct costs to the project at this budget category, and not duplicative of supply costs included in the indirect pool that is the basis of the indirect rate applied for this project.
3. Multiple supply items valued at $5,000 or less used to assemble an equipment item with a value greater than $5,000 with a useful life of more than one year should be included on the equipment tab. If supply items and costs are ambiguous in nature, contact your DOE representative for proper categorization.
4. Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.
5. Each budget period is rounded to the nearest dollar.

SOPO Task #	General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
			Budget Period 1			
4,6	EXAMPLE Wireless DAS components	10	$360.00	$3,600	Catalog price	For Alpha prototype - Task 2.4
01 02.04	[redacted]					
01 02.04						
01 03.03						
01 03.03						
				$0		
				$0		
				$0		
				$0		
	Budget Period 1 Total			$25,812		
			Budget Period 2			
02 01.01	[redacted]					
02 01.01						
02 05.01						
02 05.01						
				$0		
				$0		
				$0		
				$0		
	Budget Period 2 Total			$25,812		
			Budget Period 3			
03 01.01	[redacted]					
03 01.01						
03 02.03						
03 02.03						
				$0		
				$0		
				$0		
				$0		
	Budget Period 3 Total			$64,080		
			Budget Period 4			
04 01.01	[redacted]					
04 01.01						
04 02.01						
04 02.01						
				$0		
				$0		
				$0		
				$0		
	Budget Period 4 Total			$64 080		
			Budget Period 5			
05 01.01	[redacted]					
05 01.01						
05 02.01						
05 02.01						
				$0		
				$0		
				$0		
				$0		
	Budget Period 5 Total			$64,080		
	PROJECT TOTAL			$243,864		

(b) (4)

Additional Explanation (as needed):

f. Contractual

INSTRUCTIONS - PLEASE READ!!!

1. The entity completing this form must provide all costs related to sub-recipients, vendors, and FFRDC partners in the applicable boxes below.
2. Sub-recipients (partners, sub-awardees): Subrecipients shall submit a Budget Justification describing all project costs and calculations when their total proposed budget exceeds either (1) $250,000 or (2) 25% of total award costs. These sub-recipient forms may be completed by either the sub-recipients themselves or by the preparer of this form. The budget totals on the sub-recipient's forms must match the sub-recipient entries below. A subrecipient is a legal entity to which a subaward is made, who has performance measured against whether the objectives of the Federal program are met, is responsible for programmatic decision making, must adhere to applicable Federal program compliance requirements, and uses the Federal funds to carry out a program of the organization. All characteristics may not be present and judgment must be used to determine subrecipient vs. vendor status.
3. Vendors (including contractors): List all vendors and contractors supplying commercial supplies or services used to support the project. For each Vendor cost with total project costs of $250,000 or more, a Vendor quote must be provided. A vendor is a legal entity contracted to provide goods and services within normal business operations, provides similar goods or services to many different purchasers, operates in a competitive environment, provides goods or services that are ancillary to the operation of the Federal program, and is not subject to compliance requirements of the Federal program. All characteristics may not be present and judgment must be used to determine subrecipient vs. vendor status.
4. Federal Funded Research and Development Centers (FFRDCs): FFRDCs must submit a signed Field Work Proposal during award application. The award recipient may allow the FFRDC to provide this information directly to DOE, however project costs must also be provided below.
5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Sub-Recipient Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Project Total
2.4	EXAMPLE!!! XYZ Corp.	Partner to develop optimal lens for Gen 2 product. Cost estimate based on personnel hours	$48,000	$32,000	$16,000	$8,000	$4,000	$108,000
0.0	[redacted]							
								$0
								$0
								$0
								$0
								$0
								$0
								$0
								$0
								$0
		Sub-total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(b) (4)

SOPO Task #	Vendor Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Project Total
6	EXAMPLE!!! ABC Corp.	Vendor for developing robotics to perform lens inspection. Estimate provided by vendor	$0	$32,900	$86,500	$0	$0	$119,400
01.05.03	[redacted]							
02.04.05								
01.05.05								
01.05.05								
02.04.02								
02.04.05								
02.02.01								
02.03.01								
03.01.01								
03.02.03								
04.01.01								
04.02.01								
05.01.01								
05.02.01								
01.02.03								
01.03.03								
								$0
								$0
								$0
		Sub-total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(b) (4)

SOPO Task #	FFRDC Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Project Total
0.0	ANL	ANL provides life cycle analysis and technoeconomic modeling of Lilac's technology.	$100,000.00	$100,000.00	$100,000.00	$50,000.00	$0.00	$350,000
0.0	NREL	NREL provides supply chain analysis, analysis of alternative thermal resources for reducing environmental impact and overall operating costs, and analysis of desalination and wastewater treatment at lithium processing project sites. Most of the work is frontloaded in the first two years, with follow-up in BY4 to revise any models and update any reports with performance data from all projects.	$289,514.00	$245,065.00	$0.00	$306,421.00	$0.00	$841,000
								$0
								$0
		Sub-total	$389,514	$345,065	$100,000	$356,421	$0	$1,191,000

	Total Contractual		$12,763,650	$9,645,128	$1,478,107	$3,990,741	$3,634,320	$31,511,946

Additional Explanation (as needed):

g. Construction

PLEASE READ!!!

1. Construction, for the purpose of budgeting, is defined as all types of work done on a particular building, including erecting, altering, or remodeling. Construction conducted by the award recipient is entered on this page. Any construction work that is performed by a vendor or subrecipient should be entered under f. Contractual.

2. List all proposed construction below, providing a basis of cost such as engineering estimates, prior construction, etc., and briefly justify its need as it applies to the Statement of Project Objectives.

3. Each budget period is rounded to the nearest dollar.

Overall description of construction activities: **Example Only!!! - Build wind turbine platform**

SOPO Task #	General Description	Cost	Basis of Cost	Justification of need
	Budget Period 1			
3	EXAMPLE ONLY!!! Three days of excavation for platform site	$28,000	Engineering estimate	Site must be prepared for construction of platform.
	Budget Period 1 Total	$0		
	Budget Period 2			
	Budget Period 2 Total	$0		
	Budget Period 3			
	Budget Period 3 Total	$0		
	Budget Period 4			
	Budget Period 4 Total	$0		
	Budget Period 5			
	Budget Period 5 Total	$0		
	PROJECT TOTAL	**$0**		

Additional Explanation (as needed):

h. Other Direct Costs

INSTRUCTIONS - PLEASE READ!!!

1. Other direct costs are direct cost items required for the project which do not fit clearly into other categories. These direct costs must not be included in the indirect costs (for which the indirect rate is being applied for this project). Examples are: tuition, printing costs, etc. which can be directly charged to the project and are not duplicated in indirect costs (overhead costs).

2. Basis of cost are items such as vendor quotes, prior purchases of similar or l ke items, published price list, etc.

3. Each budget period is rounded to the nearest dollar.

SOPO Task #	General Description and SOPO Task #	Cost	Basis of Cost	Justification of need
			Budget Period 1	
5	**EXAMPLE!!!** Grad student tuition - tasks 1-3	$16,000	Established UCD costs	Support of graduate students working on project
	Budget Period 1 Total	$0		
			Budget Period 2	
	Budget Period 2 Total	$0		
			Budget Period 3	
	Budget Period 3 Total	$0		
			Budget Period 4	
	Budget Period 4 Total	$0		
			Budget Period 5	
	Budget Period 5 Total	$0		
	PROJECT TOTAL	**$0**		

Additional Explanation (as needed):

i. Indirect Costs

INSTRUCTIONS - PLEASE READ

1. Fill out the table below to indicate how your indirect costs are calculated. Use the box below to provide additional explanation regarding your indirect rate calculation.

2. The rates and how they are applied should not be averaged to get one indirect cost percentage. Complex calculations or rates that do not do not correspond to the below categories should be described/provided in the Additional Explanation section below. If questions exist, consult with your DOE contact before filling out this section.

3. The indirect rate should be applied to both the Federal Share and Recipient Cost Share.

4. Each budget period is rounded to the nearest dollar.

	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Total	Explanation of BASE
Provide ONLY Applicable Rates:							
Overhead Rate	0.00%	0.00%	0 00%	0.00%	0.00%		
General & Administrative (G&A)	0.00%	0.00%	0 00%	0.00%	0.00%		
FCCM Rate, if applicable	0.00%	0.00%	0 00%	0.00%	0.00%		
OTHER Indirect Rate	0.00%	0.00%	0 00%	0.00%	0.00%		
Indirect Costs (As Applicable):							
Overhead Costs						**$0**	
G&A Costs						**$0**	
FCCM Costs, if applicable						**$0**	
OTHER Indirect Costs						**$0**	
Total indirect costs requested:	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

A federally approved indirect rate agreement, or rate proposed (supported and agreed upon by DOE for estimating purposes) is required if reimbursement of indirect costs is requested. Please check (X) one of the options below and provide the requested information if it has not already been provided as requested, or has changed.

An indirect rate has been approved or negotiated with a federal government agency. A copy of the latest rate agreement is included with this application, and will be provided electronically to the Contracting Officer for this project.

There is not a current, federally approved rate agreement negotiated and available*.

***When this option is checked, the entity preparing this form shall submit an indirect rate proposal in the format provided by your DOE contact, or a format that provides the same level of information and which will support the rates being proposed for use in performance of the proposed project. Additionally, any non-Federal entity that has never received a negotiated indirect cost rate, except for those non-Federal entities described in Appendix VII to Part 200—States and Local Government and Indian Tribe Indirect Cost Proposals, paragraph D.1.b, may elect to charge a de minimis rate of 10% of modified total direct costs (MTDC) which may be used indefinitely.As described in §200.403 Factors affecting allowability of costs, costs must be consistently charged as either indirect or direct costs, but may not be double charged or inconsistently charged as both. If chosen, this methodology once elected must be used consistently for all Federal awards until such time as a non-Federal entity chooses to negotiate for a rate, which the non-Federal entity may apply to do at any time.**

You must provide an explanation (below or in a separate attachment) and show how your indirect cost rate was applied to this budget in order to come up with the indirect costs shown.

Lilac is not providing indirect rates for this project application

Cost Share

PLEASE READ

1. A detailed presentation of the cash or cash value of all cost share proposed must be provided in the table below. All items in the chart below must be identified within the applicable cost category tabs a. through i. in addition to the detailed presentation of the cash or cash value of all cost share proposed provided in the table below. Identify the source organization & amount of each cost share item proposed in the award.

2. Cash Cost Share - encompasses all contributions to the project made by the recipient, subrecipient, or third party (an entity that does not have a role in performing the scope of work) for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment, etc. for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project. **Vendors may not provide cost share.** Any partial donation of goods or services is considered a discount and is not allowable.

3. In Kind Cost Share - encompasses all contributions to the project made by the recipient, subrecipient, or third party (an entity that does not have a role in performing the scope of work) where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. In Kind cost share items include volunteer personnel hours, the donation of space or use of equipment, etc. The cash value and calculations thereof for all In Kind cost share items must be justified and explained in the Cost Share Item section below. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out In Kind cost share in this section. Vendors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

4. Funds from other Federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC sub-recipients. Non-Federal sources include any source not originally derived from Federal funds. Cost sharing commitment letters from subrecipients and third parties must be provided with the original application.

5. Fee or profit, including foregone fee or profit, **are not allowable** as project costs (including cost share) under any resulting award. The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

6. NOTE A Recipient who elects to employ the 10% de minimis Indirect Cost rate **cannot claim the resulting indirect costs as a Cost Share contribution.**

7. NOTE A Recipient **cannot claim "unrecovered indirect costs"** as a Cost Share contribution, **without prior approval.**

8. Each budget period is rounded to the nearest dollar.

Recipient Provided Cost Share	Organization/Source	Type (Cash or In Kind)	Cost Share Item	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Total
a. Personnel	Lilac Solutions	Cash	Cost provided by Recipient	[redacted]					
b. Fringe	Lilac Solutions	Cash	N/A						
c. Travel	Lilac Solutions	Cash	Cost provided by Recipient						
d. Equipment	Lilac Solutions	Cash	Cost provided by recipeient except for $30M equipment Cost provided by federal funds in BP 1 and $20M in BP 2						
e. Supplies	Lilac Solutions	Cash	Cost provided by Recipient						
f. Contractual (NOT subrecipient provided)	Lilac Solutions	Cash	Cost provided by Recipient						
g. Construction	Lilac Solutions	Cash	N/A						
h. Other	Lilac Solutions	Cash	N/A						
i. Indirect	Lilac Solutions	Cash	N/A						
Total recipient provided cost share									

(b) (4)

f. Subrecipient (3rd Party) Provided Cost Share	Organization/Source	Type (Cash or In Kind)	Cost Share Item For simple cost share contributions from a partner provide the detail below; for complex contributions provide a separate budget justification (if required) or a supplementary detailed explanation	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	Total
	UNR		Subrecipient does not propose any cost share. All costs paid by recipient						$0
									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Sub-Recipient cost share									$0
Total subrecipient provided cost share				$0	$0	$0	$0	$0	$0
Total Contractual Cost Share (Sum of Recipient and Subrecipients)				[redacted]					
Grand Total Cost Share All Sources			Totals						
			Cost Share Percentage per Budget Period	17.3%	14.0%	14.6%	30.2%	28.1%	

(b) (4)

Total Project Cost: $179,322,049 **Cost Share Percent of Award: 72.1%**

Additional Explanation (as needed):

Applicant Name: Lilac Solutions, Inc. Award Number: 0

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget			
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)		Total (g)
1. Budget Period 1				[redacted]			
2. Budget Period 2							
3. Budget Period 3							
4. Budget Period 4							
5. Budget Period 5							
6. Totals							

(b) (4)

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity					Total (5)
	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	
a. Personnel	[redacted]					
b. Fringe Benefits						
c. Travel						
d. Equipment						
e. Supplies						
f. Contractual						
g. Construction						
h. Other						
i. Total Direct Charges (sum of 6a-6h)						
j. Indirect Charges						
k. **Totals** (sum of 6i-6j)						
7. Program Income						$0

(b) (4)

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Applicant Name: Lilac Solutions, Inc. Award Number: 0

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget			
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)		Total (g)
1. Budget Period 1				[redacted]			
2. Budget Period 2							
3. Budget Period 3							
4. Budget Period 4							
5. Budget Period 5							
6. Totals							

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity					Total (5)
	Budget Period 1	Budget Period 2	Budget Period 3	Budget Period 4	Budget Period 5	
a. Personnel	[redacted]					
b. Fringe Benefits						
c. Travel						
d. Equipment						
e. Supplies						
f. Contractual						
g. Construction						
h. Other						
i. Total Direct Charges (sum of 6a-6h)						
j. Indirect Charges						
k. **Totals** (sum of 6i-6j)						
7. Program Income						$0

(b) (4)

(b) (4)

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[[A18—Environmental Information Volume

A18.A—Environmental Information Describing the Project and Project Sites

This EIV follows the form and format prescribed by the FOA instructions and contains all required information for the six sites in the Lilac Application. However, because Lilac assumed the extra responsibility and expense for the four extraction sites included in our response, we have attached four individual EIV reports as appendices that address additional detail and information for these sites.

A18.A.1—Summary

Approximately 75% of global lithium reserves are in natural brine resources. However, existing processes to extract lithium from these brines are inefficient and environmentally damaging. Lilac Solutions, Inc. (Lilac) has developed a proprietary ion exchange ("IX") process, which incorporates patented IX ceramic beads to increase the extraction efficiency of lithium from the current 40% to over 80%, reduces production time from years to hours, and allows for the direct extraction of lithium. The ceramic beads will be distributed to other lithium extraction companies, both in the U.S. and internationally. Lilac's proposed project activities include (1) demonstration of the viability of our IX ceramic beads and process and their adaptability to site-specific brine compositions at new Lilac lithium extraction sites, and (2) development and demonstration of the capability to produce the IX ceramic beads at commercial volumes required to support U.S. battery materials requirements, such as those used for electric vehicles. The IX demonstration process will occur at four lithium extraction sites with brine deposits in Nevada and Utah where Lilac will design and construct the test capabilities. In addition to the four extraction sites, Lilac's existing Oakland, California facility (the Oakland Facility) will serve primarily as a research and development (R&D) facility with some pilot manufacturing, and Lilac's proposed Fernley, Nevada facility (the Fernley Facility) will serve as the primary manufacturing location.

Lilac Solutions, Inc. (Lilac) is proposing to establish pilot and demonstration plant sites for lithium extraction and associated activities in Nevada and Utah (Nevada 1 and 2 sites, Utah 1 and 2 sites).

Project activities would last approximately ten months for pilot plants, including two months for site preparation and facility construction, six months for operation, and two months for demobilization and site restoration. Federal, state, and local regulations, as well as company-established guidelines would be followed; therefore, it is not anticipated that the Project would result in any safety or health impacts. The Project is proposing approximately 20 employees during construction and approximately eight employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment; however, there would be limited opportunities for construction and facility operations jobs and support services. There are no anticipated technological risks from the Project, but potential risks could result from federal and/or state permitting delays. The timelines for the Demonstration plants are significantly longer, and will outlive the duration of this FOA.

(b) (4)

Oakland Facility Site

The Oakland Facility has already been built inside an existing 92,000 square-foot building and currently houses R&D activities and may also be utilized for pilot manufacturing activities of the IX ceramic beads. Lilac modified the existing building at the Oakland Facility site for these activities, and the R&D activities]]

[[have been occurring for approximately two (2) years. The Oakland Facility is expected to create approximately 100 jobs by the end of 2023, including executive, engineer/scientist, administrator, technician, and custodian positions. Truck traffic is minimal and is not expected to have a negative effect on neighborhoods in the area, particularly due to the facility's proximity to Interstate 880.

Fernley Facility Site

The Fernley Facility site has been previously developed with an approximately 450,000 square foot light manufacturing/warehousing building and will be modified for manufacture of the IX ceramic beads, starting with small commercial production (0.5 TPD ceramic beads) and scaling up to full commercial production (20.5 TPD ceramic beads). Portions of the existing building will also be dedicated to a quality laboratory and warehousing, shipping/receiving, and administrative functions. The Fernley Facility is proposing to reach large commercial quantities production (20.5 TPD of IX material supporting approximately 200,000 t-LCE of global Li production) by 4Q 2024. Modifications to the Fernley Facility will have minor visual impacts to the surrounding areas (e.g., external storage tanks, exhaust stacks on the roof, exterior dust collectors and ventilation). These visual impacts will be mitigated by adding additional fencing and landscaping surrounding the facility. The facility will also create approximately 100 full-time jobs by the end of 2024 and significant temporary labor for construction and fabrication of the facility. Lilac anticipates that employees driving to work may cause slight increases in traffic during shift changes, and transportation of chemical precursors and finished product via trucking should have minimal effect on traffic.

Oakland Facility, Fernley Facility and Other Sites

Lilac's project will not otherwise impact the communities surrounding either the Oakland Facility or the Fernley Facility. Both sites were previously zoned for industrial/manufacturing and will continue to be used for industrial/manufacturing purposes without any new transportation access points or notable changes in local traffic patterns or density.

Hazardous materials will be used in the manufacturing process at the Oakland Facility and Fernley Facility and will be stored in compliance with federal and state hazardous material management and local fire code and other applicable regulations. Lilac will not manufacture or produce hazardous materials. Hazardous materials are used in the production of the ceramic bead, but the ceramic bead itself is not hazardous. Lilac will prepare any required plans and obtain permits for the use and storage of hazardous materials and will follow all distance guidelines for storage of such materials in relation to receptors.

Both Facilities will also be small quantity generators of hazardous waste, which will consist of 90% laboratory waste. All hazardous waste generated by the Facilities will be properly manifested, transported by a licensed hauler, and disposed of by a licensed hazardous waste disposal company in accordance with federal, state, and local laws.

Industrial machinery will be used in the manufacturing process at the Oakland Facility and the Fernley Facility, including for solids processing, filtration, and materials handling. In addition, a furnace and a solvent processing system, including compressors, fans, hydraulic equipment and similar, will be used. Noise levels inside the facility near this machinery and equipment may be elevated. While noise levels may be elevated in production areas within the facilities, and Lilac will take all necessary precautions to protect employees from noise exposure exceeding any workplace safety standards, there will be no significant process noise outside the facilities, and fenceline noise levels from Lilac's manufacturing process will not lead to a noticeable increase]]

[[in typical neighborhood or community background noise levels.

Neither the Oakland Facility nor the Fernley Facility will affect any natural or cultural resources, such as wetlands, protected species, land or coastal resources, or tribal lands, because both of these facilities will be utilizing existing buildings on previously developed sites for their operations.

Lilac anticipates operating the Oakland Facility and the Fernley Facility indefinitely. However, if the facilities ever cease operation as intended, equipment on site will be decommissioned and materials and equipment will be recycled if practicable, or otherwise properly disposed of.

Lithium is considered a non-renewable mineral, and the four lithium extraction sites involved in the proposed project will be utilized to extract lithium. The Oakland Facility and Fernley Facility operations will serve as R&D and manufacturing facilities for IX ceramic beads that will be distributed to other lithium extraction companies both locally and internationally to allow for the direct extraction of lithium. The lithium produced will be used for lithium batteries, such as those used in electric vehicle batteries, which is expected to help facilitate the transition from domestic and international reliance on energy produced from fossil fuels and result in the reduction of global GHG emissions.

A18.A.2—Proposed Project and Its Alternatives

A18.A.2. a—Proposed Project

With the proposed project, Lilac plans to:

- Demonstrate the viability of its IX ceramic beads and process and their adaptability to site-specific brine compositions at new Lilac lithium extraction sites
- Develop and demonstrate the capability to produce the IX ceramic beads at commercial volumes required to support U.S. battery materials requirements, such as those used for electric vehicles.

Lilac's patented IX ceramic beads increase the extraction efficiency of lithium from the current 40% to over 80%, reduce production time from years to hours, and allow for the direct extraction of lithium. Technology Readiness Level ("TRL") 8 demonstration of the IX process in an operational environment will occur at four lithium extraction sites with brine deposits in Nevada and Utah where Lilac will design and construct the test capabilities. In addition to the four extraction sites, Lilac's existing Oakland Facility will serve primarily as an R&D facility with some pilot manufacturing, and Lilac's proposed Fernley Facility will serve as the primary manufacturing location. The projected start of site construction is estimated to be Q1 2023, and completion of Technology Readiness Level ("TRL") 8 testing in Q2 2027. TRL 9 demonstration of capability to manufacture IX beads at large commercial quantities [redacted] (b) (4) [redacted] will occur by Q4 2024. The manufacturing process of the ceramic beads will consist of [redacted]

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Oakland Facility Site

The Oakland Facility has already been built inside an existing 92,000 square-foot building and currently houses R&D activities and may also be utilized for pilot manufacturing activities of the IX ceramic beads. Lilac modified the existing building at the Oakland Facility site for these activities, and the R&D activities have been occurring for approximately two (2) years.

Fernley Facility Site

The Fernley Facility site has been previously developed with an approximately 450,000 square foot light manufacturing/warehousing building and will be modified for manufacture of the IX ceramic beads, starting with small commercial production [redacted] and scaling up to full commercial production [redacted] by Q4 2024. Portions of the existing building will also be dedicated to a quality laboratory and warehousing, shipping/receiving, and administrative functions.

(b) (4) [redacted]

Details of the proposed projects for the four extractions sites (Nevada 1&2, Utah 1&2) can be found in the appendices.

Nevada 1 and Utah 2 Sites

The following phased activities will be accomplished at the Nevada 1 and Utah 2 sites:

- Minimal grading and site preparation to allow placement of five shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it will be removed at the end of the Project;
- Blading of a primary access road leading from the Project Area to an existing publicly maintained road;
- Erection of a temporary housing structure/ tent; and
- Deployment of ancillary units including portable chemical toilets, filters, generators and tanks.

Nevada 2 and Utah 1 Sites

The following phased activities will be accomplished at the Nevada 2 and Utah 1 sites:

- Grading and site preparation to allow placement of at least ten shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it will be removed at the end of the Project;
- Blading of a primary access road leading from the Project Area to an existing publicly maintained road;
- Erection of a multiple housing structures/ tents to accommodate the plant, tanks, utilities, supply tanks, and material storage areas; and
- Deployment of ancillary units including portable chemical toilets, filters, generators and tanks.

Topographical Maps for Sites

Oakland Facility and Fernley Facility Sites

A site plan for the Oakland Facility and topographic maps (2014 and 1985) for the Fernley Facility are included as Attachment A to this Environmental Volume submittal. Both the Oakland and Fernley sites were previously developed with water, wastewater sewer, and electricity utilities and will require electricity and water from offsite. The Fernley Facility will also be supplied with offsite gas.

Other Sites

Site plans and topographical maps for the four extraction sites are provided in Appendix A, B, C and D (Nevada 1, Nevada 2, Utah 1, Utah 2 respectively).

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A18.A.2.b—Alternatives to Proposed Project

Oakland Facility and Fernley Facility Sites

Traditional extraction and production of lithium can take years. Lilac's ceramic beads allow for direct lithium extraction, which reduces the extraction and production process from years to months and will allow for quicker deployment of lithium needed for batteries necessary to support the transition from domestic and international reliance on fossil fuels for energy, ultimately reducing GHG emissions. With respect to process development, Lilac selected key design criteria for its manufacturing operations to minimize air, water, and waste impacts. Finally, rather than new construction, Lilac will be utilizing existing buildings on previously developed sites to house its R&D and manufacturing operations.

Other Sites

Other than the No Action Alternative, no other alternatives to the proposed Project for the four extraction sites (Nevada 1 &2, Utah 1&2) have been identified. Under the No Action Alternative, the pilot plants will not be developed, and the associated activities will not occur. Lilac could continue their exploration drilling activities and groundwater chemistry characterization.

A18.A.3—Existing Environment

A18.A.3.a—Land Use

Oakland Facility Site

Both the Oakland and Fernley Facilities are located on previously developed properties zoned for industrial/manufacturing.

The Oakland Facility is located on previously developed property zoned for industrial/manufacturing and consists of 4.5-acres with an existing 92,000 square-foot industrial building that was vacated prior to Lilac's lease of the property. Transportation access is by road.

Fernley Facility Site

The Fernley Facility is located on previously developed property zoned for industrial/manufacturing and consists of approximately 49-acres with an existing 450,000 square-foot industrial building that was developed in 1998. The prior operator has ceased operations and is in the process of vacating the building. Transportation access is by road.

Nevada 1 Site

The Nevada 1 site [redacted] (b) (4) [redacted] The Project Area will be accessed by an existing highway, existing dirt roads, and a bladed primary access road leading from the Project Area to an existing publicly maintained road. [redacted]

(b) (4) [redacted]

Nevada 2 Site

The Nevada 2 site is [redacted] The Project Area will be accessed by existing dirt roads. There are no powerlines or pipelines within the vicinity of the Project Area [redacted]

Utah 1 Site

The Utah 1 site is an undeveloped area of approximately seven acres, [redacted]

Utah 2 Site

The Utah 2 site is an [redacted] The Project Area will be accessed by

]]

[[an existing highway, existing dirt roads, and a new bladed road needed to access the Project Area. There is an underground water line under the eastern portion of the Project Area.

A18.A.3.b—Atmospheric Conditions/Air Quality

Oakland Facility Site

The Oakland Facility is subject to the air quality jurisdiction of the Bay Area Air Quality Management District and is located in Alameda County, which is a Moderate Nonattainment area for PM with an aerodynamic diameter of 2.5 microns or less ("PM2.5"), and a Marginal Nonattainment Area for both the 2008 and 2015 8-hour Ozone standards. The climate in Oakland, California is Mediterranean with cool summers, with temperatures typically varying from 44 degrees Fahrenheit ("°F") to 75°F and rarely below 37°F or above 85°F. Rainfall averages 24 inches per year.

Fernley Facility Site

The Fernley Facility is subject to the air quality jurisdiction of the Nevada Division of Environmental Protection and is located in Lyon County, which is an Attainment area for criteria pollutants. The climate in Fernley, Nevada is warm and temperate, with temperatures typically varying from 23°F to 94°F and rarely below 12°F or above 101°F. Rainfall and snowfall average 5 inches and 11 inches per year, respectively.

Nevada 1 Site

The Nevada 1 site is located [redacted] (b) (4) [redacted] is 97.5 degrees (°) Fahrenheit (F) in July, and the average minimum temperature is 17.6 °F in December. The average annual total precipitation is 4.43 inches and tends to peak during the month of March (WRCC 2016). The Project Area and vicinity, [redacted] are designated as in attainment with the National Ambient Air Quality Standards for all pollutants.

(b) (4) [redacted]

Nevada 2 Site

The Nevada 2 site Area [redacted], is 93.6 degrees (°) Fahrenheit (F) in July, and the average minimum temperature is 17.7 °F in January. The average annual total precipitation is 5.29 inches and tends to peak during the month of January (WRCC 2016). [redacted] in its entirety, are designated as in attainment with the National Ambient Air Quality Standards for all pollutants.

Utah 1 Site

The Utah 1 site is located in the [redacted], is 94.1 degrees (°) Fahrenheit (F) in July, and the average minimum temperature is 16.3 °F in December. The average annual total precipitation is 10.06 inches and tends to peak during the month of April (WRCC 2016). [redacted] and is in attainment with the National Ambient Air Quality Standard for all pollutants. However, there are regions bordering the Project Area that are in non-attainment for PM2.5 (inhalable particles, with diameters that are generally 2.5 micrometers and smaller), including portions of [redacted]]]

[[

Utah 2 Site

The Utah 2 [redacted] (b) (4) [redacted] The average maximum temperature is 94.1 degrees (°) Fahrenheit (F) in July, and the average minimum temperature is 16.3 °F in December. The average annual total precipitation is 10.06 inches and tends to peak during the month of April (WRCC 2016). [redacted] and is in attainment with the National Ambient Air Quality Standard for all pollutants.

A18.A.3.c—Hydrologic Conditions/Water Quality

Oakland Facility and Fernley Facility Sites

Both the Oakland and Fernley Facilities are located on previously developed properties zoned for industrial/manufacturing. The Oakland Facility is supplied by water from the City of Oakland. The Fernley Facility is supplied by water from the City of Fernley. Wastewater is and will be discharged to the sewer at the respective facilities, and no pre-treatment is expected to be necessary. No water is or will be discharged to surface waters.

Nevada 1 Site

The Nevada 1 site is [redacted] (b) (4) [redacted] All surface ephemeral drainages drain towards the playa. There are no available data describing surface or ground water quality conditions. There are no available floodplain data for the Project Area, as the Federal Emergency Management Agency has not conducted a study for the area to determine the flood hazards. There are also no unique aquatic habitats, recreational areas, or public water supplies in the Project Area.

Nevada 2 Site

The Nevada 2 site is located [redacted] (b) (4) [redacted] The Federal Emergency Management Agency has identified the Project Area as being in Zone X, or an area of minimal flood hazards. There are no unique aquatic habitats, recreational areas, or public water supplies in the Project Area.

Utah 1 Site

The Utah 1 [redacted] (b) (4) [redacted] he susceptibility of erosion by water is slight and by wind is moderate (Natural Resources Conservation Service [NRCS] 2000). This soil type has been rated as poorly suited for rangeland seeding (NRCS 2022). The Federal Emergency Management Agency has labeled the Project Area as Zone D, which means there are possible,

]]

[[but undetermined flood hazards, as no flood hazard analysis has been conducted. There are also no unique aquatic habitats, recreational areas, or public water supplies in the Project Area.

Utah 2 Site

The Utah 2 site. [redacted] There are no known available data for groundwater levels near the Project Area. There is one intermittent drainage that drains towards the sand dune where the Project is located. There are no known available data describing surface or ground water quality conditions. The Federal Emergency Management Agency has labeled the Project Area as Zone D, which means there are possible, but undetermined flood hazards, as no flood hazard analysis has been conducted. There are also no unique aquatic habitats or recreational areas in the Project Area. [redacted] (b) (4) [redacted]

A18.A.3.d—Geologic/Soil Conditions

Oakland Facility and Fernley Facility Sites

Both the Oakland and Fernley Facilities are located in urban, previously developed environments that are zoned for industrial/manufacturing and the existing buildings will be used for the same purpose. Accordingly, assessment of soil characteristics was not necessary. In addition, to Lilac's knowledge, no fault line or liquefaction zones are present, and will have been addressed when the buildings were built decades ago.

Nevada 1 Site

The Nevada 1 site Area is located on the margin of [redacted] (b) (4) [redacted]

(b) (4) [redacted] The soil type in the Project Area is the Slaw-Kawich-Playas association. The susceptibility of erosion by water is slight and by wind is severe (Natural Resources Conservation Service [NRCS] 1991). This soil type is rated as poorly suited for rangeland seeding (NRCS 2022).

Nevada 2 Site

The Nevada 2 site is located [redacted] (b) (4) [redacted] The susceptibility of erosion by water and by wind is severe (Natural Resources Conservation Service [NRCS] 2001). This soil type has been rated poorly for rangeland seeding (NRCS 2022).

Utah 1 Site

The Utah 1 site is located [redacted] (b) (4) [redacted] There are no specific soil types in the Project Area, as it is identified as water and saline; therefore, the suitability for rangeland]]

[[seeding has not been rated (Natural Resources Conservation Service [NRCS] 2022).

Utah 2 Site

The Utah 2 site is located on [redacted] (b) (4) [redacted] he susceptibility of erosion by water is slight and by wind is moderate (Natural Resources Conservation Service [NRCS] 2000). This soil type has been rated as poorly suited for rangeland seeding (NRCS 2022).

A18.A.3.e—Vegetation and Wildlife Resources

Oakland Facility and Fernley Facility Sites

For their operations, both the Oakland and Fernley Facilities will utilize existing buildings on previously developed sites zoned for industrial/manufacturing uses. Accordingly, there are no protected species, their habitats, or other sensitive habitats or ecologically sensitive terrains associated with the modification of the Oakland or Fernley Facilities necessary to house Lilac's operations.

Nevada 1 Site

Nevada 1 site: [redacted] (b) (4) [redacted]

(b) (4) [redacted]

The United States Fish and Wildlife Service (USFWS) identifies plant and wildlife species and critical habitats listed under the Endangered Species Act of 1973, as amended, that may occur within one or more delineated USGS 7.5-minute quadrangles that the Project Area intersects. Each quadrangle covers, at a minimum, 49 square miles. The Official Species List provided by the Reno USFWS Office (Project Code 2022-0048715) lists one Candidate species, the monarch butterfly (Danaus]]

[[plexippus) with the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats or migratory birds of concern within the vicinity of the Project Area.

In a data response from the Nevada Department of Wildlife (NDOW), there were no state-protected species identified within the Project Area or within a four-mile radius of the Project Area.

Nevada 2 Site

Nevada 2 site: [redacted]

In a data response from the Nevada Department of Wildlife (NDOW), there were no state-protected species identified within the Project Area or within a four-mile radius of the Project Area.

The Official Species List provided by the Reno USFWS Office (Project Code 2022-0049431) lists one Endangered species, [redacted] with the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats or migratory birds of concern within the vicinity of the Project Area.

Utah 1 Site

Utah 1 site [redacted]

The Official Species List provided by the Utah Ecological Services Field Office (Project Code 2022-0049431) lists [redacted] ith the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats within the vicinity of the Project Area.

The online search report provided by the Utah Natural Heritage Program (UNHP) identified [redacted]

Utah 2 Site

Utah 2 site: [redacted]

The Official Species List provided by the Utah Ecological Services Field Office (Project Code 2022-0049448) lists one Candidate species, the monarch butterfly (Danaus plexippus) with the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats or migratory birds of concern within the vicinity of the Project Area.

The online search report provided by the Utah Natural Heritage Program (UNHP) identified no stateprotected species in the Project Area or within a two-mile radius of the Project Area.

A18.A.3.f—Socioeconomic Conditions

Oakland Facility Site

As of July 2021, Oakland, California, where the Oakland Facility is located, has a population of 433,823, 6.3% of which are under five years old, 19.4% of which are under 18 years old, and 13.4% of which are over 65 years old.]]

[[The race and Hispanic origin breakdown is as follows: 34.4% white, 22.7% black or African American, 0.9% Native American or Alaska Native, 15.8% Asian, 0.6% Native Hawaiian or Other Pacific Islander, 8.4% two or more races, 27% Hispanic or Latino, and 28.5% white/ not Hispanic or Latino. 84.3% of the population age 25 years or older have a high school graduate degree or higher, and 46.1% of the population age 25 years or older have a bachelor's degree or higher.

Fernley Facility Site

As of July 2021, Fernley, Nevada, where the Fernley Facility is planned, has a population of 23,511, 6.2% of which are under five years old, 23.5% of which are under 18 years old, and 15.7% of which are over 65 years old. The race and Hispanic origin breakdown is as follows: 80.8% white, 2.1% black or African American, 1.8% Native American or Alaska Native, 1.4% Asian, 0% Native Hawaiian or Other Pacific Islander, 8.1% two or more races, 20.6% Hispanic or Latino, and 69.1% white/ not Hispanic or Latino. 90.1% of the population age 25 years or older have a high school graduate degree or higher, and 11.3% of the population age 25 years or older have a bachelor's degree or higher.

Nevada 1 Site

The Project Area consists of approximately

(b) (4)

Nevada 2 Site

The Project Area consists of approximately

.

Utah 1 Site

The Project Area

(b) (4)

Utah 2 Site

The Project Area consists of approximately

A18.A.3.g—Historic/Cultural Resources

Oakland Facility and Fernley Facility Sites

Both the Oakland and Fernley Facilities will utilize existing buildings on previously developed sites for their operations; accordingly, no impacts to historical or cultural resources will occur in connection with the modification of the Oakland or Fernley Facilities necessary to house Lilac's operations.

Nevada 1 Site

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Nevada Cultural Resources Information System (NVCRIS) database and a review of available historic topographic maps and General Land Office survey plats.

Nevada 2 Site

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area.]]

[[This assessment included a search of the [redacted]

(b) (4)

Utah 1 and Utah 1 Sites

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Utah Division of State History Sego database and a review of available historic topographic maps and General Land Office (GLO) survey plats.

A18.A.3.h—Visual Resources

Oakland Facility and Fernley Facility Sites

Both the Oakland and Fernley facilities are located in urban, previously developed environments that are zoned for industrial/manufacturing uses. The sites will be landscaped and fenced, as appropriate, to mitigate any visual impacts of exterior equipment associated with the operations, and will not impede any existing scenic vistas or aesthetic landscaping in their respective areas

Nevada 1 Site

There are no scenic vistas in the Project Area or vicinity. The Project Area lies on the edge of [redacted]

Nevada 2 Site

There are no scenic vistas in the Project Area or vicinity. The Project Area lies on the edge of an [redacted]

(b) (4)

Utah 1 Site

There are no designated scenic byways near the Project Area, [redacted]

Utah 2 Site

There are no scenic vistas in the Project Area or vicinity. [redacted]

A18.A.3.i —Health and Safety Factors

Lilac is not familiar with any emissions, effluents, or noise from previous operations by prior owners/operators at the properties where the Oakland Facility and Fernley Facility are located. There are no activities currently occurring in the Nevada and Utah Project Areas; therefore, the current emissions and noise levels are at ambient levels.

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[[A18.B—Environmental Impacts of the Work To Be Performed

A18.B.1—Land Use

Oakland Facility and Fernley Facility Sites

Land use impacts should be minimal or de minimis, as both the Oakland and Fernley Facilities will utilize existing buildings on previously developed industrial/manufacturing sites for their operations. No waste disposal problems are anticipated, and the Facilities will not have any effluent discharges or use settling ponds.

Nevada 1 Site

The proposed Project will change [redacted] (b) (4) [redacted] to a lithium extraction pilot plant for approximately ten months. The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land will minimize any impacts to the temporary change in land use. All wastes will be properly contained and the Project will not result in any effluent discharges. Any existing disturbance or features such as access roads will be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

Nevada 2 Site

The proposed Project will change approximately [redacted] (b) (4) [redacted] The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land will minimize any impacts to the temporary change in land use. All wastes will be properly contained and the Project will not result in any effluent discharges. Any existing disturbance or features such as access roads will be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

Utah 1 Site

The proposed Project will change approximately [redacted] (b) (4) [redacted] to a lithium extraction pilot plant for approximately three years. The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land will minimize any impacts to the temporary change in land use. All wastes will be properly contained and the Project will not result in any effluent discharges. Any existing disturbance or features such as access roads will be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

Utah 2 Site

The proposed Project will change [redacted] to a lithium extraction pilot plant for approximately ten months. The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land will minimize any impacts to the temporary change in land use. All wastes will be properly contained and the Project will not result in any effluent discharges. Any existing disturbance or features such as access roads will be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

A18.B.2—Atmospheric Conditions/Air Quality

Oakland Facility Site

The Oakland Facility utilizes an existing building and is already operating. No or de minimis emissions resulted from modification of the Oakland Facility building for Lilac's operations. No or de minimis emissions are also expected]]

[[from the modification of the existing building for the Fernley Facility operations.

The Oakland Facility is located in Alameda County, which is a Moderate Nonattainment area for $PM_{2.5}$, and a Marginal Nonattainment Area for both the 2008 and 2015 8-hour Ozone standards. Potential emissions include $PM_{2.5}$, NO_X, VOCs, toxic air contaminants ("TACs"), and greenhouse gases ("GHGs") from stationary sources, including material handling of the solids received and processed, furnace processing [redacted] (b) (4) [redacted] and an emergency generator. Maximum potential to emit quantities of air emissions from these sources are expected to be as follows (with the exception of emissions from the emergency generator which have not yet been quantified because engine details (i.e., model, make, engine rating, and fuel type) are still to be determined; note that the emergency generator is expected to be the only source of GHG emissions):

- $PM_{2.5}$: 1.81 tons per year (tpy)
- NO_X: 0.73 tpy
- VOC: 1.96 tpy

Fernley Facility Site

The Fernley Facility is located in Lyon County, which is an Attainment area for criteria pollutants. Potential emissions include $PM_{2.5}$ and PM_{10}, NO_X, VOCs, Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Lead (Pb), hazardous air pollutants (HAPs) and GHGs from stationary sources, including material handling of the solids received and processed, furnace processing; [redacted] (b) (4) [redacted] in tanks; and emergency generators. Maximum potential to emit quantities of air emissions from these sources for the first phase of ceramic bead production- [redacted] are expected to be as follows:

- Total PM: 5.045 tpy
- PM_{10}: 5.0071 tpy
- $PM_{2.5}$: 4.9736 tpy
- SO_2: 0.0897 tpy
- CO: 2.0284 tpy
- NO_X: 5.5665 tpy
- VOC: 3.4784 tpy
- Pb: 1.13E-05
- Total HAPs: 3.1793
- Total GHGs (CO_2e): 2779.3627

(b) (4)

Emissions levels at [redacted] ill be determined in subsequent permitting phases.

Other Sites

The Project has the potential to disturb approximately five acres for the Nevada 1 and 2 Sites and seven acres for the Utah 1 and 2 Sites. Travel around the Project Area and Project-related activities within the Project Area will create emissions, which will have a potential impact on air quality. Fugitive dust, in the form of PM_{10} (inhalable particles, with diameters that are generally ten micrometers and smaller) and $PM_{2.5}$ (inhalable particles, with diameters that are generally 2.5 micrometers and smaller), will be caused by the operation of the equipment listed in Section 1.2.1.3. Vehicle emissions, in the form of sulfur dioxide (SO_2), nitrogen oxide (NO_X), carbon monoxide (CO), and volatile organic compounds (VOCs), will occur any time the internal combustion engines on the vehicles are operating. *Exhibit 1.* shows the tons of emissions of the identified pollutants.

In addition to the emissions listed in Exhibit 1, there will be a total of approximately 0.0014 ton per year of hazardous air pollutants and

Project Emissions Summary						
Emission Type	PM10	PM2.5	SO2	NOx	CO	VOCs
Fugitive Emissions	10.07	1.98	0.003	1.80	1.52	0.09

Exhibit 1. *Air Emissions Associated with the Project, Tons per Year*]]

[[approximately 264 tonnes per year of greenhouse gases (GHGs). To minimize impacts from fugitive dust, Lilac will commit to limiting vehicles speeds to ten to 15 miles per hour and watering roads and other disturbed areas. Estimated emissions from the Project are below the Federal Conformity De Minimis thresholds, which will suggest that the Project will have a de minimis effect on compliance with state and federal air quality standards. In addition, the annual GHG emissions of 264 tonnes per year is equivalent to the emissions from approximately 57 passenger vehicles driven for one year (United States Environmental Protection Agency [EPA] 2022). This amount is well below the 25,000 tonnes threshold set for reporting from stationary sources by the EPA. Therefore, emissions resulting from the proposed Project will be inconsequential to the existing air quality environment.

A18.B.3—Hydrologic Conditions/Water Quality

The modifications to the Oakland Facility and the Fernley Facility necessary to house Lilac's operations will not cause changes to groundwater or surface water quality or quantity, nor will operation of the facilities. Construction will occur primarily inside the buildings and there will be no storage piles or waste disposal sites exposed to stormwater runoff in connection with either modification of the Facilities for Lilac's operations or with the operations themselves. Pretreatment of wastewater is not expected to be required at either facility, and wastewater from the facilities will be discharged to the respective City sewer systems.

The proposed Project is not anticipated to result in any changes to surface or groundwater quality at the Nevada 1 and 2 sites or the Utah 1 and 2 sites, as all discharge water and delithiated brine will be held in plastic-lined storage ponds. The Project does not include stream diversion activities or waste disposal sites.

A18.B.4—Geologic/Soil Conditions

Both the Oakland and Fernley Facilities will utilize existing buildings on previously developed industrial/manufacturing sites for their operations. Subsidence and, to Lilac's knowledge, erosion, stream diversion, and floodplain or wetland intrusion are not concerns at either of the sites.

Construction activities associated with the proposed Project at the Nevada and Utah sites are not anticipated to cause subsidence, stream diversion, floodplain or wetland intrusion, or increases or decreases in soil permeability and filtration. Small amounts of erosion may occur but will be minimized by implementing best management practices (BMPs) to address air and water quality impacts.

A18.B.5—Vegetation and Wildlife Resources

Both the Oakland and Fernley Facilities will utilize existing buildings on previously developed sites for their operations. Accordingly, there will be no impacts to indigenous flora or fauna, protected species or their habitats, or other sensitive habitats or ecologically sensitive terrains associated with the Oakland or Fernley Facilities.

Nevada 1 Site

The proposed Project will result in [redacted] (b) (4) [redacted] The USFWS identified the potential for the Monarch butterfly to be impacted by the Project; however, based on an aerial view of the Project Area, there are no applicable host plants for the Monarch butterfly (e.g., milkweed) in the Project Area. No other state or federally listed species were identified through USFWS and NDOW data responses. The Project Area also does not contain any sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.]]

[[

Nevada 2 Site

The Proposed Action will result in the [redacted] (b) (4) [redacted] No other state or federally listed species were identified through USFWS and NDOW data responses. The Project Area also does not contain any sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.

Utah 1 Site

The Proposed Action will result in the removal of approximately [redacted] (b) (4) [redacted] other state or federally listed species were identified through USFWS and UNHP data responses. The Project Area also does not contain any sensitive habitats such as floodplains or other ecologically sensitive terrain. [redacted]

Utah 2 Site

The Proposed Action will result in the removal of [redacted] (b) (4) [redacted] The USFWS identified the potential for the Monarch butterfly to be impacted by the Project; however, based on an aerial view of the Project Area, there are no applicable host plants for the Monarch butterfly (e.g., milkweed) in the Project Area. No other state or federally listed species were identified through USFWS and UNHP database searches. The Project Area also does not contain any sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.

A18.B.6—Socioeconomic Conditions

The Oakland Facility is expected to create approximately 100 jobs by the end of 2023, including executive, engineer/scientist, administrator, technician, and custodian positions.

The facility will also create approximately 100 full-time jobs by the end of 2023 and significant temporary labor for construction and fabrication of the facility.

Project activities at the Nevada and Utah sites will last approximately ten months, including two months for site preparation and facility construction, six months for operation, and two months for demobilization and site restoration. The Project is proposing approximately 20 employees during construction and approximately eight employees during operations and restoration/reclamation, which most likely will temporarily stay in [redacted] Due to the low number of employees, any temporary beneficial or detrimental impacts to [redacted] will be absorbed by the existing socioeconomic environment.

A18.B.7—Historic/Cultural Resources

Both the Oakland and Fernley Facilities will utilize existing buildings on previously developed sites for their operations; accordingly, no impacts to historical or cultural resources and no interference with Native American tribal or

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[[other religious practices or sites will occur in connection with operation of the facilities.

Nevada 1 Site

The online search of the NVCRIS database revealed that no previously identified archaeological sites or architectural resources have been recorded within the Project Area; however, no cultural inventories have been conducted. Additionally, no historic features (e.g., roads, structures, buildings, etc.) are depicted within the Project Area on any historic archival maps. No recent field inventories have been conducted in the Project Area, but could occur if necessary.

Nevada Site 2

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Nevada Cultural Resources Information System (NVCRIS) database and a review of available historic topographic maps and General Land Office (GLO) survey plats. The online search of the NVCRIS database revealed that a total of [redacted] (b) (4) [redacted]

Utah 1 Site

The online search of the Sego database revealed that no previously identified archaeological sites or architectural resources have been recorded within the Project Area and no cultural inventories have been conducted. [redacted]

[redacted] (b) (4) [redacted] No other historic features (e.g., roads, structures, buildings, etc.) are depicted within the Project Area on any historic archival maps.

Utah 2 Site

The online search of the Sego database revealed that a [redacted] (b) (4) [redacted] This road is also shown on subsequent topographic maps and is visible in modern aerial imagery as an eroded two-track road. No other historic features (e.g., roads, structures, buildings, etc.) are depicted within the Project Area on any historic archival maps. No recent field inventories have been conducted in the Project Area, but could occur if necessary.

A18.B.8—Visual Resources

Both the Oakland and Fernley facilities are located in urban, previously developed environments that are zoned for industrial/manufacturing uses. There will be no impacts to scenic vistas or aesthetic landscaping in connection with operation of the Oakland Facility and Fernley Facility.

The decommissioning of the Project, removal of the facilities, and reclamation and]]

[[revegetation of the disturbed land will minimize any impacts to the existing aesthetics of the Project Area at the Nevada and Utah sites.

A18.B.9—Health and Safety Factors

Hazardous materials will be used in the manufacturing process at the Oakland Facility and Fernley Facility. For example, strong acids are utilized during the ceramic bead manufacturing process. SO_x and NO_x gases are generated within the process and is subsequently treated with scrubbers as an air pollution control device. None of the acids or gases leave the property as a hazardous waste stream. Other chemicals, including sodium hydroxide, organic solvents, compressed gases, and metal oxides will also be stored on site and used in the manufacturing process, and all hazardous materials are managed in accordance with Federal, state, and local environmental, hazardous material, and fire code requirements.

All workers are trained in the hazards of strong acids and toxic/corrosive gases, as well as of other hazardous materials on site, to understand safe work practices and appropriate actions in the event of a spill or release. Workers are also required to wear personal protective equipment (PPE) appropriate for their job tasks. As the strong acids used are liquids, leak detection equipment will be installed prior to filling the tanks with the acid. As toxic and hazardous gases are developed within process equipment, leak detection equipment and alarms will be installed. Lilac also employs a hazardous waste contractor fully equipped with 24-hour emergency response services. Safety information will be updated whenever there is a major change that makes the information inaccurate. Before starting up a process after a major change, all relevant elements of the facility's risk management program, including prevention program elements, will be reviewed and updated as appropriate. Operators will be trained in any updated procedures before starting up the changed process. Any new or revised standards that are applicable to the change itself or to the changed process will be analyzed and reflected in the update.

Industrial machinery will be used in the manufacturing process at the Oakland Facility and the Fernley Facility, including for solids processing, filtration, and materials handling. In addition, a furnace and a solvent processing system, including compressors, fans, hydraulic equipment and similar, will be used. Noise levels inside the facility near this machinery and equipment may be elevated. While noise levels may be elevated in production areas within the facilities, and Lilac will take all necessary precautions to protect employees from noise exposure exceeding any workplace safety standards, there will be no significant process noise outside the facilities, and fenceline noise levels from Lilac's manufacturing process will not lead to a noticeable increase in typical neighborhood or community background noise levels.

As the Proposed Action involves the use of hazardous substances at the Nevada and Utah sites, potential exposures will be minimized by adherence to guidelines established by the Occupational Safety and Health Administration. All employees will be required to wear appropriate Personal Protective Equipment to minimize potential exposures to noise, odor, and heat, in compliance with the Mine Safety and Health Administration.

A18.B.10—Solid and Hazardous Wastes

Nonhazardous waste at both the Oakland Facility and Fernley Facility will include both non-recyclables and recyclables--approximately 2000 pounds/month for the Oakland Facility and 6000 pounds/month for the Fernley Facility at large commercial quantities production levels.

Both Facilities will be small quantity generators of hazardous waste, which will consist of 90% laboratory waste. All hazardous waste generated by the Facilities will be properly]]

[[manifested, transported by a licensed hauler, and disposed of by a licensed hazardous waste disposal company in accordance with federal, state, and local laws. A U.S. Environmental Protection Agency Hazardous Waste Generator ID for small quantity generators will be obtained in connection with these small quantities of hazardous waste generation.

All solid and hazardous waste generated by the Project at the Nevada and Utah sites will be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. Appendices A, B, C and D show the respective amounts of waste generated by Project activities at the respective sites. Solids, primarily undissolved salts, silica and sand, will be generated in volumes expected to be 220 pounds per month. These are expected to be nonhazardous and will be sent to a landfill. The delithiated brine will be stored in a lined storage pond of approximately 370,000 cubic feet. The dimensions of the pond will be 1.6 acres and 6.5 feet deep. The discharge water will be stored in a lined discharge water storage pond of approximately 250,000 cubic feet. The dimensions of the pond will be 1.2 acres and 5.5 feet deep.

A18.B.11—Impacts on Regional or Local Plans

Lilac is not aware of any adverse impacts to regional or local plans for fuel, water resources, solid waste, land, or air quality resources.

The Oakland Facility is expected to create approximately 100 jobs by the end of 2023, including executive, engineer/scientist, administrator, technician, and custodian positions. The facility will also create approximately 100 full-time jobs by the end of 2023 and significant temporary labor for construction and fabrication of the facility.

With respect to process development, Lilac selected key design criteria for its manufacturing operations to minimize air, water, and waste impacts, including process design that will predominantly result in consumption/recycling of reagents and precursors within process, and minimize any waste requiring disposal.

Finally, rather than new construction, Lilac is utilizing existing buildings on previously developed sites to house its R&D and manufacturing operations, minimizing the construction materials and other resources that will otherwise be necessary for new construction.

Other Sites

Any solid waste generated by the Project will be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. The discharge water may be used for dust suppression upon confirming sufficient water quality standards and upon receiving appropriate permits.

Nevada 1 Site

The proposed Project will not impact [redacted]

(b) (4)

Nevada 2 Site

The proposed Project will not impact [redacted]

Utah 1 Site

There are no known regional or local plans that will be impacted by the proposed Project.

Utah 2 Site

The proposed Project will not impact [redacted]

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Providing Workforce Opportunities in Low- And Moderate-Income Communities

Lilac is conducting outreach and providing significant workforce opportunities for Low- and Moderate-Income Communities. Lilac is partnering with University of Nevada-Reno (UNR) to conduct workforce development activities. Full description of these activities is located within the equity plan of the application.

Partnering with Universities and Laboratories to Spur Innovation and Drive Down Costs

Lilac proposes partnering with Argonne National Lab and the National Renewable Energy Lab to conduct life cycle assessment and technoeconomic analysis of our processes. These results will be used as feedback to identify areas of potential cost and environmental impact reduction. Lilac is also specifically partnering with NREL to perform analysis of alternative thermal energy resources to provide sustainable industrial heat for Lilac's lithium processing facilities. NREL is also providing an analysis of desalination and water treatment processes for Lilac, which will help drive down costs of Lilac's lithium processing operations.

Partnering With Tribal Communities

Lilac is partnering with UNR to conduct workforce development activities with tribal communities. UNR will collaborate with tribal representatives to provide training programs and workshops to improve employment of tribal community members.

Providing Workforce Opportunities in Communities with Fossil Energy Job Displacements

In recognition of our unique role under this FOA to help catalyze an end-to-end Made-In-America clean energy economy, Lilac will actively work to recruit and hire displaced members of the fossil energy workforce. Lilac will also actively recruit recently laid off manufacturing employees including manufacturing of internal combustion engine vehicles and powertrains in rural communities.

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[[A18.C—Potential Liability to DOE of Existing Conditions At The Sites

Lilac is not aware of any previous environmental liability concerns associated with the proposed project, including any liability or site conditions associated with previous construction activities in connection with the Facilities or with predecessor research and development and demonstration testing of the IX ceramic beads.

Outside of the current proposer's exploration drilling activity in the Project Areas in Nevada and Utah, any previous activity at the site is unknown. The currently approved activities are not anticipated to result in any impacts to the site.

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[[A18.D—Ability to Meet Compliance Requirements at the Sites

Operations at both the Oakland Facility and Fernley Facility are or are potentially subject to the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation, and Liability Act, Toxic Substances Control Act, Occupational Safety and Health Act, Emergency Planning and Community Right-to-Know Act, analogous state and local laws, and implementing regulations thereunder.

The Oakland R&D and pilot manufacturing and facility will require permits typical of industrial manufacturing facilities, including air permit exemptions from the Bay Area Air Quality Management District; Multisector Industrial General Permit for Stormwater No Exposure Certification; a U.S. Environmental Protection Agency Hazardous Waste Generator ID for small quantity generators and waste inventory registration with the California Department of Toxic Substances Control and Alameda County Department of Environmental Health; registration with the California Accidental Release Program (and a Risk Management Plan); as well as a Conditional Use Permit from the City of Oakland which also addresses trash, blight, graffiti, third-party traffic, and operational noise. A wastewater sewer discharge permit from the East Bay Municipal Utility District is not expected to be required due to the very small volumes of wastewater from the site.

The Fernley manufacturing facility will also require permits typical of industrial manufacturing facilities, including an air permit or air permit exemption from the Nevada Division of Environmental Protection; Multisector Industrial General Permit for Stormwater No Exposure Certification; a wastewater sewer discharge permit for nonhazardous wastewater; a U.S. Environmental Protection Agency Hazardous Waste Generator ID for small quantity generators; registration with the Nevada Chemical Accident Prevention Program (and a Risk Management Plan); as well as business licenses and building permits as applicable.

All hazardous waste generated by the Facilities will be properly manifested, transported by a licensed hauler, and disposed of by a licensed hazardous waste disposal company in accordance with federal, state, and local laws.

Each of the Oakland Facility and Fernley Facility has or will have an Environmental Management System in place to ensure that each site is in compliance with applicable federal, state and local air, water, and waste regulations. The Oakland site is currently in compliance with applicable environmental, health, and safety ("EHS") requirements.

The proposed Project in Nevada and Utah will comply with the following applicable federal, state, and/or local laws and regulations:

- National Environmental Policy Act of 1969
- Federal Land Policy and Management Act of 1976, as amended
- Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.)
- Endangered Species Act of 1973, as amended (7 U.S.C. § 1531 et seq.)
- BLM Policy Manual 6840 Special Status Species Management
- Section 106 of the National Historic Preservation Act (54 U.S.C. §306108)
- Archaeological Resources Protection Act of 1979
- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act of 1979
- Indian Sacred Sites – Executive Order (EO) 13007
- Consultation and Coordination with Indian Tribal Governments – EO 1317
- Clean Water Act of 1972
- Clean Air Act of 1970
- Clean Air Act Amendments of 1990

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- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c)
- Federal Noxious Weed Act of 1974
- Resource Conservation and Recovery Act of 1976
- Toxic Substances Control Act of 1976
- Occupational Safety and Health Act of 1970

Lilac will obtain the following permits for the Project:

- General Stormwater Permit at Construction Sites (NDEP)
- General Industrial Stormwater Permit (NDEP)
- Temporary Discharge Permit (NDEP)
- Industrial Artificial Pond Permit (NDOW)
- Hazardous Waste Site Identification Number (EPA)
- Special Use Permit [redacted] (b) (4) [redacted]

Lilac will obtain the following permits and/or submit the following notices for the Project in Utah:

- Notice of Intention to Commence Small Mining Operations (DNR DOGM)
- Construction General Permit - Stormwater (Utah Department of Environmental Quality [DEQ])
- Utah Ground Water Discharge Permit (Utah DEQ)
- Hazardous Waste Identification Number (EPA)
- Conditional Use Permit [redacted] (b) (4) [redacted]
- Section 404 Nationwide Permit #7 (Army Corps of Engineers)
- Construction General Permit - Stormwater (Utah Department of Environmental Quality [DEQ])
- Industrial General Permit - Stormwater (Utah DEQ)
- Utah Pollutant Discharge Elimination System Permit (Utah DEQ)
- Notice of Intention to Commence Small Mining Operations (State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining)
- Hazardous Waste Identification Number (EPA)
- Special Use Permit [redacted] (b) (4) [redacted]

To comply with the applicable laws and regulations for air quality, land use, and water quality, Lilac will implement the following measures:

- Emissions of fugitive dust from disturbed surfaces will be minimized by using appropriate control measures. Surface application of water from a water truck and reduced speed limits on dirt access roads are the current methods of dust control.
- Stormwater BMPs will be used at construction sites to minimize stormwater erosion, including fabric or certified weed-free straw bale filter fences, or siltation or filter berms.
- If a spill of a petroleum constituent is considered to meet the reportable quantity per the NDEP's guidelines (greater than 25 gallons or greater than three cubic yards of impacted material or any quantity of a water body is impacted), or a reportable quantity for hazardous waste is released based on the EPA guidelines established under 40 Code of Federal Regulations Part 302, the NDEP will be notified within 24 hours, and the appropriate remedial actions and confirmation sampling will be conducted under direction of the NDEP.

40 CFR 60 Standards of Performance for New Stationary Sources

The Fernley facility requires a minor state air permit. The other sites do not require a permit.

National Emission Standards for Hazardous Air Pollutants

Not applicable at this time.

New Source Review

Not applicable at this time.

Prevention of Significant Deterioration

Not applicable at this time.
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Title V Operating Permit Program

Not applicable.

Stormwater and Related Regulations

Applicable for lithium extraction sites (construction general permit) and Fernley/Oakland (industrial general permit). BMPs to be installed per regulatory requirements.

National Pollution Discharge Elimination System (NPDES)

Applicable to Utah 1 site.

Stormwater Pollution Prevention Plan (SWPPP) and Best Management Practices

Spill Prevention Control and Countermeasures (SPCC)

Likely not applicable, but if more than 1320 gallons is stored on-site an SPCC will be prepared and complied with.

Federal Waste Regulations

Oakland is an SQG. All other sites expected to be a VSQG or an SQG.

Very Small Quantity Generator (VSQGs)

Not applicable.

Small Quantity Generator (SQGs)

Not applicable.

Emergency Planning and Community Right-to-Know Act (EPCRA)

Applicable to all sites.

County Regulations

Any county regulations will be met. At this time, Oakland has no applicable county regulations.

A18.E—Experience and Approach to the Identification and Resolution of Environmental Issues

Environmental regulations applicable to the project are limited. An environmental management system is in place at Oakland and will be in place at new locations. The management system is based on the plan, do, check and improve model.

A18.E.1—Key Project Management Personnel

Lilac Solutions has a Director of Permitting and Environmental Affairs that overseas all operations. In Oakland, compliance is headed by the facility manager and responsibilities are delegated across operations and environmental staff.

Air Quality Management

Oakland has no applicable air permit. Fernley staff will be trained to ensure compliance with the permit that will be issued in late 2022.

Surface Water and Ground Water Management

Drinking water aquifers are not affected. Brine aquifers are subject to mining regulations. Utah Project 1 will have an UPDES (NPDES) for processed brine.

Solid and Liquid Waste Management and Disposal Practices

Oakland complies with hazardous and non-hazardous liquid and solid waste regulations. Additional sites will follow same practices.

Noise, Land Use, Ecological Resources, Archaeological, Cultural, and Historical Resources Management

At this time, none of these aspects are significant (Oakland/Fernley) or expected to be significant (4 lithium extraction sites).

Environmental Permit Applications, Amendments, and Renewals

Fernley has a pending air permit application that should be issued late 2022.

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A18.E.2—Past Performance on Similar Projects

The staff of Lilac solutions have decades of experience complying with environmental regulations.

A18.E.3—Environmental Policies, Procedures and Plans

Employees overseeing and managing the subjects above have or will have relevant education, competencies, and experience. The Oakland Facility Manager and EHS Manager at the Oakland Facility is and the Fernley Facility Manager and EHS Manager at the Fernley Facility will be responsible for compliance with local, state, and federal regulations. Third party consultants with appropriate expertise will be engaged as necessary.

The Lilac team already has experience with an extensive permitting and local authorization process in connection with its Oakland Facility, a smaller-scale ceramic bead R&D and pilot manufacturing operation, but similar in complexity and permitting needs to the Fernley Facility, which will ultimately be utilized for large commercial production of IX ceramic beads.

Each of the Oakland Facility and Fernley Facility has or will have an Environmental Management System in place to ensure that each site is in compliance with applicable federal, state and local air, water, and waste regulations.

Tony DiNicola, Director of Permitting and Environmental Affairs is responsible for ensuring projects meet applicable Federal, State, and local regulations. He holds a Bachelor of Arts in Political Science and his career has focused on environmental compliance and strategy. In addition, Dennis Neymit is the Environmental Health and Safety (EHS) Manager covering the Oakland, California, facility.

At each site, the site manager will have overall accountability for environmental compliance and to ensure that a robust environmental management system covers environmental aspects and compliance obligations. At each site a dedicated EHS staff person is required.

Lilac has been addressing and resolving environmental concerns at the following:

- [redacted] Under their regulatory framework, Lilac complies with Environmental Impact Assessment (EIA) requirements related to the preparation of EIAs and, during exploration, compliance with management obligations contained in the EIAs. Lilac is in the process of obtaining EIAs for production, as well, which will have broader and more detailed compliance requirements.
- Oakland: Lilac has applied for and complies with applicable state and local permits, including Industrial General Permit (stormwater)-exemption, air permit- exemption, hazardous waste generation, hazardous materials storage, emergency response and city sewer discharge permit.
- Fernley: This facility will start operating in Q4 2022 and be subject to the following Hazardous Materials Report (State Fire Marshall), Air Permit (minor), Multisector (Industrial) General Permit- Stormwater (NDEP), Sewer Discharge (Fernley), Hazardous Waste EPA ID# (small quantity generator), SDS Inventory (Community Right to Know).

(b) (4)

Lilac requires site-specific environmental compliance requirements matrices that specify requirements, actions and accountabilities. The Vice-President of Permitting and Environmental Affairs conducts audits to ensure compliance and address any gaps. Air, water, hazardous waste and other environmental training are required for all new employees. Additional ongoing training is required for staff charged with compliance or involved with regulated operations.

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Appendix A
Nevada 1 Project [redacted]

(b) (4)

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LILAC SOLUTIONS, INC.
NEVADA 1 PROJECT – [redacted] (b) (4)

Environmental Volume

June 2022

Prepared for:

Lilac Solutions, Inc.
1700 20th Street
Oakland, California 94607

Submitted to:

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Office of Energy Efficiency and Renewable Energy
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LILAC SOLUTIONS, INC.
NEVADA 1 PROJECT [redacted] (b) (4)
ENVIRONMENTAL VOLUME [redacted]

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LIST OF ACRONYMS AND ABBREVIATIONS

°	degrees
bgs	below ground surface
BLM	Bureau of Land Management
BMP	best management practice
CO	carbon monoxide
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EO	Executive Order
EPA	United States Environmental Protection Agency
F	Fahrenheit
GHG	Greenhouse gas
HCl	hydrochloric acid
Lilac	Lilac Solutions, Inc.
MT	Metric tons
NaOH	sodium hydroxide
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Department of Wildlife
NOx	nitrogen oxide
NRCS	Natural Resources Conservation Service
NVCRIS	Nevada Cultural Resources Information System
PM_{10}	inhalable particles, with diameters that are generally ten micrometers and smaller
$PM_{2.5}$	inhalable particles, with diameters that are generally 2.5 micrometers and smaller
Project	Nevada 1 Project
SO_2	sulfur dioxide
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WRCC	Western Regional Climate Center

1 ENVIRONMENTAL INFORMATION

1.1 Summary

Lilac Solutions, Inc. (Lilac) is proposing to establish a pilot plant site for lithium extraction and associated activities in [redacted] (b) (4) [redacted]

Project activities would last approximately ten months, including two months for site preparation and facility construction, six months for operation, and two months for demobilization and site restoration. Federal, state, and local regulations, as well as company-established guidelines would be followed; therefore, it is not anticipated that the Project would result in any safety or health impacts. The Project is proposing approximately 20 employees during construction and approximately eight employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment; however, there would be limited opportunities for construction and facility operations jobs and support services. There are no anticipated technological risks from the Project, but potential risks could result from federal and/or state permitting delays.

(b) (4)

1.2 Proposed Project and Alternatives

1.2.1 Proposed Project

The Project would consist of the following phased activities:

- Minimal grading and site preparation to allow placement of five shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it would be removed at the end of the Project;
- Blading of a primary access road leading from the Project Area to an existing publicly maintained road;
- Erection of a temporary housing structure/tent; and
- Deployment of ancillary units including portable chemical toilets, filters, generators and tanks.

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[redacted]

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1.2.1.1 Facilties and Structures

The Project would include the construction, installation, and operation of the following:

- A 100-foot by 120-foot temporary tent-like structure for the protection of the equipment and personnel, covering a portion of the Project Area.
- Up to 15 storage tanks for the storage of brine feed, water, lithium, diesel, and other chemicals needed for the Project.
- Two separate tanks surrounded by a spill containment system in accordance with federal, state, and local regulations, to store hydrochloric acid (HCl) and sodium hydroxide (NaOH).
- Five standard shipping containers (e.g., CONEX or similar) would house the technology for extracting lithium from the brine. The containers would be connected to the various tanks with pipe work. Power from the main power panel would be routed to each container individually to run the process equipment.
- One containerized office unit (which would house offices, meeting rooms, a control center, and lab space).
- One containerized maintenance shop (to store equipment, materials, and other supplies).
- One small plastic-lined sump of approximately 200 square feet (0.005 acre).
- One plastic-lined discharge water pond approximately 5.5 feet deep and 1.2 acres in size for a total volume of 250,000 cubic feet.
- One plastic-lined delithiated brine storage pond approximately 6.5 feet deep and 1.6 acres in size for a total volume of 370,000 cubic feet.
- Mobile electrical generators, junction boxes, distribution boxes, circuit panels, power switchgear, and metering equipment to handle the electrical loads of the entire facility. The number of generators would be based on market availability but the initial expectation is that there would be one plus one backup.
- Portable chemical toilets for employees. All sewage from the Project would be removed off site periodically to maintain hygiene and cleanliness standards.
- A nominal six-foot-high chain-link security fence would be constructed around the Project plant site. The fence would be constructed to meet federal and state regulations.

Figure 2 shows the anticipated configuration of the plant site and associated facilities.

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1.2.1.2 Project Construction, Work Force, and Schedule

Construction would include light grading of approximately five acres of land that would include the plant site, loading area, and the entry road. This would include a berm extended to the outer perimeter of the site. The discharge ponds totaling approximately three acres would be excavated up to 6.5 feet deep and lined with plastic. All discharges from the Project would be managed on site with nothing leaving the Project battery limits. The Project would be constructed so that no off site discharge would be allowed, and all water would be managed on site.

It is estimated that on average ten trucks per day would travel in and out of the Project site during construction. An average of 20 workers would commute to the Project site during construction, and approximately eight workers would commute during operations. The workers would most likely temporarily reside in [redacted] (b) (4)

Project construction would begin when all necessary permits and approvals are obtained. All construction work would occur in one phase, with all work occurring during daylight hours over five to six days per week over the two-month period.

1.2.1.3 Equipment

Below is a list of construction equipment anticipated to be utilized for the Project:

- Two off-highway trucks
- One roller
- One excavator
- One grader
- Two water trucks
- One compactor
- One crane
- Four generators
- One rough terrain forklift
- One Tractor/Loader/Backhoe
- Seven light-duty pick-up trucks

1.2.1.4 Project Operations

The pilot plant would process brine from the [redacted] (b) (4) to extract lithium and then discharge the delithiated brine into a holding pond. The production operations would consist of the following general processing steps:

1. Pumping of raw brine into storage tanks from the brine well
2. Processing of the lithium brine to be processed in the Direct Lithium Extraction plant
3. Off-site product shipping
4. Storage of delithiated brine and discharge water in holding ponds

A schematic of the processing steps is shown in Figure 3. The production processing steps may be altered over time as production methods and efficiencies evolve and new or revised product lines are developed at the facility. The exact arrangement of the processing equipment is part of the proprietary technology developed for the Project.

1.2.2 Alternatives to Proposed Project

Other than the No Action Alternative, no other alternatives to the proposed Project have been identified. Under the No Action Alternative, the pilot plant would not be developed, and the associated activities would not occur. Lilac could continue their exploration drilling activities and groundwater chemistry characterization through their Notice NVN-101165 as acknowledged by the BLM and the Dissolved Mineral Resource Exploration Well Permit approved by the Nevada Division of Minerals.

1.3 Existing Environment

1.3.1 Land Use

The proposed Project Area is an undeveloped area of approximately five acres, [redacted] (b) (4) [redacted]

1.3.2 Atmospheric Conditions/Air Quality

The Project Area is located in the [redacted] (b) (4) is 97.5 degrees (°) Fahrenheit (F) in July, and the average minimum temperature is 17.6 °F in December. The average annual total precipitation is [redacted]

The Project Area and vicinity, as well as [redacted] in its entirety, are designated as in attainment with the National Ambient Air Quality Standards for all pollutants.

(b) (4)

1.3.3 Hydrologic Conditions/Water Quality

The Project Area is located in the [redacted]

(b) (4)

There are no available data describing surface or ground water quality conditions.

There are no available floodplain data for the Project Area, as the Federal Emergency Management Agency has not conducted a study for the area to determine the flood hazards. There are also no unique aquatic habitats, recreational areas, or public water supplies in the Project Area.

1.3.4 Geologic/Soil Conditions

The Project Area is located on the margin of [redacted]

(b) (4)

The soil type in the Project Area is the [redacted] The susceptibility of erosion by water is slight and by wind is severe (Natural Resources Conservation Service [NRCS] 1991). This soil type is rated as poorly suited for rangeland seeding (NRCS 2022).

1.3.5 Vegetation and Wildlife Resources

The [redacted]

(b) (4)

The [redacted]

The [redacted]

The United States Fish and Wildlife Service (USFWS) identifies plant and wildlife species and critical habitats listed under the Endangered Species Act of 1973, as amended, that may occur within one or more delineated USGS 7.5-minute quadrangles that the Project Area intersects. Each quadrangle covers, at a minimum, 49 square miles. The Official Species List provided by the Reno USFWS Office (Project Code 2022-0048715) lists one Candidate species, the monarch butterfly (*Danaus plexippus*) with the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats or migratory birds of concern within the vicinity of the Project Area.

In a data response from the Nevada Department of Wildlife (NDOW), there were no state-protected species identified within the Project Area or within a four-mile radius of the Project Area.

1.3.6 Socioeconomic Conditions

The Project Area consists of approximately [redacted] (b) (4)

1.3.7 Historic/Cultural Resources

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Nevada Cultural Resources Information System (NVCRIS) database and a review of available historic topographic maps and General Land Office survey plats.

1.3.8 Visual Resources

There are no scenic vistas in the Project Area or vicinity. The Project Area lies on the edge of an [redacted] (b) (4)

1.3.9 Health and Safety Factors

There are no activities currently occurring in the Project Area; therefore, the current emissions and noise levels are at ambient levels.

1.4 Environmental Impacts

1.4.1 Land Use

The proposed Project would change approximately five acres of an [redacted] (b) (4) [redacted] lithium extraction pilot plant for approximately ten months. The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the temporary change in land use. All wastes would be properly contained and the Project would not result in any effluent discharges. Any existing disturbance or features such as access roads would be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

1.4.2 Atmospheric Conditions/Air Quality

The Project has the potential to disturb approximately five acres. Travel around the Project Area and Project-related activities within the Project Area would create emissions, which would have a potential impact on air quality. Fugitive dust, in the form of PM_{10} (inhalable particles, with diameters that are generally ten micrometers and smaller) and $PM_{2.5}$ (inhalable particles, with diameters that are generally 2.5 micrometers and smaller), would be caused by the operation of the equipment listed in Section 1.2.1.3. Vehicle emissions, in the form of sulfur dioxide (SO_2), nitrogen oxide (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs), would occur any time the internal combustion engines on the vehicles are operating. Table 1 shows the tons of emissions of the identified pollutants.

Table 1: Air Emissions Associated with the Project, Tons per Year

Project Emissions Summary						
Emission Type	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**CO**	**VOCs**
Fugitive Emissions	10.07	1.98	0.003	1.80	1.52	0.09

In addition to the emissions listed in Table 1, there would be a total of approximately 0.0014 ton per year of hazardous air pollutants and approximately 264 metric tons (MT) per year of greenhouse gases (GHGs). To minimize impacts from fugitive dust, Lilac would commit to limiting vehicles speeds to ten to 15 miles per hour and watering roads and other disturbed areas. Estimated emissions from the Project are below the Federal Conformity De Minimis thresholds, which would suggest that the Project would have a de minimis effect on compliance with state and federal air quality standards. In addition, the annual GHG emissions of 264 MT per year is equivalent to the emissions from approximately 57 passenger vehicles driven for one year (United States Environmental Protection Agency [EPA] 2022). This amount is well below the

25,000 MT threshold set for reporting from stationary sources by the EPA. Therefore, emissions resulting from the proposed Project would be inconsequential to the existing air quality environment.

1.4.3 Hydrologic Conditions/Water Quality

The proposed Project is not anticipated to result in any changes to surface or groundwater quality, as all discharge water and delithiated brine would be held in plastic-lined storage ponds. The Project does not include stream diversion activities or waste disposal sites.

1.4.4 Geologic/Soil Conditions

Construction activities associated with the proposed Project are not anticipated to cause subsidence, stream diversion, floodplain or wetland intrusion, or increases or decreases in soil permeability and filtration. Small amounts of erosion may occur but would be minimized by implementing best management practices (BMPs) to address air and water quality impacts.

1.4.5 Vegetation and Wildlife Resources

The proposed Project would result in the removal of approximately [redacted] (b) (4) [redacted] The USFWS identified the potential for the Monarch butterfly to be impacted by the Project; however, based on an aerial view of the Project Area, there are no applicable host plants for the Monarch butterfly (e.g., milkweed) in the Project Area. No other state or federally listed species were identified through USFWS and NDOW data responses. The Project Area also does not contain any sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.

1.4.6 Socioeconomic Conditions

Project activities would last approximately ten months, including two months for site preparation and facility construction, six months for operation, and two months for demobilization and site restoration. The Project is proposing approximately 20 employees during construction and approximately eight employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any temporary beneficial or detrimental impacts to [redacted] (b) (4) would be absorbed by the existing socioeconomic environment.

1.4.7 Historic/Cultural Resources

The online search of the NVCRIS database revealed that no previously identified archaeological sites or architectural resources have been recorded within the Project Area; however, no cultural inventories have been conducted. Additionally, no historic features (e.g., roads, structures,

buildings, etc.) are depicted within the Project Area on any historic archival maps. No recent field inventories have been conducted in the Project Area, but could occur if necessary.

1.4.8 Visual Resources

The decommissioning of the Project, removal of the facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the existing aesthetics of the Project Area.

1.4.9 Health and Safety Factors

As the Proposed Action involves the use of hazardous substances, potential exposures would be minimized by adherence to guidelines established by the Occupational Safety and Health Administration. All employees would be required to wear appropriate Personal Protective Equipment to minimize potential exposures to noise, odor, and heat, in compliance with the Mine Safety and Health Administration.

1.4.10 Solid and Hazardous Wastes

All solid and hazardous waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. Table 2 shows the amount of waste generated by Project activities. Solids, primarily undissolved salts, silica and sand, would be generated in volumes expected to be 220 pounds per month. These are expected to be nonhazardous and would be sent to a landfill. The delithiated brine would be stored in a lined storage pond of approximately 370,000 cubic feet. The dimensions of the pond would be 1.6 acres and 6.5 feet deep. The discharge water would be stored in a lined discharge water storage pond of approximately 250,000 cubic feet. The dimensions of the pond would be 1.2 acres and 5.5 feet deep.

Table 2: Wastes Generated by the Project

Material Type	Source	Maximum Daily Output (gallons per day)	Storage Tank Size (gallons)
[redacted] (b) (4)	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

1.4.11 Impacts on Regional or Local Plans

The proposed Project would not impact [redacted] (b) (4) Any solid waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. The discharge water may be used for dust suppression upon confirming sufficient water quality standards and upon receiving appropriate permits from the Nevada Division of Environmental Protection (NDEP) Bureau of Mining Regulation and Reclamation.

2 POTENTIAL LIABILITY TO DOE OF EXISTING CONDITIONS AT THE SITE

Outside of the current proposer's Notice-level drilling activity in the Project Area, any previous activity at the site is unknown. The currently acknowledged activities are not anticipated to result in any impacts to the site.

3 ABILITY TO MEET COMPLIANCE REQUIREMENTS AT THE SITE

The proposed Project would comply with the following applicable federal, state, and/or local laws and regulations:

- National Environmental Policy Act of 1969
- Federal Land Policy and Management Act of 1976, as amended
- Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.)
- Endangered Species Act of 1973, as amended (7 U.S.C. § 1531 et seq.)
- BLM Policy Manual 6840 Special Status Species Management
- Section 106 of the National Historic Preservation Act (54 U.S.C. §306108)
- Archaeological Resources Protection Act of 1979
- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act of 1979
- Indian Sacred Sites – Executive Order (EO) 13007
- Consultation and Coordination with Indian Tribal Governments – EO 1317
- Clean Water Act of 1972
- Clean Air Act of 1970
- Clean Air Act Amendments of 1990
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c)
- Nevada Revised Statute 555.150
- Federal Noxious Weed Act of 1974
- Resource Conservation and Recovery Act of 1976
- Toxic Substances Control Act of 1976
- Occupational Safety and Health Act of 1970

Lilac would obtain the following permits for the Project:

- General Stormwater Permit at Construction Sites (NDEP)
- General Industrial Stormwater Permit (NDEP)
- Temporary Discharge Permit (NDEP)
- Industrial Artificial Pond Permit (NDOW)
- Hazardous Waste Site Identification Number (EPA)
- Special Use Permit [redacted] (b) (4) County)

To comply with the applicable laws and regulations for air quality, land use, and water quality, Lilac would implement the following measures:

- Emissions of fugitive dust from disturbed surfaces would be minimized by using appropriate control measures. Surface application of water from a water truck and reduced speed limits on dirt access roads are the current methods of dust control.
- Stormwater BMPs would be used at construction sites to minimize stormwater erosion, including fabric or certified weed-free straw bale filter fences, or siltation or filter berms.
- If a spill of a petroleum constituent is considered to meet the reportable quantity per the NDEP's guidelines (greater than 25 gallons or greater than three cubic yards of impacted material or any quantity of a water body is impacted), or a reportable quantity for hazardous waste is released based on the EPA guidelines established under 40 Code of Federal Regulations Part 302, the NDEP would be notified within 24 hours, and the appropriate remedial actions and confirmation sampling would be conducted under direction of the NDEP.

4 EXPERIENCE AND APPROACH TO THE IDENTIFICATION AND RESOLUTION OF ENVIRONMENTAL ISSUES

Tony DiNicola, Director of Permitting and Environmental Affairs is responsible for ensuring projects meet applicable Federal, State and local regulations. He holds a Bachelor of Arts in Political Science and his career has focused on environmental compliance and strategy. In addition, Dennis Neymit is the Environmental Health and Safety (EHS) Manager covering the Oakland, California, facility.

At each site, the site manager would have overall accountability for environmental compliance and to ensure that a robust environmental management system covers environmental aspects and compliance obligations. At each site a dedicated EHS staff person is required.

Lilac has been addressing and resolving environmental concerns at the following:

- [redacted] (b) (4) [redacted] Under their regulatory framework, Lilac complies with Environmental Impact Assessment (EIA) requirements related to the preparation of EIAs and, during exploration, compliance with management obligations contained in the EIAs. Lilac is in the process of obtaining EIAs for production, as well, which will have broader and more detailed compliance requirements.
- Oakland: Lilac has applied for and complies with applicable state and local permits, including Industrial General Permit (stormwater)-exemption, air permit- exemption, hazardous waste generation, hazardous materials storage, emergency response and city sewer discharge permit.
- Fernley: This facility will start operating in Q4 2022 and be subject to the following Hazardous Materials Report (State Fire Marshall), Air Permit (minor), Multisector

(Industrial) General Permit- Stormwater (NDEP), Sewer Discharge (Fernley), Hazardous Waste EPA ID# (small quantity generator), SDS Inventory (Community Right to Know).

Lilac requires site-specific environmental compliance requirements matrices that specify requirements, actions and accountabilities. The Vice-President of Permitting and Environmental Affairs conducts audits to ensure compliance and address any gaps. Air, water, hazardous waste and other environmental training are required for all new employees. Additional ongoing training is required for staff charged with compliance or involved with regulated operations.

5 REFERENCES

[redacted]

(b) (4)

[redacted]

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Appendix B
Nevada 2 Project (b) (4)

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LILAC SOLUTIONS, INC.
NEVADA 2 PROJECT – [redacted] (b) (4)

Environmental Volume

June 2022

Prepared for:

Lilac Solutions, Inc.
1700 20th Street
Oakland, California 94607

Submitted to:

United States Department of Energy
Office of Energy Efficiency and Renewable Energy
Forrestal Building
1000 Independence Avenue, SW
Washington, DC 20585

Prepared by:

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LIST OF ACRONYMS AND ABBREVIATIONS

°	degrees
bgs	below ground surface
BLM	Bureau of Land Management
BMP	best management practice
CO	carbon monoxide
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EO	Executive Order
EPA	United States Environmental Protection Agency
F	Fahrenheit
GHG	Greenhouse gas
GLO	General Land Office
HCl	hydrochloric acid
Lilac	Lilac Solutions, Inc.
MT	Metric tons
NaOH	sodium hydroxide
NBMG	Nevada Bureau of Mines and Geology
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Department of Wildlife
NOx	nitrogen oxide
NRCS	Natural Resources Conservation Service
NVCRIS	Nevada Cultural Resources Information System
PM_{10}	inhalable particles, with diameters that are generally ten micrometers and smaller
$PM_{2.5}$	inhalable particles, with diameters that are generally 2.5 micrometers and smaller
Project	Nevada 2 Project
SO_2	sulfur dioxide
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WRCC	Western Regional Climate Center

1 ENVIRONMENTAL INFORMATION

1.1 Summary

Lilac Solutions, Inc. (Lilac) is proposing to establish a pilot plant site for lithium extraction and associated activities in [redacted] (b) (4) [redacted] he Project is located on public lands managed by the Bureau of Land Management Stillwater Field Office (BLM), [redacted]

Project activities would last approximately three years, including six months for site preparation and facility construction, two years for operation, and four months for demobilization and site restoration. Federal, state, and local regulations, as well as company-established guidelines would be followed; therefore, it is not anticipated that the Project would result in any safety or health impacts. The Project is proposing approximately 20 employees during construction and approximately 20 employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted]. Due to the low number of employees, any beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment; however, there would be limited opportunities for construction and facility operations jobs and support services. There are no anticipated technological risks from the Project, but potential risks could result from federal and/or state permitting delays.

1.2 Proposed Project and Alternatives

1.2.1 Proposed Project

The Project would consist of the following phased activities:

- Grading and site preparation to allow placement of at least ten shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it would be removed at the end of the Project;
- Blading of a primary access road leading from the Project Area to an existing publicly maintained road;
- Erection of a multiple housing structures/tents to accommodate the plant, tanks, utilities, supply tanks, and material storage areas; and
- Deployment of ancillary units including portable chemical toilets, filters, generators and tanks.

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This entire page contains trade secrets, confidential, proprietary, or privileged information exempt from public disclosure, and is subject to the restriction on the title page.

1.2.1.1 Facilties and Structures

The Project would include the construction, installation, and operation of the following:

- Multiple tent-like structures, the largest being approximately 150 feet by 140 feet in size, for the protection of the equipment and personnel, covering a portion of the Project Area.
- Up to 15 storage tanks for the storage of brine feed, water, lithium, diesel, and other chemicals needed for the Project.
- Two separate tanks surrounded by a spill containment system in accordance with federal, state, and local regulations, to store hydrochloric acid (HCl) and sodium hydroxide (NaOH).
- Ten standard shipping containers (e.g., CONEX or similar) would house the technology for extracting lithium from the brine. The containers would be connected to the various tanks with pipe work. Power from the main power panel would be routed to each container individually to run the process equipment.
- One containerized office unit (which would house offices, meeting rooms, a control center, and lab space).
- One containerized maintenance shop (to store equipment, materials, and other supplies).
- One plastic-lined discharge water pond approximately 5.5 feet deep and 1.2 acres in size for a total volume of 250,000 cubic feet.
- One plastic-lined delithiated brine storage pond approximately 6.5 feet deep and 1.6 acres in size for a total volume of 370,000 cubic feet.
- Mobile electrical generators, junction boxes, distribution boxes, circuit panels, power switchgear, and metering equipment to handle the electrical loads of the entire facility. The number of generators would be based on market availability but the initial expectation is that there would be one plus one backup.
- Portable chemical toilets for employees. All sewage from the Project would be removed off site periodically to maintain hygiene and cleanliness standards.
- A nominal six-foot-high chain-link security fence would be constructed around the Project plant site. The fence would be constructed to meet federal and state regulations.

Figure 2 shows the anticipated configuration of the plant site and associated facilities.

(b) (4)

1.2.1.2 Project Construction, Work Force, and Schedule

Construction would include light grading of approximately seven acres of land that would include the plant site, loading area, and the entry road. This would include a berm extended to the outer perimeter of the site. The discharge ponds totaling approximately three acres would be excavated up to 6.5 feet deep and lined with plastic. All discharges from the Project would be managed on site with nothing leaving the Project battery limits. The Project would be constructed so that no off site discharge would be allowed, and all water would be managed on site.

It is estimated that on average ten trucks per day would travel in and out of the Project site during construction. An average of 20 workers would commute to the Project site during construction, and approximately 20 workers would commute during operations. The workers would most likely temporarily reside in [redacted] (b) (4)

Project construction would begin when all necessary permits and approvals are obtained. All construction work would occur in one phase, with all work occurring during daylight hours over five to six days per week over the six-month period.

1.2.1.3 Equipment

Below is a list of construction equipment anticipated to be utilized for the Project:

- Two off-highway trucks
- One roller
- One excavator
- One grader
- Two water trucks
- One compactor
- One crane
- Four generators
- One rough terrain forklift
- One Tractor/Loader/Backhoe
- Seven light-duty pick-up trucks

1.2.1.4 Project Operations

The pilot plant would process brine from the [redacted] (b) (4) to extract lithium and then discharge the delithiated brine into a holding pond. The production operations would consist of the following general processing steps:

1. Pumping of raw brine into storage tanks from the brine well
2. Processing of the lithium brine to be processed in the Direct Lithium Extraction plant
3. Off-site product shipping
4. Storage of process water in holding ponds

A schematic of the processing steps is shown in Figure 3. The production processing steps may be altered over time as production methods and efficiencies evolve and new or revised product lines are developed at the facility. The exact arrangement of the processing equipment is part of the proprietary technology developed for the Project.

1.2.2 Alternatives to Proposed Project

Other than the No Action Alternative, no other alternatives to the proposed Project have been identified. Under the No Action Alternative, the pilot plant would not be developed, and the associated activities would not occur. Lilac could continue their exploration drilling activities and groundwater chemistry characterization through their Notice NVN-100773 as acknowledged by the BLM and the Dissolved Mineral Resource Exploration Well Permit approved by the Nevada Division of Minerals.

1.3 Existing Environment

1.3.1 Land Use

The proposed Project Area is an undeveloped area of [redacted] The Project Area would be accessed by existing dirt roads (Figure 1). There are no powerlines or pipelines within the vicinity of the Project Area; [redacted] (b) (4)

1.3.2 Atmospheric Conditions/Air Quality

The Project Area is located in the [redacted] are designated as in attainment with the National Ambient Air Quality Standards for all pollutants.

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1.3.3 Hydrologic Conditions/Water Quality

The Project Area is located in the [redacted] (b) (4) [redacted] All surface ephemeral drainages drain west to east, but there are no drainages in the Project Area. There are no available data describing surface or ground water quality conditions.

The Federal Emergency Management Agency has identified the Project Area as being in Zone X, or an area of minimal flood hazards. There are no unique aquatic habitats, recreational areas, or public water supplies in the Project Area.

1.3.4 Geologic/Soil Conditions

The Project Area is located in the [redacted] (b) (4) [redacted]

The soil type in the Project Area is the [redacted] The susceptibility of erosion by water and by wind is severe (Natural Resources Conservation Service [NRCS] 2001). This soil type has been rated poorly for rangeland seeding (NRCS 2022).

1.3.5 Vegetation and Wildlife Resources

The Southwest Regional Gap Analysis Program maps [redacted]

The United States Fish and Wildlife Service (USFWS) identifies plant and wildlife species and critical habitats listed under the Endangered Species Act of 1973, as amended, that may occur

within one or more delineated USGS 7.5-minute quadrangles that the Project Area intersects. Each quadrangle covers, at a minimum, 49 square miles. [redacted] (b) (4) with the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats or migratory birds of concern within the vicinity of the Project Area.

In a data response from the Nevada Department of Wildlife (NDOW), there were no state-protected species identified within the Project Area or within a four-mile radius of the Project Area.

1.3.6 Socioeconomic Conditions

The Project Area consists of approximately [redacted]

1.3.7 Historic/Cultural Resources

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Nevada Cultural Resources Information System (NVCRIS) database and a review of available historic topographic maps and General Land Office (GLO) survey plats. The online search of the NVCRIS database revealed that a total of [redacted] (b) (4) [redacted]

1.3.8 Visual Resources

There are no scenic vistas in the Project Area or vicinity. The Project Area lies on the edge of an [redacted]

1.3.9 Health and Safety Factors

There are no activities currently occurring in the Project Area; therefore, the current emissions and noise levels are at ambient levels.

1.4 Environmental Im [redacted]

(b) (4)

1.4.1 Land Use

The proposed Project would change approximately seven acres of an [redacted] a lithium extraction pilot plant for approximately three years. The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the temporary change in land use. All wastes would be properly contained and the Project would not result in any effluent discharges. Any existing disturbance or features such as access roads would be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

1.4.2 Atmospheric Conditions/Air Quality

The Project has the potential to disturb approximately seven acres. Travel around the Project Area and Project-related activities within the Project Area would create emissions, which would have a potential impact on air quality. Fugitive dust, in the form of PM_{10} (inhalable particles, with diameters that are generally ten micrometers and smaller) and $PM_{2.5}$ (inhalable particles, with diameters that are generally 2.5 micrometers and smaller), would be caused by the operation of the equipment listed in Section 1.2.1.3. Vehicle emissions, in the form of sulfur dioxide (SO_2), nitrogen oxide (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs), would occur any time the internal combustion engines on the vehicles are operating. Table 1 shows the tons of emissions of the identified pollutants.

Table 1: Air Emissions Associated with the Project, Tons per Year

Project Emissions Summary						
Emission Type	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**CO**	**VOCs**
Fugitive Emissions	10.07	1.98	0.003	1.80	1.52	0.09

In addition to the emissions listed in Table 1, there would be a total of approximately 0.0014 ton per year of hazardous air pollutants and approximately 264 metric tons (MT) per year of greenhouse gases (GHGs). To minimize impacts from fugitive dust, Lilac would commit to limiting vehicles speeds to ten to 15 miles per hour and watering roads and other disturbed areas. Estimated emissions from the Project are below the Federal Conformity De Minimis thresholds, which would suggest that the Project would have a de minimis effect on compliance with state and federal air quality standards. In addition, the annual GHG emissions of 264 MT per year is equivalent to the emissions from approximately 57 passenger vehicles driven for one year (United States Environmental Protection Agency [EPA] 2022). This amount is well below the 25,000 MT threshold set for reporting from stationary sources by the EPA. Therefore, emissions resulting from the proposed Project would be inconsequential to the existing air quality environment.

1.4.3 Hydrologic Conditions/Water Quality

The proposed Project is not anticipated to result in any changes to surface or groundwater quality, as all discharge water and delithiated brine would be held in plastic-lined storage ponds. The Project does not include stream diversion activities or waste disposal sites.

1.4.4 Geologic/Soil Conditions

Construction activities associated with the proposed Project are not anticipated to cause subsidence, stream diversion, floodplain or wetland intrusion, or increases or decreases in soil permeability and filtration. Small amounts of erosion may occur but would be minimized by implementing best management practices (BMPs) to address air and water quality impacts.

1.4.5 Vegetation and Wildlife Resources

The Proposed Action would result in the removal of approximately [redacted] However, the Project Area is sparsely vegetated, primarily with plants associated with a mixed salt desert scrub community. [redacted] (b) (4) [redacted] No other state or federally listed species were identified through USFWS and NDOW data responses. The Project Area also does not contain any sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.

1.4.6 Socioeconomic Conditions

Project activities would last approximately three years, six months for site preparation and facility construction, two years for operation, and four months for demobilization and site restoration. The Project is proposing approximately 20 employees during construction and approximately 20 employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any temporary beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment.

1.4.7 Historic/Cultural Resources

As a result of the review of the inventories of NVCRIS and the GLO plats, no archaeological sites nor architectural resources were identified. [redacted] (b) (4) [redacted] This road is also shown on subsequent topographic maps and GLO survey plats and is visible in modern aerial imagery as a bladed road. No other historic features (e.g., roads, structures, buildings, etc.) are depicted within the Project Area on any historic archival maps. No recent field inventories have been conducted in the Project Area, but could occur if necessary.

1.4.8 Visual Resources

The decommissioning of the Project, removal of the facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the existing aesthetics of the Project Area.

1.4.9 Health and Safety Factors

As the proposed Project involves the use of hazardous substances, potential exposures would be minimized by adherence to guidelines established by the Occupational Safety and Health Administration. All employees would be required to wear appropriate Personal Protective Equipment to minimize potential exposures to noise, odor, and heat, in compliance with the Mine Safety and Health Administration.

1.4.10 Solid and Hazardous Wastes

All solid and hazardous waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. Table 2 shows the amount of waste generated by Project activities. Solids, primarily undissolved salts, silica and sand, would be generated in volumes expected to be 220 pounds per month. These are expected to be nonhazardous and would be sent to a landfill. The delithiated brine would be stored in a lined storage pond of approximately 370,000 cubic feet. The dimensions of the pond would be 1.6 acres and 6.5 feet deep. The discharge water would be stored in a lined discharge water storage pond of approximately 250,000 cubic feet. The dimensions of the pond would be 1.2 acres and 5.5 feet deep.

Table 2: Wastes Generated by the Project

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

1.4.11 Impacts on Regional or Local Plans

The proposed Project would not impact [redacted] (b) (4) [redacted] Any solid waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. The discharge water may be used for dust suppression upon confirming sufficient water quality standards and upon receiving appropriate permits from the Nevada Division of Environmental Protection [NDEP] Bureau of Mining Regulation and Reclamation.

2 POTENTIAL LIABILITY TO DOE OF EXISTING CONDITIONS AT THE SITE

Outside of the current proposer's Notice-level drilling activity in the Project Area, any previous activity at the site is unknown. The currently acknowledged activities are not anticipated to result in any impacts to the site.

3 ABILITY TO MEET COMPLIANCE REQUIREMENTS AT THE SITE

The proposed Project would comply with the following applicable federal, state, and/or local laws and regulations:

- National Environmental Policy Act of 1969
- Federal Land Policy and Management Act of 1976, as amended
- Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.)
- Endangered Species Act of 1973, as amended (7 U.S.C. § 1531 et seq.)
- BLM Policy Manual 6840 Special Status Species Management
- Section 106 of the National Historic Preservation Act (54 U.S.C. §306108)
- Archaeological Resources Protection Act of 1979
- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act of 1979
- Indian Sacred Sites – Executive Order (EO) 13007
- Consultation and Coordination with Indian Tribal Governments – EO 1317
- Clean Water Act of 1972
- Clean Air Act of 1970
- Clean Air Act Amendments of 1990
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c)
- Nevada Revised Statute 555.150
- Federal Noxious Weed Act of 1974
- Resource Conservation and Recovery Act of 1976
- Toxic Substances Control Act of 1976
- Occupational Safety and Health Act of 1970

Lilac would obtain the following permits for the Project:

- General Stormwater Permit at Construction Sites (NDEP)
- General Industrial Stormwater Permit (NDEP)
- Temporary Discharge Permit (NDEP)
- Class V Underground Injection Control Permit (NDEP)
- Industrial Artificial Pond Permit (NDOW)
- Hazardous Waste Identification Number (EPA)
- Special Use Permit ([redacted] County)
  (b) (4)

To comply with the applicable laws and regulations for air quality, land use, and water quality, Lilac would implement the following measures:

- Emissions of fugitive dust from disturbed surfaces would be minimized by using appropriate control measures. Surface application of water from a water truck and reduced speed limits on dirt access roads are the current methods of dust control.
- Stormwater BMPs would be used at construction sites to minimize stormwater erosion, including fabric or certified weed-free straw bale filter fences, or siltation or filter berms.
- If a spill of a petroleum constituent is considered to meet the reportable quantity per the NDEP's guidelines (greater than 25 gallons or greater than three cubic yards of impacted material or any quantity of a water body is impacted), or a reportable quantity for hazardous waste is released based on the EPA guidelines established under 40 Code of Federal Regulations Part 302, the NDEP would be notified within 24 hours, and the appropriate remedial actions and confirmation sampling would be conducted under direction of the NDEP.

4 EXPERIENCE AND APPROACH TO THE IDENTIFICATION AND RESOLUTION OF ENVIRONMENTAL ISSUES

Tony DiNicola, Director of Permitting and Environmental Affairs is responsible for ensuring projects meet applicable Federal, State and local regulations. He holds a Bachelor of Arts in Political Science and his career has focused on environmental compliance and strategy. In addition, Dennis Neymit is the Environmental Health and Safety (EHS) Manager covering the Oakland, California, facility.

At each site, the site manager would have overall accountability for environmental compliance and to ensure that a robust environmental management system covers environmental aspects and compliance obligations. At each site a dedicated EHS staff person is required.

Lilac has been addressing and resolving environmental concerns at the following:

- [redacted] (b) (4) Under their regulatory framework, Lilac complies with Environmental Impact Assessment (EIA) requirements related to the preparation of EIAs and, during exploration, compliance with management obligations contained in the EIAs. Lilac is in the process of obtaining EIAs for production, as well, which will have broader and more detailed compliance requirements.
- Oakland: Lilac has applied for and complies with applicable state and local permits, including Industrial General Permit (stormwater)-exemption, air permit- exemption, hazardous waste generation, hazardous materials storage, emergency response and city sewer discharge permit.
- Fernley: This facility will start operating in Q4 2022 and be subject to the following Hazardous Materials Report (State Fire Marshall), Air Permit (minor), Multisector

(Industrial) General Permit- Stormwater (NDEP), Sewer Discharge (Fernley), Hazardous Waste EPA ID# (small quantity generator), SDS Inventory (Community Right to Know).

Lilac requires site-specific environmental compliance requirements matrices that specify requirements, actions and accountabilities. The Vice-President of Permitting and Environmental Affairs conducts audits to ensure compliance and address any gaps. Air, water, hazardous waste and other environmental training are required for all new employees. Additional ongoing training is required for staff charged with compliance or involved with regulated operations.

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Appendix C
Utah 1 Project [redacted] (b) (4) [redacted]

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LILAC SOLUTIONS, INC.
UTAH 1 PROJECT – [redacted] (b) (4)

Environmental Volume

June 2022

Prepared for:

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Submitted to:

United States Department of Energy
Office of Energy Efficiency and Renewable Energy
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LILAC SOLUTIONS, INC.
UTAH 1 PROJECT – [redacted] (b) (4)
ENVIRONMENTAL VOLUME

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LIST OF ACRONYMS AND ABBREVIATIONS

°	degrees
BMP	best management practice
CO	carbon monoxide
DEQ	Department of Environmental Quality
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EO	Executive Order
EPA	United States Environmental Protection Agency
F	Fahrenheit
GHG	Greenhouse gas
GSL	Great Salt Lake
HCl	hydrochloric acid
Lilac	Lilac Solutions, Inc.
LWA	Loughlin Water Associates, LLC
MT	Metric tons
NaOH	sodium hydroxide
NOx	nitrogen oxide
NRCS	Natural Resources Conservation Service
PM_{10}	inhalable particles, with diameters that are generally ten micrometers and smaller
$PM_{2.5}$	inhalable particles, with diameters that are generally 2.5 micrometers and smaller
Project	Utah 1 Project
SO_2	sulfur dioxide
UNHP	Utah Natural Heritage Program
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WRCC	Western Regional Climate Center

UTAH 1 PROJECT – [redacted] (b) (4) [redacted]
ENVIRONMENTAL VOLUME

1 ENVIRONMENTAL INFORMATION

1.1 Summary

Lilac Solutions, Inc. (Lilac) is proposing to establish a pilot plant site for lithium extraction and associated activities in [redacted] (b) (4) [redacted]

Project activities would last approximately three years, including six months for site preparation and facility construction, two years for operation, and four months for demobilization and site restoration. Federal, state, and local regulations, as well as company-established guidelines would be followed; therefore, it is not anticipated that the Project would result in any safety or health impacts. The Project is proposing approximately 20 employees during construction and approximately 20 employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment; however, there would be limited opportunities for construction and facility operations jobs and support services. There are no anticipated technological risks from the Project, but potential risks could result from federal and/or state permitting delays.

1.2 Proposed Project and Alternatives

1.2.1 Proposed Project

The Project would consist of the following phased activities:

- Grading and site preparation to allow placement of at least ten shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it would be removed at the end of the Project;
- Blading of a primary access road leading from the Project Area to an existing publicly maintained road;
- Erection of a multiple housing structures/tents to accommodate the plant, tanks, utilities, supply tanks, and material storage areas; and
- Deployment of ancillary units including portable chemical toilets, filters, generators and tanks.

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(b) (4)

[redacted]

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1.2.1.1 Facilties and Structures

The Project would include the construction, installation, and operation of the following:

- Multiple tent-like structures, the largest being approximately 150 feet by 140 feet in size, for the protection of the equipment and personnel, covering a portion of the Project Area.
- Up to 15 storage tanks for the storage of brine feed, water, lithium, diesel, and other chemicals needed for the Project.
- Two separate tanks surrounded by a spill containment system in accordance with federal, state, and local regulations, to store hydrochloric acid (HCl) and sodium hydroxide (NaOH).
- Ten standard shipping containers (e.g., CONEX or similar) would house the technology for extracting lithium from the brine. The containers would be connected to the various tanks with pipe work. Power from the main power panel would be routed to each container individually to run the process equipment.
- One containerized office unit (which would house offices, meeting rooms, a control center, and lab space).
- One containerized maintenance shop (to store equipment, materials, and other supplies).
- One plastic-lined discharge water pond approximately 5.5 feet deep and 1.2 acres in size for a total volume of 250,000 cubic feet.
- One plastic-lined delithiated brine storage pond approximately 6.5 feet deep and 1.6 acres in size for a total volume of 370,000 cubic feet.
- Mobile electrical generators, junction boxes, distribution boxes, circuit panels, power switchgear, and metering equipment to handle the electrical loads of the entire facility. The number of generators would be based on market availability but the initial expectation is that there would be one plus one backup.
- Portable chemical toilets for employees. All sewage from the Project would be removed off site periodically to maintain hygiene and cleanliness standards.
- A nominal six-foot-high chain-link security fence would be constructed around the Project plant site. The fence would be constructed to meet federal and state regulations.

Figure 2 shows the anticipated configuration of the plant site and associated facilities.

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1.2.1.2 Project Construction, Work Force, and Schedule

Construction would include light grading of approximately seven acres of land that would include the plant site, loading area, and the entry road. This would include a berm extended to the outer perimeter of the site. The discharge ponds totaling approximately three acres would be excavated up to 6.5 feet deep and lined with plastic. All discharges from the Project would be managed on site with nothing leaving the Project battery limits. The Project would be constructed so that no off site discharge would be allowed, and all water would be managed on site.

It is estimated that on average ten trucks per day would travel in and out of the Project site during construction. An average of 20 workers would commute to the Project site during construction, and approximately 20 workers would commute during operations. The workers would most likely temporarily reside in [redacted]

Project construction would begin when all necessary permits and approvals are obtained. All construction work would occur in one phase, with all work occurring during daylight hours over five to six days per week over the six-month period.

1.2.1.3 Equipment

Below is a list of construction equipment anticipated to be utilized for the Project:

- Two off-highway trucks
- One roller
- One excavator
- One grader
- Two water trucks
- One compactor
- One crane
- Four generators
- One rough terrain forklift
- One Tractor/Loader/Backhoe
- Seven light-duty pick-up trucks

1.2.1.4 Project Operations

The pilot plant would process brine from the [redacted] (b) (4) to extract lithium and then discharge the delithiated brine into a holding pond. The production operations would consist of the following general processing steps:

1. Pumping of raw brine into storage tanks from the brine well
2. Processing of the lithium brine to be processed in the Direct Lithium Extraction plant
3. Off-site product shipping
4. Storage of process water in holding ponds

A schematic of the processing steps is shown in Figure 3. The production processing steps may be altered over time as production methods and efficiencies evolve and new or revised product lines are developed at the facility. The exact arrangement of the processing equipment is part of the proprietary technology developed for the Project.

1.2.2 Alternatives to Proposed Project

Other than the No Action Alternative, no other alternatives to the proposed Project have been identified. Under the No Action Alternative, the pilot plant would not be developed, and the associated activities would not occur. Lilac could continue their exploration drilling activities and groundwater chemistry characterization.

1.3 Existing Environment

1.3.1 Land Use

The proposed Project Area is an undeveloped area of [redacted] The Project Area would be primarily accessed by existing dirt roads, with a small road spur needed to access the Project Area (Figure 1). [redacted]

(b) (4)

1.3.2 Atmospheric Conditions/Air Quality

The Project Area is located in [redacted]

(b) (4)

The Project Area is in [redacted] and is in attainment with the National Ambient Air Quality Standard for all pollutants. However, there are regions bordering the Project Area that are in non-attainment for $PM_{2.5}$ (inhalable particles, with diameters that are generally 2.5 micrometers and smaller), including portions of [redacted] (b) (4)

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(b) (4)

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1.3.3 Hydrologic Conditions/Water Quality

The Project Area is located in [redacted] there are no other surface water features in the Project Area.

The Federal Emergency Management Agency has labeled the Project Area as Zone D, which means there are possible, but undetermined flood hazards, as no flood hazard analysis has been conducted. There are also no unique aquatic habitats, recreational areas, or public water supplies in the Project Area.

1.3.4 Geologic/Soil Conditions

The Project Area is [redacted] (b) (4) [redacted]

There are no specific soil types in the Project Area, as it is identified as water and saline; therefore, the suitability for rangeland seeding has not been rated (Natural Resources Conservation Service [NRCS] 2022).

1.3.5 Vegetation and Wildlife Resources

The Southwest Regional Gap Analysis Program maps one vegetation community in the [redacted] The remainder of the Project Area is identified as Water (Lowry et al. 2005; United States Geological Survey [USGS] 2005).

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

The United States Fish and Wildlife Service (USFWS) identifies plant and wildlife species and critical habitats listed under the Endangered Species Act of 1973, as amended, that may occur within one or more delineated USGS 7.5-minute quadrangles that the Project Area intersects.

Each quadrangle covers, at a minimum, 49 square miles. The Official Species List provided by the Utah Ecological Services Field Office (Project Code 2022-0049431) [redacted] There are no critical habitats within the vicinity of the Project Area. The online search report provided by the Utah Natural Heritage Program (UNHP) identified [redacted] (b) (4) [redacted]

1.3.6 Socioeconomic Conditions

The Project Area consists of approximately seven acres of [redacted] therefore, there is no existing population in the Project Area. The closest populated area to the Project Area is the [redacted]

1.3.7 Historic/Cultural Resources

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Utah Division of State History Sego database and a review of available historic topographic maps and General Land Office (GLO) survey plats.

1.3.8 Visual Resources

There are no designated scenic byways near the Project Area, nor are there any publicly designated [redacted] (b) (4) [redacted]

1.3.9 Health and Safety Factors

There are no activities currently occurring in the Project Area; therefore, the current emissions and noise levels are at ambient levels.

1.4 Environmental Impacts

1.4.1 Land Use

(b) (4) [redacted]

The proposed Project would change approximately [redacted] of the Project Area, to a lithium extraction pilot plant for approximately three years. The decommissioning of the Project, removal of the temporary facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the temporary change in land use. All wastes would be properly contained and the

Project would not [redacted] n any effluent discharges. Any existing disturbance or features such as access roads would be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

1.4.2 Atmospheric Conditions/Air Quality

The Project has the potential to disturb approximately seven acres. Travel around the Project Area and Project-related activities within the Project Area would create emissions, which would have a potential impact on air quality. Fugitive dust, in the form of PM_{10} (inhalable particles, with diameters that are generally ten micrometers and smaller) and $PM_{2.5}$, would be caused by the operation of the equipment listed in Section 1.2.1.3. Vehicle emissions, in the form of sulfur dioxide (SO_2), nitrogen oxide (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs), would occur any time the internal combustion engines on the vehicles are operating. Table 1 shows the tons of emissions of the identified pollutants.

Table 1: Air Emissions Associated with the Project, Tons per Year

Project Emissions Summary						
Emission Type	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**CO**	**VOCs**
Fugitive Emissions	10.07	1.98	0.003	1.80	1.52	0.09

In addition to the emissions listed in Table 1, there would be a total of approximately 0.0014 ton per year of hazardous air pollutants and approximately 264 metric tons (MT) per year of greenhouse gases (GHGs). To minimize impacts from fugitive dust, Lilac would commit to limiting vehicles speeds to ten to 15 miles per hour and watering roads and other disturbed areas. Estimated emissions from the Project are below the Federal Conformity De Minimis thresholds, which would suggest that the Project would have a de minimis effect on compliance with state and federal air quality standards. In addition, the annual GHG emissions of 264 MT per year is equivalent to the emissions from approximately 57 passenger vehicles driven for one year (United States Environmental Protection Agency [EPA] 2022). This amount is well below the 25,000 MT threshold set for reporting from stationary sources by the EPA. Therefore, emissions resulting from the proposed Project would be inconsequential to the existing air quality environment.

1.4.3 Hydrologic Conditions/Water Quality

The proposed Project is not anticipated to result in any changes to surface or groundwater quality, as all discharge water and delithiated brine would be held in plastic-lined storage ponds. The Project does not include stream diversion activities or waste disposal sites.

1.4.4 Geologic/Soil Conditions

Construction activities associated with the proposed Project are not anticipated to cause subsidence, stream diversion, floodplain or wetland intrusion, or increases or decreases in soil

permeability and filtration. Small amounts of erosion may occur but would be minimized by implementing best management practices (BMPs) to address air and water quality impacts.

1.4.5 Vegetation and Wildlife Resources

The Proposed Action would result in the removal of approximately [redacted] (b) (4) [redacted] The Project Area also does not contain any sensitive habitats such as floodplains or other ecologically sensitive terrain. [redacted]

1.4.6 Socioeconomic Conditions

Project activities would last approximately three years, six months for site preparation and facility construction, two years for operation, and four months for demobilization and site restoration. The Project is proposing approximately 20 employees during construction and approximately 20 employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any temporary beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment.

1.4.7 Historic/Cultural Resources

The online search of the Sego database revealed that no previously identified archaeological sites or architectural resources have been recorded within the Project Area and no cultural inventories have been conducted. A review of historic archival maps shows an [redacted] (b) (4) [redacted] No other historic features (e.g., roads, structures, buildings, etc.) are depicted within the Project Area on any historic archival maps.

1.4.8 Visual Resources

The decommissioning of the Project, removal of the facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the existing aesthetics of the Project Area.

1.4.9 Health and Safety Factors

As the proposed Project involves the use of hazardous substances, potential exposures would be minimized by adherence to guidelines established by the Occupational Safety and Health Administration. All employees would be required to wear appropriate Personal Protective

Equipment to minimize potential exposures to noise, odor, and heat, in compliance with the Mine Safety and Health Administration.

1.4.10 Solid and Hazardous Wastes

All solid and hazardous waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. Table 2 shows the amount of waste generated by Project activities. Solids, primarily undissolved salts, silica and sand, would be generated in volumes expected to be 220 pounds per month. These are expected to be nonhazardous and would be sent to a landfill. The delithiated brine would be stored in a lined storage pond of approximately 370,000 cubic feet. The dimensions of the pond would be 1.6 acres and 6.5 feet deep. The discharge water would be stored in a lined discharge water storage pond of approximately 250,000 cubic feet. The dimensions of the pond would be 1.2 acres and 5.5 feet deep.

Table 2: Wastes Generated by the Project

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

1.4.11 Impacts on Regional or Local Plans

There are no known regional or local plans that would be impacted by the proposed Project. Any solid waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. The discharge water may be used for dust suppression upon confirming sufficient water quality standards and upon receiving appropriate permits.

2 POTENTIAL LIABILITY TO DOE OF EXISTING CONDITIONS AT THE SITE

Outside of the current proposer's drilling activity in the Project Area, any previous activity at the site is unknown. The current activities are not anticipated to result in any impacts to the site.

3 ABILITY TO MEET COMPLIANCE REQUIREMENTS AT THE SITE

The proposed Project would comply with the following applicable federal, state, and/or local laws and regulations:

- National Environmental Policy Act of 1969
- Federal Land Policy and Management Act of 1976, as amended
- Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.)

- Endangered Species Act of 1973, as amended (7 U.S.C. § 1531 et seq.)
- BLM Policy Manual 6840 Special Status Species Management
- Section 106 of the National Historic Preservation Act (54 U.S.C. §306108)
- Archaeological Resources Protection Act of 1979
- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act of 1979
- Indian Sacred Sites – Executive Order (EO) 13007
- Consultation and Coordination with Indian Tribal Governments – EO 1317
- Clean Water Act of 1972
- Clean Air Act of 1970
- Clean Air Act Amendments of 1990
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c)
- Federal Noxious Weed Act of 1974
- Resource Conservation and Recovery Act of 1976
- Toxic Substances Control Act of 1976
- Occupational Safety and Health Act of 1970

Lilac would obtain the following permits and/or submit the following notices for the Project:

- Section 404 Nationwide Permit #7 (Army Corps of Engineers)
- Construction General Permit - Stormwater (Utah Department of Environmental Quality [DEQ])
- Industrial General Permit - Stormwater (Utah DEQ)
- Utah Pollutant Discharge Elimination System Permit (Utah DEQ)
- Notice of Intention to Commence Small Mining Operations (State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining)
- Hazardous Waste Identification Number (EPA)
- Special Use Permit ([redacted] (b) (4) ounty)

To comply with the applicable laws and regulations for air quality, land use, and water quality, Lilac would implement the following measures:

- Emissions of fugitive dust from disturbed surfaces would be minimized by using appropriate control measures. Surface application of water from a water truck and reduced speed limits on dirt access roads are the current methods of dust control.
- Stormwater BMPs would be used at construction sites to minimize stormwater erosion, including fabric or certified weed-free straw bale filter fences, or siltation or filter berms.

4 EXPERIENCE AND APPROACH TO THE IDENTIFICATION AND RESOLUTION OF ENVIRONMENTAL ISSUES

Tony DiNicola, Director of Permitting and Environmental Affairs is responsible for ensuring projects meet applicable Federal, State and local regulations. He holds a Bachelor of Arts in Political Science and his career has focused on environmental compliance and strategy. In addition, Dennis Neymit is the Environmental Health and Safety (EHS) Manager covering the Oakland, California, facility.

At each site, the site manager would have overall accountability for environmental compliance and to ensure that a robust environmental management system covers environmental aspects and compliance obligations. At each site a dedicated EHS staff person is required.

Lilac has been addressing and resolving environmental concerns at the following:

- [redacted] (b) (4) Under their regulatory framework, Lilac complies with Environmental Impact Assessment (EIA) requirements related to the preparation of EIAs and, during exploration, compliance with management obligations contained in the EIAs. Lilac is in the process of obtaining EIAs for production, as well, which will have broader and more detailed compliance requirements.
- Oakland: Lilac has applied for and complies with applicable state and local permits, including Industrial General Permit (stormwater)-exemption, air permit- exemption, hazardous waste generation, hazardous materials storage, emergency response and city sewer discharge permit.
- Fernley: This facility will start operating in Q4 2022 and be subject to the following Hazardous Materials Report (State Fire Marshall), Air Permit (minor), Multisector (Industrial) General Permit- Stormwater (Nevada Division of Environmental Protection), Sewer Discharge (Fernley), Hazardous Waste EPA ID# (small quantity generator), SDS Inventory (Community Right to Know).

Lilac requires site-specific environmental compliance requirements matrices that specify requirements, actions and accountabilities. The Vice-President of Permitting and Environmental Affairs conducts audits to ensure compliance and address any gaps. Air, water, hazardous waste and other environmental training are required for all new employees. Additional ongoing training is required for staff charged with compliance or involved with regulated operations.

5 REFERENCES

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Appendix D
UTAH 2 Project (b) (4) [redacted]

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LILAC SOLUTIONS, INC.
UTAH 2 PROJECT – [redacted] (b) (4)

Environmental Volume

June 2022

Prepared for:

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Submitted to:

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LILAC SOLUTIONS, INC.
UTAH 2 PROJECT – [redacted] (b) (4)
ENVIRONMENTAL VOLUME

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LIST OF ACRONYMS AND ABBREVIATIONS

°	degrees
bgs	below ground surface
BMP	best management practice
CO	carbon monoxide
DEQ	Department of Environmental Quality
DNR DOGM	Department of Natural Resources, Division of Oil, Gas and Mining
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EO	Executive Order
EPA	United States Environmental Protection Agency
F	Fahrenheit
GHG	Greenhouse gas
HCl	hydrochloric acid
Lilac	Lilac Solutions, Inc.
MT	Metric tons
NaOH	sodium hydroxide
NBMG	Nevada Bureau of Mines and Geology
NOx	nitrogen oxide
NRCS	Natural Resources Conservation Service
PM_{10}	inhalable particles, with diameters that are generally ten micrometers and smaller
$PM_{2.5}$	inhalable particles, with diameters that are generally 2.5 micrometers and smaller
Project	Utah 2 Project
SO_2	sulfur dioxide
UNHP	Utah Natural Heritage Program
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WRCC	Western Regional Climate Center

1 ENVIRONMENTAL INFORMATION

1.1 Summary

Lilac Solutions, Inc. (Lilac) is proposing to establish a pilot plant site for lithium extraction and associated activities in [redacted] (b) (4) [redacted]

Project activities would last approximately ten months, including two months for site preparation and facility construction, six months for operation, and two months for demobilization and site restoration. Federal, state, and local regulations, as well as company-established guidelines would be followed; therefore, it is not anticipated that the Project would result in any safety or health impacts. The Project is proposing approximately 20 employees during construction and approximately eight employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any beneficial or detrimental impacts to [redacted] (b) (4) would be absorbed by the existing socioeconomic environment; however, there would be limited opportunities for construction and facility operations jobs and support services. There are no anticipated technological risks from the Project, but potential risks could result from federal and/or state permitting delays.

1.2 Proposed Project and Alternatives

1.2.1 Proposed Project

The Project would consist of the following phased activities:

- Minimal grading and site preparation to allow placement of five shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it would be removed at the end of the Project;
- Blading of a primary access road leading from the Project Area to an existing publicly maintained road;
- Erection of a temporary housing structure/tent; and
- Deployment of ancillary units including portable chemical toilets, filters, generators and tanks.

(b) (4)

1.2.1.1 Facilties and Structures

The Project would include the construction, installation, and operation of the following:

- A 100-foot by 120-foot temporary tent-like structure for the protection of the equipment and personnel, covering a portion of the Project Area.
- Up to 15 storage tanks for the storage of brine feed, water, lithium, diesel, and other chemicals needed for the Project.
- Two separate tanks surrounded by a spill containment system in accordance with federal, state, and local regulations, to store hydrochloric acid (HCl) and sodium hydroxide (NaOH).
- Five standard shipping containers (e.g., CONEX or similar) would house the technology for extracting lithium from the brine. The containers would be connected to the various tanks with pipe work. Power from the main power panel would be routed to each container individually to run the process equipment.
- One containerized office unit (which would house offices, meeting rooms, a control center, and lab space).
- One containerized maintenance shop (to store equipment, materials, and other supplies).
- One small plastic-lined sump of approximately 200 square feet (0.005 acre).
- One plastic-lined discharge water pond approximately 5.5 feet deep and 1.2 acres in size for a total volume of 250,000 cubic feet.
- One plastic-lined delithiated brine storage pond approximately 6.5 feet deep and 1.6 acres in size for a total volume of 370,000 cubic feet.
- Mobile electrical generators, junction boxes, distribution boxes, circuit panels, power switchgear, and metering equipment to handle the electrical loads of the entire facility. The number of generators would be based on market availability but the initial expectation is that there would be one plus one backup.
- Portable chemical toilets for employees. All sewage from the Project would be removed off site periodically to maintain hygiene and cleanliness standards.
- A nominal six-foot-high chain-link security fence would be constructed around the Project plant site. The fence would be constructed to meet federal and state regulations.

Figure 2 shows the anticipated configuration of the plant site and associated facilities.

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1.2.1.2 Project Construction, Work Force, and Schedule

Construction would include light grading of approximately five acres of land that would include the plant site, loading area, and the entry road. This would include a berm extended to the outer perimeter of the site. The discharge ponds totaling approximately three acres would be excavated up to 6.5 feet deep and lined with plastic. All discharges from the Project would be managed on site with nothing leaving the Project battery limits. The Project would be constructed so that no off site discharge would be allowed, and all water would be managed on site.

It is estimated that on average ten trucks per day would travel in and out of the Project site during construction. An average of 20 workers would commute to the Project site during construction, and approximately eight workers would commute during operations. The workers would most likely temporarily reside in [redacted] (b) (4)

Project construction would begin [redacted] necessary permits and approvals are obtained. All construction work would occur in one phase, with all work occurring during daylight hours over five to six days per week over the two-month period.

1.2.1.3 Equipment

Below is a list of construction equipment anticipated to be utilized for the Project:

- Two off-highway trucks
- One roller
- One excavator
- One grader
- Two water trucks
- One compactor
- One crane
- Four generators
- One rough terrain forklift
- One Tractor/Loader/Backhoe
- Seven light-duty pick-up trucks

1.2.1.4 Project Operations

The pilot plant would process brine from the [redacted] (b) (4) to extract lithium and then discharge the delithiated brine into a holding pond. The production operations would consist of the following general processing steps:

1. Pumping of raw brine into storage tanks from the brine well
2. Processing of the lithium brine to be processed in the Direct Lithium Extraction plant
3. Off-site product shipping
4. Storage of delithiated brine and discharge water in holding ponds

A schematic of the processing steps is shown in Figure 3. The production processing steps may be altered over time as production methods and efficiencies evolve and new or revised product lines are developed at the facility. The exact arrangement of the processing equipment is part of the proprietary technology developed for the Project.

1.2.2 Alternatives to Proposed Project

Other than the No Action Alternative, no other alternatives to the proposed Project have been identified. Under the No Action Alternative, the pilot plant would not be developed, and the associated activities would not occur. Lilac could continue their exploration drilling activities and groundwater chemistry characterization through their Exploration Notice as approved by the State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining (DNR DOGM).

1.3 Existing Environment

1.3.1 Land Use

The proposed Project Area is an undeveloped area of approximately five acres, located on a sand dune. The Project Area would be accessed by an existing highway, existing dirt roads, and a new bladed road needed to access the Project Area. There is an underground water line under the eastern portion of the Project Area.

1.3.2 Atmospheric Conditions/Air Quality

The Project Area is located in the [redacted] (b) (4) [redacted]

The Project Area and vicinity, as well as the portion of [redacted]

This entire page contains trade secrets, confidential, proprietary, or privileged information exempt from public disclosure, and is subject to the restriction on the title page.

(b) (4)

This entire page contains trade secrets, confidential, proprietary, or privileged information exempt from public disclosure, and is subject to the restriction on the title page.

1.3.3 Hydrologic Conditions/Water Quality

The Project Area is located in the West Desert Basin. There are no known available data for groundwater levels near the Project Area. There is one intermittent drainage that drains towards the sand dune where the Project is located. There are no known available data describing surface or ground water quality conditions.

The Federal Emergency Management Agency has labeled the Project Area as Zone D, which means there are possible, but undetermined flood hazards, as no flood hazard analysis has been conducted. There are also no unique aquatic habitats or recreational areas in the Project Area. The underground water pipeline under the eastern portion of the Project Area provides water to [redacted]

1.3.4 Geologic/Soil Conditions

The Project Area is located on an [redacted]

(b) (4)

The soil type in the Project Area is the [redacted]. The susceptibility of erosion by water is slight and by wind is moderate (Natural Resources Conservation Service [NRCS] 2000). This soil type has been rated as poorly suited for rangeland seeding (NRCS 2022).

1.3.5 Vegetation and Wildlife Resources

The Southwest Regional Gap Analysis Program maps one vegetation community within the Project Area: [redacted]

(b) (4)

The United States Fish and Wildlife Service (USFWS) identifies plant and wildlife species and critical habitats listed under the Endangered Species Act (ESA) of 1973, as amended, that may occur within one or more delineated USGS 7.5-minute quadrangles that the Project Area intersects. Each quadrangle covers, at a minimum, 49 square miles. The Official Species List provided by the Utah Ecological Services Field Office (Project Code 2022-0049448) lists one Candidate species, the monarch butterfly (*Danaus plexippus*) with the potential to be affected by anthropogenic activities in the vicinity of the Project Area. There are no critical habitats or migratory birds of concern within the vicinity of the Project Area.

The online search report provided by the Utah Natural Heritage Program (UNHP) identified no state-protected species in the Project Area or within a two-mile radius of the Project Area.

1.3.6 Socioeconomic Conditions

The Project Area consists of approximately five acres of undisturbed land managed by the BLM; therefore, there is no existing population in the Project Area. The closest populated area to the Project Area is the [redacted] (b) (4)

1.3.7 Historic/Cultural Resources

An online archival literature search of the Project Area was conducted to identify whether any previously identified or unrecorded archaeological sites or architectural resources are located within the Project Area. This assessment included a search of the Utah Division of State History Sego database and a review of available historic topographic maps and General Land Office survey plats.

1.3.8 Visual Resources

There are no scenic vistas in the Project Area or vicinity. The Project Area lies on a sparsely vegetated sand dune.

1.3.9 Health and Safety Factors

There are no activities currently occurring in the Project Area; therefore, the current emissions and noise levels are at ambient levels.

1.4 Environmental Impacts

1.4.1 Land Use

The proposed Project would change approximately [redacted] (b) (4) [redacted] to a lithium extraction pilot plant for approximately ten months. The decommissioning of the Project, removal of the temporary facilities, and reclamation and

revegetation of the disturbed land would minimize any impacts to the temporary change in land use. All wastes would be properly contained and the Project would not result in any effluent discharges. Any existing disturbance or features such as access roads would be maintained, if necessary, during the Project and reclaimed at the end of the Project to pre-Project conditions.

1.4.2 Atmospheric Conditions/Air Quality

The Project has the potential to disturb approximately five acres. Travel around the Project Area and Project-related activities within the Project Area would create emissions, which would have a potential impact on air quality. Fugitive dust, in the form of PM_{10} (inhalable particles, with diameters that are generally ten micrometers and smaller) and $PM_{2.5}$ (inhalable particles, with diameters that are generally 2.5 micrometers and smaller), would be caused by the operation of the equipment listed in Section 1.2.1.3. Vehicle emissions, in the form of sulfur dioxide (SO_2), nitrogen oxide (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs), would occur any time the internal combustion engines on the vehicles are operating. Table 1 shows the tons of emissions of the identified pollutants.

Table 1: Air Emissions Associated with the Project, Tons per Year

Project Emissions Summary						
Emission Type	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**CO**	**VOCs**
Fugitive Emissions	10.07	1.98	0.003	1.80	1.52	0.09

In addition to the emissions listed in Table 1, there would be a total of approximately 0.0014 ton per year of hazardous air pollutants and approximately 264 metric tons (MT) per year of greenhouse gases (GHGs). To minimize impacts from fugitive dust, Lilac would commit to limiting vehicles speeds to ten to 15 miles per hour and watering roads and other disturbed areas. Estimated emissions from the Project are below the Federal Conformity De Minimis thresholds, which would suggest that the Project would have a de minimis effect on compliance with state and federal air quality standards. In addition, the annual GHG emissions of 264 MT per year is equivalent to the emissions from approximately 57 passenger vehicles driven for one year (United States Environmental Protection Agency [EPA] 2022). This amount is well below the 25,000 MT threshold set for reporting from stationary sources by the EPA. Therefore, emissions resulting from the proposed Project would be inconsequential to the existing air quality environment.

1.4.3 Hydrologic Conditions/Water Quality

The Proposed Action is not anticipated to result in any changes to surface or groundwater quality, as all discharge water and delithiated brine would be held in plastic-lined storage ponds. The Project does not include stream diversion activities or waste disposal sites.

1.4.4 Geologic/Soil Conditions

Construction activities associated with the proposed Project are not anticipated to cause subsidence, stream diversion, floodplain or wetland intrusion, or increases or decreases in soil permeability and filtration. Small amounts of erosion may occur but would be minimized by implementing best management practices (BMPs) to address air and water quality impacts.

1.4.5 Vegetation and Wildlife Resources

The Proposed Action would result in the removal of approximately five acres of portions of the [redacted] (b) (4) [redacted] he USFWS identified the potential for the Monarch butterfly to be impacted by the Project; however, based on an aerial view of the Project Area, there are no applicable host plants for the Monarch butterfly (e.g., milkweed) in the Project Area. No other state or federally listed species were identified through USFWS and UNHP database searches. The Project Area also does not contain any sensitive habitats such as wetlands, floodplains, or other ecologically sensitive terrain.

1.4.6 Socioeconomic Conditions

Project activities would last approximately ten months, including two months for site preparation and facility construction, six months for operation, and two months for demobilization and site restoration. The Project is proposing approximately 20 employees during construction and approximately eight employees during operations and restoration/reclamation, which most likely would temporarily stay in [redacted] Due to the low number of employees, any temporary beneficial or detrimental impacts to [redacted] would be absorbed by the existing socioeconomic environment.

1.4.7 Historic/Cultural Resources

The online search of the Sego database revealed that a total [redacted] (b) (4) [redacted]

1.4.8 Visual Resources

The decommissioning of the Project, removal of the facilities, and reclamation and revegetation of the disturbed land would minimize any impacts to the existing aesthetics of the Project Area.

1.4.9 Health and Safety Factors

As the Proposed Action involves the use of hazardous substances, potential exposures would be minimized by adherence to guidelines established by the Occupational Safety and Health Administration. All employees would be required to wear appropriate Personal Protective Equipment to minimize potential exposures to noise, odor, and heat, in compliance with the Mine Safety and Health Administration.

1.4.10 Solid and Hazardous Wastes

All solid and hazardous waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. Table 2 shows the amount of waste generated by Project activities. Solids, primarily undissolved salts, silica and sand, would be generated in volumes expected to be 220 pounds per month. These are expected to be nonhazardous and would be sent to a landfill. The delithiated brine would be stored in a lined storage pond of approximately 370,000 cubic feet. The dimensions of the pond would be 1.6 acres and 6.5 feet deep. The discharge water would be stored in a lined discharge water storage pond of approximately 250,000 cubic feet. The dimensions of the pond would be 1.2 acres and 5.5 feet deep.

Table 2: Wastes Generated by the Project

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

(b) (4)

1.4.11 Impacts on Regional or Local Plans

(b) (4) The proposed Project would not impact [redacted] Any solid waste generated by the Project would be hauled off site to appropriate facilities in compliance with federal, state, and local regulations. The discharge water may be used for dust suppression upon confirming sufficient water quality standards and upon receiving the appropriate permits.

2 POTENTIAL LIABILITY TO DOE OF EXISTING CONDITIONS AT THE SITE

Outside of the current proposer's exploration drilling activity in the Project Area, any previous activity at the site is unknown. The currently approved activities are not anticipated to result in any impacts to the site.

3 ABILITY TO MEET COMPLIANCE REQUIREMENTS AT THE SITE

The proposed Project would comply with the following applicable federal, state, and/or local laws and regulations:

- National Environmental Policy Act of 1969
- Federal Land Policy and Management Act of 1976, as amended
- Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.)
- Endangered Species Act of 1973, as amended (7 U.S.C. § 1531 et seq.)
- BLM Policy Manual 6840 Special Status Species Management
- Section 106 of the National Historic Preservation Act (54 U.S.C. §306108)
- Archaeological Resources Protection Act of 1979
- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act of 1979
- Indian Sacred Sites – Executive Order (EO) 13007
- Consultation and Coordination with Indian Tribal Governments – EO 1317
- Clean Water Act of 1972
- Clean Air Act of 1970
- Clean Air Act Amendments of 1990
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c)
- Federal Noxious Weed Act of 1974
- Resource Conservation and Recovery Act of 1976
- Toxic Substances Control Act of 1976
- Occupational Safety and Health Act of 1970

Lilac would obtain the following permits and/or submit the following notices for the Project:

- Notice of Intention to Commence Small Mining Operations (DNR DOGM)
- Construction General Permit - Stormwater (Utah Department of Environmental Quality [DEQ])
- Utah Ground Water Discharge Permit (Utah DEQ)
- Hazardous Waste Identification Number (EPA)
- Conditional Use Permit ([redacted] (b) (4) County)

To comply with the applicable laws and regulations for air quality, land use, and water quality, Lilac would implement the following measures:

- Emissions of fugitive dust from disturbed surfaces would be minimized by using appropriate control measures. Surface application of water from a water truck and reduced speed limits on dirt access roads are the current methods of dust control.
- Stormwater BMPs would be used at construction sites to minimize stormwater erosion, including fabric or certified weed-free straw bale filter fences, or siltation or filter berms.

4 EXPERIENCE AND APPROACH TO THE IDENTIFICATION AND RESOLUTION OF ENVIRONMENTAL ISSUES

Tony DiNicola, Director of Permitting and Environmental Affairs is responsible for ensuring projects meet applicable Federal, State and local regulations. He holds a Bachelor of Arts in Political Science and his career has focused on environmental compliance and strategy. In addition, Dennis Neymit is the Environmental Health and Safety (EHS) Manager covering the Oakland, California, facility.

At each site, the site manager would have overall accountability for environmental compliance and to ensure that a robust environmental management system covers environmental aspects and compliance obligations. At each site a dedicated EHS staff person is required.
Lilac has been addressing and resolving environmental concerns at the following:

- [redacted] (b) (4) Under their regulatory framework, Lilac complies with Environmental Impact Assessment (EIA) requirements related to the preparation of EIAs and, during exploration, compliance with management obligations contained in the EIAs. Lilac is in the process of obtaining EIAs for production, as well, which will have broader and more detailed compliance requirements.
- Oakland: Lilac has applied for and complies with applicable state and local permits, including Industrial General Permit (stormwater)-exemption, air permit- exemption, hazardous waste generation, hazardous materials storage, emergency response and city sewer discharge permit.
- Fernley: This facility will start operating in Q4 2022 and be subject to the following Hazardous Materials Report (State Fire Marshall), Air Permit (minor), Multisector (Industrial) General Permit- Stormwater (Nevada Division of Environmental Protection), Sewer Discharge (Fernley), Hazardous Waste EPA ID# (small quantity generator), SDS Inventory (Community Right to Know).

Lilac requires site-specific environmental compliance requirements matrices that specify requirements, actions and accountabilities. The Vice-President of Permitting and Environmental Affairs conducts audits to ensure compliance and address any gaps. Air, water, hazardous waste and other environmental training are required for all new employees. Additional ongoing training is required for staff charged with compliance or involved with regulated operations.

5 REFERENCES

[redacted] (b) (4)

Lowry, J. H, Jr., R. D. Ramsey, K. Boykin, D. Bradford, P. Comer, S. Falzarano, W. Kepner, J. Kirby, L. Langs, J. Prior-Magee, G. Manis, L. O'Brien, T. Sajwaj, K. A. Thomas, W. Rieth, S. Schrader, D. Schrupp, K. Schulz, B. Thompson, C. Velasquez, C. Wallace, E. Waller and B. Wolk. 2005. *Southwest Regional Gap Analysis Project: Final Report on Land Cover Mapping Methods*, RS/GIS Laboratory, Utah State University, Logan, Utah.

[redacted] (b) (4)

United States Environmental Protection Agency (EPA). 2022. Greenhouse Gas Equivalencies Calculator. https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results. Accessed June 6, 2022.

United States Geological Survey National Gap Analysis Program (USGS). 2005. Southwest Regional GAP Analysis Project - Land Cover Descriptions. United States Geological Survey National Gap Analysis Program. RS/GIS Laboratory, College of Natural Resources, Utah State University. Logan, Utah. Available online at: http://earth.gis.usu.edu/swgap/legend_desc.html.

[redacted] (b) (4)

DOE F 540
(04-2017)

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

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

ENVIRONMENTAL QUESTIONNAIRE

SECTION I. PROJECT SUMMARY	
Control Number:	2678-1564
Project Title:	Unlocking U.S. Lithium Production
Applicant:	Lilac Solutions, Inc.
Other Participants (Subrecipients, Contractors, etc.):	Argonne National Laboratory National Renewable Energy Laboratory University of Nevada at Reno
FOA Number:	DE-FOA-0002678
FOA Title: Bipartisan Infrastructure Law (BIL) Battery Materials Processing and Battery Manufacturing .	

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.

Explanation:

[redacted]

(b) (4)

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:

[redacted]

(b) (4)

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 checkned "NO" you must complete the entire questionnaire.

Explanation:

[redacted]

(b) (4)

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:

[redacted] (b) (4)

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).

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(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*
Lilac Headquarters 1700 20th Street, Oakland, CA 94607	Oakland Facility - Urban manufacturing facility (R&D)	R&D and pilot manufacturing activities for IX ceramic beads to be utilized in the direct extraction of lithium for batteries	Private Lease
Fernley Manufacturing Facility 2200 East Newlands Drive, Fernley, NV	Fernley Facility - Industrial, previously developed but currently	Commercial manufacturing activities for IX ceramic beads to be utilized in the direct extraction of lithium for batteries (e.g., used in electric vehicles), quality laboratory, warehousing,	Private Lease
[redacted]	The site is undisturbed in a rural area	The Project would consist of the following phased activities: • Minimal grading and site preparation to allow placement of five shipping containers that house the pilot plant, as well as	BLM
	The site is undisturbed in a rural area	The Project would consist of the following phased activities: • Minimal grading and site preparation to allow placement of five shipping containers	BLM
	The site is undisturbed in a rural area	The Project would consist of the following phased activities: • Minimal grading and site preparation to allow placement of five shipping containers that house the pilot plant, as well as office and storage containers. A temporary foundation may be needed depending on season and land condition; if needed, it would be	Private
	The site is undisturbed in a rural area	The Project would consist of the following phased activities: • Minimal grading and site preparation to allow placement of five shipping containers that house the pilot plant, as well as office and storage containers. A	State of Utah

(b) (4)

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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. Describe individually for each site discussed in Question 2b.

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.

(b) (4)

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

(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.

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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:

The Oakland Facility will include R&D and pilot manufacturing activities for IX ceramic beads. Lilac modified the existing building at the Oakland Facility site for these activities, and the R&D activities have been occurring for approximately two (2) years. No ground disturbing activities and no change in use of the existing facility was made (it remains manufacturing). Existing roads are being (and will continue to be) utilized to access the Oakland Facility.

The Fernley Facility has been previously developed with an approximately 450,000 square foot manufacturing/warehousing building and will be modified for manufacture of the IX ceramic beads. Portions of the existing building will also be modified to accommodate a quality laboratory and warehousing, shipping/receiving, and administrative functions and to tie new manufacturing equipment into building and city utilities. Finally, a new foundation outdoors to site utilities and electrical distribution to support processing equipment will be installed. No ground disturbing activities and no change in use of the existing facility will be made (it remains manufacturing). Existing roads will be utilized to access the Fernley Facility.

Nevada 1 Site: The proposed project would result in ground clearing of approximately five acres. It would also include the installation and construction of the following new facilities: a temporary tent-like structure; up to 15 storage tanks; two separate tanks for the storage of HCl and NaOH; five standard shipping containers; one containerized office unit; one containerized maintenance shop; one plastic-lined sump; one plastic-lined discharge water pond; one plastic-lined delithiated brine pond; and associated ancillary facilities (e.g., generators, portable chemical toilets, and a chain-link security fence).

Nevada 2 Site: The proposed project would result in ground clearing of approximately seven acres. t would also include the installation and construction of the following new facilities: multiple tent-like structures; up to 15 storage tanks; two separate tanks for the storage of HCl and NaOH; ten standard shipping containers; one containerized office unit; one containerized maintenance shop; one plastic-lined sump; one plastic-lined discharge water pond; one plastic-lined delithiated brine pond; and associated ancillary facilities (e.g., generators, portable chemical toilets, and a chain-link security fence).

Utah 1 Site: The proposed project would result in ground clearing of approximately seven acres. It would also include the installation and construction of the following new facilities: multiple tent-like structures; up to 15 storage tanks; two separate tanks for the storage of HCl and NaOH; ten standard shipping containers; one containerized office unit; one containerized maintenance shop; one plastic-lined sump; one plastic-lined discharge water pond; one plastic-lined delithiated brine pond; and associated ancillary facilities (e.g., generators, portable chemical toilets, and a chain-link security fence).

Utah 2 Site: The proposed project would result in ground clearing of approximately five acres. It would also include the installation and construction of the following new facilities: a temporary tent-like structure; up to 15 storage tanks; two separate tanks for the storage of HCl and NaOH; five standard shipping containers; one containerized office unit; one containerized maintenance shop; one plastic-lined sump; one plastic-lined discharge water pond; one plastic-lined delithiated brine pond; and associated ancillary facilities (e.g., generators, portable chemical toilets, and a chain-link security fence).

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:

The Oakland R&D and pilot manufacturing and facility will require permits typical of industrial manufacturing facilities, including air permit exemptions from the Bay Area Air Quality Management District for low levels of volatile organic compounds ("VOCs"), Nitrogen Oxides (NOx), and particulate matter ("PM"); Multisector Industrial General Permit for Stormwater No Exposure Certification; a U.S. Environmental Protection Agency Hazardous Waste Generator ID for small quantity generators and waste inventory registration with the California Department of Toxic Substances Control and Alameda County Department of Environmental Health; registration with the California Accidental Release Program (and a Risk Management Plan); as well as a Conditional Use Permit from the City of Oakland which also addresses trash, blight, grafitti, third-party traffic, and operational noise. A wastewater sewer discharge permit from the East Bay Municipal Utility District is not expected to be required due to the very small volumes of wastewater from the site.

The Fernley manufacturing facility will also require permits typical of industrial manufacturing facilities, including an air permit or air permit exemption from the Nevada Division of Environmental Protection for low levels of VOCs, NOx, and PM; Multisector Industrial General Permit for Stormwater No Exposure Certification; a wastewater sewer discharge permit for nonhazardous wastewater; a U.S. Environmental Protection Agency Hazardous Waste Generator ID for small quantity generators; registration with the Nevada Chemical Accident Prevention Program (and a Risk Management Plan); as well as business licenses and building permits as applicable.

Nevada 1 Site: The proposed Project would require the following permits and authorizations: General Stormwater Permit at Construction Sites; General Industrial Stormwater Permit; Temporary Discharge Permit; EPA ID number; Special Use Permit; and Project authorization from the BLM.

Nevada 2 Site: The proposed Project may require the following permits and authorizations: General Stormwater Permit at Construction Sites; General Industrial Stormwater Permit; Temporary Discharge Permit; EPA ID number; Special Use Permit; and Project authorization from the BLM.

Utah 1 Site: The proposed Project may require the following permits and authorizations: Section 404 Nationwide Permit #7; Construction General Permit - Stormwater; Industrial General Permit - Stormwater; Utah Pollutant Discharge Elimination System Permit; and EPA ID number.

Utah 2 Site: The proposed Project would require the following permits and authorizations: Construction General Permit - Stormwater; EPA ID number; Conditional Use Permit; and Project authorization from the State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining.

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). <u>Describe individually for each site discussed in Question 2b.</u>

Explanation:

[redacted]

(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. <u>Describe air emissions individually for each site discussed in Question 2b.</u>

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:

The Oakland Facility is located in Alameda County, which is a Moderate Nonattainment area for PM with an aerodynamic diameter of 2.5 microns or less (PM2.5), and a Marginal Nonattainment Area for both the 2008 and 2015 8-hour Ozone standards. Potential emissions include PM2.5, NOx, VOCs, toxic air contaminants ("TACs"), and greenhouse gases ("GHGs") from stationary sources, including material handling of the solids received and processed, furnace processing; mixing process of the solvents; loading activities associated with the storage of acetone, ethanol, and tetrahydrofuran in tanks; and an emergency generator. Maximum potential to emit quantities of air emissions from these sources are expected to be as follows (with the exception of emissions from the emergency generator which have not yet been quantified because engine details (i.e., model, make, engine rating, and fuel type) are still to be determined; note that the emergency generator is expected to be the only source of GHG emissions)
- PM2.5 1.81 tons per year ("tpy")
- NOx 0.73 tpy
- VOC 1.96 tpy

The Fernley Facility is located in Lyon County, which is an Attainment area for criteria pollutants. Potential emissions include PM2.5 and PM10, NOx, VOCs, Sulfur Dioxide ("SO2"), Carbon Monoxide ("CO"), Lead ("Pb"), hazardous air pollutants ("HAPs") and GHGs from stationary sources, including material handling of the solids received and processed, furnace processing; mixing process of the solvents; loading activities associated with the storage of acetone, ethanol, and tetrahydrofuran in tanks; and emergency generators. Maximum potential to emit quantities of air emissions from these sources for the first phase of ceramic bead production–small scale commercial (0.5 MT/day)–are expected to be as follows
- Total PM 5.045 tpy
- PM10 5.0071 tpy
- PM2.5 4.9736 tpy
- SO2 0.0897 tpy
- CO 2.0284 tpy
- NOx 5.5665 tpy
- VOC 3.4784 tpy
- Pb 1.13E-05
- Total HAPs 3.1793

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:

Nonhazardous waste at both the Oakland Facility and Fernley Facility will include both non-recyclables and recyclables--aproximately 2000 pounds/month for the Oakland Facility and 6000 pounds/month for the Fernley Facility at large commercial quantities production levels.

Nevada 1 Site: All non-hazardous construction waste and human-generated trash would be collected in the appropriate bins or dumpsters and disposed of in applicable facilities in compliance with federal, state, and local regulations.

Nevada 2 Site: All non-hazardous construction waste and human-generated trash would be collected in the appropriate bins or dumpsters and disposed of in applicable facilities in compliance with federal, state, and local regulations.

Utah 1 Site: All non-hazardous construction waste and human-generated trash would be collected in the appropriate bins or dumpsters and disposed of in applicable facilities in compliance with federal, state, and local regulations.

Utah 2 Site: All non-hazardous construction waste and human-generated trash would be collected in the appropriate bins or dumpsters and disposed of in applicable facilities in compliance with federal, state, and local regulations.

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.)

- [x] 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
- [x] 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:

[redacted]

(b) (4)

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:

Lithium is considered a non-renewable mineral, and the four lithium extraction sites involved in the proposed project will be utilized to extract lithium. The Oakland Facility and Fernley Facility operations will serve as R&D and manufacturing facilities for IX ceramic beads that will be distributed to other lithium extraction companies both locally and internationally to allow for the direct extraction of lithium. The lithium produced will be used for lithium batteries, such as those used in electric vehicle batteries, which is expected to result in the reduction of global GHG emissions.

Nevada 1 Site: The proposed Project includes the clearing of undisturbed land approximately five acres in size.
If any noxious weeds are encountered in the Project Area, pesticides may be applied for their eradication. However, Lilac would coordinate with the BLM for the proper treatment methods.

Nevada 2 Site:The proposed Project includes the clearing of undisturbed land approximately seven acres in size.
If any noxious weeds are encountered in the Project Area, pesticides may be applied for their eradication. However, Lilac would coordinate with the BLM for the proper treatment methods.

Utah 1 Site: The proposed Project includes the clearing of undisturbed land approximately seven acres in size.
If any noxious weeds are encountered in the Project Area, pesticides may be applied for their eradication.

Utah 2 Site: The proposed Project includes the clearing of undisturbed land approximately five acres in size.
If any noxious weeds are encountered in the Project Area, pesticides may be applied for their eradication. However, Lilac would coordinate with the State of Utah for the proper treatment methods.

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.

- [x] a. Visual impacts
- [ ] b. Populations of low income or minorities (Environmental Justice)
- [x] c. Changes in local employment
- [x] 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:

[redacted]

(b) (4)

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 [x] | **No** [ ]

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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:

(b) (4)

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.

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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:

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.

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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:

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:

At both the Oakland Facility and the Fernley Facility, wastewater is discharged to the sewer. At the Oakland Facility, the volumes are minimal, around 1000 gallons/week. At the Fernley Facility, we expect wastewater volumes to be around 200k gallons/day for large commercial production levels. No pre-treatment is expected to be necessary and the wastewater is predominantly water.
No water is discharged to surface waters. Both the Oakland Facility and the Fernley Facility will have a Multisector Industrial General Permit for Stormwater No Exposure Certification.

Nevada 1 Site: Process water and delithiated brine would be discharged into plastic-lined ponds.

Nevada 2 Site: Process water and delithiated brine would be discharged into plastic-lined ponds.

Utah 1 Site: Process water and delithiated brine would be discharged into plastic-lined ponds.

Utah 2 Site: Process water and delithiated brine would be discharged into plastic-lined ponds.

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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:

Industrial machinery will be used in the manufacturing process at the Oakland Facility and the Fernley Facility, including for solids processing, filtration, and materials handling. In addition, a furnace and a solvent processing system, including compressors, fans, hydraulic equipment and similar, will be used. Noise levels inside the facility near this machinery and equipment may be elevated. If noise exposure to employees exceeds the Cal/OSHA noise "Action Level" of 85-dBA (using an 8-hour time-weighted average) or Nevada OSHA or federal OSHA standards, as applicable, Lilac will implement a Hearing Conservation Program (HCP), as required by 8 CCR 5097, Nevada OSHA regulations, and federal OSHA regulations, as applicable, to ensure safety of Lilac employees in the facilities. While noise levels may be elevated in production areas within the facilities, there will be no significant process noise outside the facilities, and fence-line noise levels from Lilac's manufacturing process will not lead to a noticeable increase in typical neighborhood or community background noise levels.

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

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Explanation: Lilac anticipates operating the Oakland Facility and the Fernley Facility indefinitely. However, if the facilities ever cease operation as intended, equipment on site will be decommissioned and materials and equipment will be recycled if practicable, or otherwise properly disposed of.

Nevada 1 Site: All structures and equipment would be dismantled and removed at the end of the Project. The ponds would be emptied, liner removed, and ponds filled with reclamation material and recontoured. The rest of the five acres would be recontoured to match the surrounding topography and reseeded with a weed-free seed mix, in coordination with the BLM.

Nevada 2 Site: All structures and equipment would be dismantled and removed at the end of the Project. The ponds would be emptied, liner removed, and ponds filled with reclamation material and recontoured. The rest of the seven acres would be recontoured to match the surrounding topography and reseeded with a weed-free seed mix, in coordination with the BLM.

Utah 1 Site: All structures and equipment would be dismantled and removed at the end of the Project. The ponds would be emptied, liner removed, and ponds filled with reclamation material and recontoured.

Utah 2 Site: All structures and equipment would be dismantled and removed at the end of the Project. The ponds would be emptied, liner removed, and ponds filled with reclamation material and recontoured. The rest of the five acres would be recontoured to match the surrounding topography and reseeded with a weed-free seed mix, in coordination with the State of Utah.

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	David Snydacker
Title	CEO, Lilac Solutions
Applicant	Lilac Solutions, Inc.
Signature	David Henry Snydacker
Date	6/30/2022

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Location(s) of Work Documentation

DE-FOA-0002678

Control Number: 2678-1564

Prime Applicant/ Team Member	Address	City	State	Nine Digit Zip Code (ZIP+4)
Lilac SolutionsWestern Ceramics Company 1 (Lilac subs	2200 E. Newlands Drive	Fernley	NV	89408
Lilac SolutionsNevada 1 Project	[redacted]			
Lilac SolutionsNevada 2 Project				
Lilac SolutionsUtah 1 Project				
Lilac SolutionsUtah 2 Project				
Lilac Solutions Headquarters	1700 20th St.	Oakland	CA	94607
University of Nevada- Reno (School of Business)	1664 No. Virginia St. MS 0325	Reno	NV	89557-0325
Argonne National Laboratory (ANL)	9700 S. Cass Ave. Bldg. 363A	Lemont	IL	60439
National Renewable Energy Laboratory (NREL)	15013 Denver West Parkway	Golden	CO	80401

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David Snydacker—Principal Investigator

Education	Contact Information
• Northwestern University, Evanston, IL | Materials Science and Engineering | Ph.D. 2016 • Wesleyan University, Middletown, CT | Chemistry, Molec-ular Biology, and Biochemistry | B.A. 2009	dave@lilacsolutions.com (b) (6)

Current Positions

Lilac Solutions, Inc. | Chief Executive Officer **2014–present**
- Lithium extraction from brine resources with unique ion exchange technology
- Technical lead on IX bead and IX process design
- Lead author on 9 patent filings, co-author on 5 patent filings

Research and Professional Experience

Dosima Research | Battery Consultant **2014–2017**
- Identified and solved critical problems in battery technology.
- Deigned advanced materials for durable high-energy batteries.

Wolverton Research Group | Ph.D. Researcher **2010–2016**
- Scouted technologies for next generation lithium batteries.
- Led R&D strategy on materials degradation and design.
- Modeled battery properties and chemical reactions including solid, liquid, and gas phases.
- Discovered new materials for electrode coatings to improve battery lifespan.
- Wrote 6 papers and 2 provisional patent applications as lead author.
- Created and led seminar series for battery researchers on performance and degradation.

SiNode Systems, Inc. | Research Advisor **2014–2015**
- Advanced lithium-ion startup (details undisclosed).

Northwestern Energy and Sustainability Consortium | Co-Founder and Co-Director **2011–2014**
- Built team of students from science, engineering, business, and liberal arts.
- Led technology seminars on energy storage, electric vehicles, transportation, and advanced fuels.

Wesleyan University | Undergraduate Researcher **2008–2009**
- High Honors in chemistry for characterization of fluorescent DNA probe.
- Interdisciplinary study with physical chemistry and structural biology labs.

NYU Polytechnic, Montclare Protein Engineering Lab | Summer Researcher **2007**
- Synthesized proteins using fluorinated amino acids.
- Cloned bacteria, purified protein, and analyzed composition.

Red Wire Black Wire (Indie Rock Band) | Drummer **2006–2010**
- Performed in 40 cities including New York, Chicago, San Francisco, Toronto, and Moscow.
- Co-wrote, recorded, and promoted 2 albums: Robots and Roses and Compass EP.
- Licensed music to The Voice (NBC), Skins (MTV), Taking the Stage (MTV), and Cash Money Records.

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Awards and Honors

- Eight patents filed as first author.
- High Honors in chemistry from Wesleyan University
- Hawk Prize for effective work in biochemistry
- CRC Chemistry Award to "outstanding first-year chemistry student"

Publications

1. Snydacker, D.; Hegde, V.; Aykol, M.; Wolverton, C. Computational Discovery of Li-M-O Ion Exchange Materials for Lithium Extraction from Brines. *Non-provisional patent application filed February 2017.*
2. Snydacker, D.; Wolverton, C. Transition Metal Mixing and Redox Potentials in $Li_x(M_{1-y}M'_y)PO_4$ (M, M' = Mn, Fe, Ni) Olivine Materials from First Principles Calculations. *J. Phys. Chem. C.* ***2016****, 120 (11),* 5932–5939
3. Snydacker, D.; Wolverton, C. Oxygen Evolution from Olivine Mn(1-x)M(x)PO4 (M = Fe, Ni, Al, Mg) Delithiated Cathode Materials. *Phys. Rev. B* **95** 024102-9 (2017).
4. Snydacker, D.; Aykol, M.; Kirklin, S.; Wolverton, C. Lithium Ion Cathode/Coating Pairs for Transition Metal Containment. *J. Electrochem. Soc.,* **163** (9) A2054-A2064 (2016).
5. Voloshchuk, N.; Zhu, A.; Snydacker, D.; Montclare, J.K. Positional effects of monofluorinated phenylalanines on histone acetyltransferase stability and activity. *Bioorganic & Medicinal Chemistry Letters* **2009,** 19 (18), 5449-5451.

Synergistic Activities

1. Materials design
2. Lithium chemistry and processing
3. Technology scouting
4. Failure analysis
5. Chemical synthesis and characterization, thermodynamic and chemical modeling

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[[David Gelinas—Key Personnel (Project Financial Officer)

Education	Contact Information
▪ Cornell University, Ithaca, NY | B.A. 2007	david.gelinas@lilacsolutions.com (b) (6)

Current Positions

Lilac Solutions, Inc. \| CFO **Mar 2021–present**

- Responsible for tracking cash flow, financial planning, analyzing the company's financial strengths, and proposing strategic directions.

Research and Professional Experience

Stem \| Vice President, Finance **Jan 2020–Feb 2021**

- Responsible for Financial Planning and Analysis (FP&A), Corporate Finance and Project Finance.

Guggenheim Securities \| Vice President **Jan 2019–Dec 2019**

- Investment Banking for Power, Energy and Renewables companies.

Stem \| Vice President, Finance **Jul 2016–Dec 2018**

- Responsible for FP&A, Corporate Finance and Project Finance.

Greentech Capital Advisors \| Vice President **Jun 2013–Jul 2016**

- Investment Banking for Power, Energy and Renewables companies.

J.P. Morgan \| Associate **Jul 2010–Jun 2013**

- Investment banking

First Manhattan Consulting Group **Jun 2008–Jul 2010**

- Strategy, marketing, and risk management services

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
Not Applicable

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[[Nicolás A. Grosso Giordano, PhD—Key Personnel

Education	Contact Information
▪ University of California at Berkeley, Berkeley, CA| Chemical and Biomolecular Engineering | Ph.D. 2019 ▪ Northwestern University, Evanston, IL | Chemical Engineering | B.S. 2013	nico@lilacsolutions.com [redacted]

Current Positions

Lilac Solutions, Inc., Oakland, California | Principal Process Engineer/Innovation Lead/Process Engineer **2020–present**

- Led process innovation efforts across internal technical teams and key external partners, improving all aspects of Lilac's R&D operations, lithium extraction technology, and ancillary processes. Responsible $1,000,000+ of capital expenditures.
- Designed, fabricated, automated, and operated lab- and pilot- scale process equipment with hundreds of integrated components to produce lithium from brines.
- Optimized process conditions and determined scale-up criteria. Scaled-up process from bench to pilot scale. Designed commercial scale process.
- Managed IP portfolio, including new IP generation and patent filings.

Research and Professional Experience

Katz Research Group, Berkeley, CA | Graduate Student Researcher **2015–2019**

- Designed heterogeneous catalysts and adsorbents through organic/inorganic synthetic approaches. These materials demonstrated 5x improvements over industrial catalysts.
- Developed multidisciplinary strategies combining synthesis, spectroscopy, and theoretical computer calculations to understand catalytic properties.
- Ensured safe and sustainable working environment as the Laboratory Safety Delegate.
- Co-taught and developed new coursework for 2 classes with 100+ students.
- Published 8+ first-author papers in top journals. 3+ oral presentations at international conferences.

Notestein Research Group, Evanston, IL | Undergraduate Researcher and Fellow **2011–2013**

- Developed green diesel production catalysts based on organic coatings on supported noble metal nanoparticles.

National Renewable Energy Laboratory, Golden, CO | Research Experience for Undergraduates **2012**

- Integrated chromatographic measurements into mass transfer models using Python routines, to assess the diffusion of biomacromolecules in biorefining applications.

IQ Farma, Lima, Peru | Quality Control Intern **2010**

- Performed analytical tests on raw materials to ensure quality compliance

Awards and Honors
▪ Top three poster presentation at 2018 Gordon Research Seminar in Catalysis (New London, NH) ▪ McCormack Award for top graduating senior in Chemical Engineering at Northwestern

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Publications

1. Snydacker, D.H; Grosso Giordano, N.A.; Indranada, A.; Lukito, A.; Bootwala, M.J.; Laporte, D.K.; Fleming, C. (Lilac Solutions, Inc.), Ion Exchange Devices for Lithium Extraction, *U.S. Provisional Patent Application* 63/179,153 (April 23rd, 2021)
2. Snydacker, D.H; Grosso Giordano, N.A.; Indranada, A.; Lukito, A.; Utan, S.; Bootwala, M.J.; Laporte, D.K.; Barber, A.B.; Fleming, C. (Lilac Solutions, Inc.), Lithium Extraction Enhanced by an Alternate Phase, *U.S. Provisional Patent Application* 63/324,559 (March 28rd, 2022)
3. Snydacker, D.H; Grosso Giordano, N.A.; Mock, S.P.; Fleming, C.; Sewant, T.; Bootwala, M.J.; Indranada, A.; Lukito, A.; Sciamanna, .K. (Lilac Solutions, Inc.), Extraction of Lithium with Chemical Additives, *U.S. Provisional Patent Application* 63/326,734 (April 1st, 2022)
4. Snydacker, D.H; Mock, S.P.; Komlos, C.; Grosso Giordano, N.A; Indranada, A. (Lilac Solutions, Inc.), Synthetic Lithium Solutions with Controlled Impurity Profiles, *U.S. Provisional Patent Application* 63/332,194 (April 18th, 2022)
5. Snydacker, D.H; Mock, S.P.; Komlos, C.; Grosso Giordano, N.A; Indranada, A.; Lau, G. (Lilac Solutions, Inc.), Removal of Impurities from Lithium Eluate, *U.S. Provisional Patent Application* 63/337,735 (May 3rd, 2022)
6. N.A. Grosso Giordano; C. Schroeder; L. Xu; A. Solovyov, D.W. Small; H Koller; S.I. Zones; A. Katz, *Characterization of a Molecule Partially Confined at the Pore Mouth of a Zeotype,* Angew. Chem. Int. Ed., **2021**, *60*, 10239-10246
7. N.A. Grosso Giordano; A.S. Hoffman; A. Boubnov; D.W. Small; S.R. Bare; S.I. Zones; A. Katz; *Dynamic reorganization and confinement of Ti^{IV} active sites controls olefin epoxidation catalysis on two-dimensional zeotypes,* J. Am. Chem. Soc., **2019**, *141*, 7090-7106
8. N.A. Grosso Giordano; C. Schroeder; A. Okrut; A. Solovyov, C. Schoettle; W. Chasse; N. Marinkovic; H. Koller; S.I. Zones; A. Katz,; *Outer-Sphere Control of Catalysis on Surfaces: A Comparative Study of Ti(IV) Single-Sites Grafted on Amorphous versus Crystalline Silicates for Alkene Epoxidation*, J. Am. Chem. Soc., **2019**, *141*, 7090-7106
9. Grosso Giordano, N.A; T.R. Eaton, Z. Bo, S. Yacob, C.C. Yang, J.M. Notestein, *Silica Support Modifications to Enhance Pd-Catalyzed Deoxygenation of Stearic Acid*, Appl. Catal. B Environ. **2016**, *192*, 93-11
10. C.P. Canlas; J. Lu; N.A. Ray; N.A. Grosso Giordano; S. Lee; J.W. Elam; R.E. Winans; R.P. Van Duyne; P.C. Stair; J.M. Notestein, *Shape Selective Sieving Layers on an Oxide Catalyst Surface,* Nature Chemistry. **2012**, *4*, 1030-1036

Synergistic Activities

1. American Chemical Society, Member
2. American Institute of Chemical Engineers, Member

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Amos Indranada—Key Personnel

Education	Contact Information
▪ University of California, Berkeley, CA | Chemical Engineering | B.S. 2017 ▪ University of California, Berkeley, CA | Materials Science and Engineering | B.S. 2017	amos@lilacsolutions.com [redacted] (b) (6)

Current Positions

Lilac Solutions, Inc. | Research Engineer **May 2017–present**

- Lead technology development for Lilac's proprietary novel lithium extraction technology.
- Manage design, procurement, fabrication, and operation teams of Lilac's automated ion exchange technology across bench scale and pilot scale.
- Defined Lilac's technical vision and managed multiple team leads in support of achieving technical objectives.

Research and Professional Experience

Lawrence Berkeley National Laboratory | Undergraduate Research Affiliate **Jan 2016–Dec 2017**

- Developed new class of self-assembled block copolymers and nanocrystals composites that formed microphase separated morphologies on spin-coated thin films.
- Synthesized and purified novel polymers and materials made using RAFT and free-radical polymerization.
- Characterized various chemical synthesis products and polymers using NMR, GPC-SEC, TGA, DSC, Fluorometer, GISAXS, DLS, and SEM.

BASF | Laboratory Intern **Jun 2015–Jul 2015**

- Tested various properties such as viscosity, solid content, LD value, bacterial contamination, and total volatile organic compounds on raw materials, production samples, and product prototypes
- Improved Gas Chromatography instrument run time by 24% and accuracy by optimizing temperature programs and calibration curves.

Awards and Honors
Not Applicable

Publications/Patents
1. Snydacker, D.H.; Indranada, A.; Lukito, A. (Lilac Solutions, Inc.), Lithium extraction in the presence of scalants, US20210380429A1

Synergistic Activities
Not Applicable

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[[GARRETT C. LAU—KEY PERSONNEL

Education	Contact Information
▪ Northwestern University Evanston, IL | Materials Science/ Engineering | Ph.D. 2020 ▪ Massachusetts Institute Cambridge, MA | Materials Science/ Engineering | B.S. 2013	garrett@lilacsolutions.com [redacted] (b) (6)

Current Positions

Lilac Solutions, Inc. | QC/New Process Development Lead/Process Engineer Dec 2021–present

- Establish materials characterization/QC lab and batch tracking system to maintain high quality production of ion-exchange beads for pilot lithium extraction projects.
- Develop specifications and procure precursors for manufacturing of ion-exchange beads.
- Design and run experiments for scale-up of new processes to reduce cost and improve yield of ion-exchange bead manufacturing.

Research and Professional Experience

Lilac Solutions, Inc. | Materials Engineer **Jun 2019–Dec 2021**

- Designed, procured, fabricated, and commissioned instrumentation, sensors, automated control systems and equipment for scaling-up production and powder handling of proprietary lithium ion-exchange material to pilot and commercial-scale.
- Designed and implemented rapid screens for characterization and quality assurance of ion-exchange materials.
- Developed OPEX model for full bead manufacturing process.

Northwestern University | Ph.D. Graduate (Stupp Group) **Oct 2013–Jun 2019**

- Investigate synergistic effects of organic and inorganic phases in hybrid and composite materials towards direction of functional micro- and nanostructures for energy storage, photocatalysis and soft robotics.
- Co-authored grant application that was awarded $15M to establish the Center for Bio-Inspired Energy Science, a DOE BES Energy Frontier Research Center.

Kellogg Management for Scientists and Engineers **Jun 2018–Aug 2018**

- Completed certificate program covering a wide range of business and leadership topics.

Polsky I-Corps Program, University of Chicago | Volexion (Advanced Li-ion Battery Materials Startup **Jun 2018**

- Conducted over twenty interviews with potential customers and partners
- Identified and visited potential partners for scale-up of cathode materials production and battery cell prototyping

Kellogg Commercializing Innovations Class—Advanced Li-ion Battery Team Jan 2018–Mar 2018

- Performed market analysis, financial forecasting, and technical feasibility studies.
- Conducted end-user interviews and identified key upstream raw materials suppliers.
- Investigated potential partnership pathways with established battery manufacturers, battery materials suppliers and EV OEMsts.
- Performed phase analysis of cell components using scanning electron microscopy (SEM), energy dispersive x-ray analysis (EDX), and x-ray diffraction]]

[[**Ambri, Inc. | Materials Engineer Intern** **May 2012–Aug 2012**

- Performed post-mortem analysis of grid-scale liquid metal battery cells and provided key design recommendations that led to a successfully issued patent
- Managed database of cell performance data, summarizing and logging performance metrics

Massachusetts Institute of Technology | Undergraduate Researcher, Liquid Metal Battery Project (ARPA-E funded Project) **Jan 2010–May 2012**

- Assembled, tested, and performed post-mortem analysis on small-scale versions of the liquid metal battery

Awards and Honors

- February 2017: Selected for the ARPA-E Energy Innovation Summit Student Program
- 2014-2019: National Defense Science and Engineering Graduate Fellowship
- 2013: Inducted to Tau Beta Pi Engineering Honor Society
- 2012: MIT MADMEC Sustainable Materials Design Competition, 1st place

Publications/Patents

1. Lau, G.*; Sather, N.*; Sai, H.; Waring, E.; Deiss-Yehieley, E.; Barreda, L.; Beeman, E.; Palmer, L.; Stupp, S. I.; Oriented multi-walled hybrid organic-Co(OH)2 nanotubes for electrochemical energy storage. *Advanced Functional Materials* **28(3)** (2018) 1702320
   *These authors contributed equally
2. Sai, H.*; Lau, G.*; Dannenhoffer, A.; Chin, S.; Đorđević, L.; Stupp, S. I.; Imaging Supramolecular Morphogenesis with Confocal Laser Scanning Microscopy at Elevated Temperatures *Nano Letters* **20(6),** (2020) 4234–4241
   *These authors contributed equally
3. Li, C.*; Lau, G.*; Yuan, H.; Aggarwal, A.; Lopez Dominguez, V.; Liu, S.; Sai, H.; Palmer, L.; Sather, **N.**; … Stupp, S. I.; Fast and programmable locomotion of hydrogel-metal hybrids under light and magnetic fields *Science Robotics* **5(49),** (2020)
   *These authors contributed equally
4. Bradwell, D.; Vai, A.; Kinney, T.; Theriault, S.; Lau, G.; Electrochemical energy storage devices. *US Patent No. US9728814B2* (August 2017)
5. Powell, A.; Pati, S.; Derezinski, S.; Lau, G.; Pal, U.; Guan, X.; Gopalan, S.; Conductor of high electrical current at high temperature in oxygen and liquid metal environment. *US Patent No. US9234288B2* (January 2016)

Synergistic Activities

Not Applicable

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MATT MCCALL—KEY PERSONNEL

Education	Contact Information
▪ Tulane University, New Orleans, LA | Finance and Management | MBA 2004 ▪ Louisiana State University, Baton Rouge, LA | Biological Engineering | B.S. 1996	matt.mccall@lilacsolutions.com [redacted] (b) (6)

Current Positions

Lilac Solutions, Inc. | Vice President of Operations **Jun 2022–present**

- Manage company-wide operations

Research and Professional Experience

Celanese, Clear Lake, TX | Operations Director **2020–2022**

- Led a team of 300 employees and contractors.
- Led operations and turnarounds for acetic acid, vinyl acetate monomer, methanol, ethylene oxide, ethylene glycol, and syngas units.
- Additionally, responsible for leading site utilities and distribution departments that support Celanese and multiple site partners.
- Supported construction and preparations for commissioning of a second world-scale acetic acid unit.

Celanese, Clear Lake, TX | Production Director, Acetyls **2019–2020**

- Led operations for acetic acid, vinyl acetate monomer, and syngas units.

Celanese, Bay City, TX | Site Director **2017–2019**

- Led over 100 employees and contractors in the operation and maintenance of a vinyl acetate monomer plant and a barge, rail, and truck distribution complex supporting Celanese and site partners.

Celanese, Clear Lake city, TX | Senior Manager, Maintenance, Project Engineering, and Turnarounds **2016–2017**

- Led more than 60 engineers, specialists, and technicians and 100 to 300 contractors.
- Executed four maintenance turnarounds in thirteen months, including the first Total Site Outage (TSO) in the site's history.
- Responsible for Maintenance Work Process execution, including backlog reduction, prioritization alignment, and schedule compliance.

General Electric Plastics, Burkville, AL | Senior Operations Manager, LEXIN Resin/Phosgene **2012–2016**

- Led 60 employees in the operation and maintenance of a polycarbonate resin plant including phosgene and CO production.
- Led operations and maintenance for a 285kt BPA monomer plant.

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[[**General Electric Plastics, Selkirk, NY | Environmental Health Safety and Security (EHSS) Manager** **2010–2012**

- Led a team of 20 engineers and specialists and 15 contractors. Responsible for Process Safety, Mechanical Integrity, Occupational Health and Safety, Environmental Compliance, and Emergency Response for a site comprising three chemical plants, three compounding plants, and a research and development operation.

General Electric Plastics, Selkirk, NY | Capital Projects and Process Automation Manager **2008–2010**

- Led 18 engineers and project managers in the execution of $15M-20M in annual capital investments.

General Electric Plastics, Selkirk, NY | Compounding Engineering Leader/Operations Manager **2006–2008**

- Delivered line productivity, quality control, product yield, and safe operation of two (100kt) compounding units.
- Managed new product introduction, from lab scale-up to production line qualification for more than 30 products.

General Electric Plastics, Selkirk, NY | Process Improvement Leader **2004–2006**

- Identified and executed process improvements and capital projects up to $1.5 million, applying Lean Six Sigma principles to reduce cost, decrease quality defects, and improve service.

U.S. Navy | Lieutenant Commander **1996–2004**

- Achieved Nuclear Engineer and Surface Warfare certification. Awarded two Navy Commendation Medals, five Navy Achievement Medals, and the Arleigh Burke Leadership Trophy.

Awards and Honors
▪ Arleigh Burke Leadership Trophy.

Publications
Not Applicable

Synergistic Activities
Not Applicable

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[[Thomas Pecoraro—Key Personnel

Education	Contact Information
▪ University of Illinois at Chicago, Chicago, IL | Chemical Engineering | B.S. 1988	pecoraro@lilacsolutions.com [redacted] (b) (6)

Current Positions

Lilac Solutions, Inc., Oakland, CA | Senior Process Engineer **Nov 2021–present**

- Review and comment on engineering documents such as heat and mass balances, PFDs, P&IDs, general arrangements, and detailed equipment designs.
- Design, specify and procure evaporation and crystallization test equipment

Research and Professional Experience

Veolia Water Technologies, Plainfield, IL | Senior Process Engineer **Sep 2012–Nov 2021**

- Design Evaporation and Crystallization equipment and systems.
- Develop Heat and Material Balances for complex integrated processes.
- Work closely with R&D to develop and confirm process flowsheets and equipment design parameters.

Dedert Corporation, Homewood, IL | Senior Process Engineer **Jan 2006–Aug 2012**

- Designed, sold, built and commissioned evaporation, crystallization and drying systems for the grain processing industry.
- Customers included Cargill, ADM, Tate & Lyle, Ajinomoto, Abengoa and Evonik.

Veolia Water Technologies, Plainfield, IL | Senior Project Engineer **Sep 2003–Dec 2005**

- Managed several projecst for the supply of evaporation and crystallization systems.

Veolia Water Technologies, Plainfield, IL | R&D Supervisor **Sep 1995–Aug 2003**

- Supervised the personnel at the HPD Pilot Plant, consisting of 3 Research Engineers, 2 Research Chemists and 9 Research Technicians.
- Expanded the R&D facility capabilities with additional laboratories, bench and pilot test equipment, analytical instruments, and personnel.

HPD Evaporation and Crystallization, Plainfield, IL | Research Engineer **Mar 1989–Aug 1995**

- Performed bench scale and pilot scale evaporation and crystallization studies.
- Wrote test reports and proposals.

Awards and Honors
Not Applicable

Publications/Patents
1. US 10,961,126-Process for Reducing Fouling in Evaporators in Lithium Hydroxide Recovery - Issued March 30, 2021
2. US 9,574,303 B2-Method of Recovering Pulping Chemicals from Dissolved Ash having a High Carbonate Content - Issued February 21, 2017
3. US 6,887,452 B1-System and Method for Crystallization of Salts - Issued May 3, 2005

Synergistic Activities
Not Applicable

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Gerald R. Sullivan—Key Personnel

Education	Contact Information
▪ Wayne State University, Detroit, MI | Chemical Engineering | B.S. 1990	jerry@lilacsolutions.com (b) (6)

Current Positions

Lilac Solutions, Inc. | Vice President of Technology – Bead Division **Mar 2022–present**

- Execute hiring plan so Bead Division can reach our goals on tight time schedules.
- Deliver product to meet demand.
- Execute capacity expansion projects.
- Develop packaging and shipping protocols for manufacturing.
- Procure and validate domestic supply chain of precursors.

Research and Professional Experience

Lilac Solutions, Inc. | Director of Manufacturing Technology **Sep 2021–Mar 2022**

- Develop an efficient Bead Division organization.
- Set-up a QC program for the entire Bead production.
- Create/Implement equipment selection and design process.
- Implement a formal stage gate managed capital process for SC project.

Solvay | Manufacturing Technology Director **Dec 2015–Sep 2021**

- Developed both short term and long-term strategies to meet global demand efficiently, cost effectively, and leveraging regional resources. Includes recommending best sourcing options for remote regions of the world.
- Responsible for scale up of new products/raw material qualifications/troubleshooting process/ product issues.
- Accountable for development of and execution of capital plan and major new capital projects.

Cytec Industries | Manufacturing Director **Apr 2012–Dec 2015**

- Advance major global strategic initiatives.
- Responsible for scale up of new products/raw material qualifications/troubleshooting process/ product issues.
- Accountable for development of and execution of capital plan and major new capital projects.

Cytec Industries | IPS Manufacturing Program Director **Nov 2011–Mar 2012**

- Primary responsibility was to ensure Manufacturing Sites were advancing projects in support of the major strategic initiatives.
- Served as the manufacturing representative for Canadian Expansion project.
- Liaison and integration leader for operations for all M&A.
- Accountable for overall required manufacturing footprint in Latin America.
- Recommended sourcing options to bridge temporary gap in supply.

Cytec Industries | Mineral Processing Global Marketing Manager **Feb 2010–Oct 2011**

- Oversaw global marketing for the Mineral Processing segment with $115 million in yearly sales.
- Developed the strategic plan for the Mineral Processing business segment.

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- Developed growth strategies into remote regions of the world (e.g. Africa, Central Asia, Russia, and Mongolia).
- Lead new product development projects for Mineral Processing and ensured the new product pipeline was robust and full. Bullets.

Cytec Industries | Operations Technology Director **Jan 2004–Jan 2010**
- Mining Chemical Technology leader who was the key interface between operations and the business team.
- Developed and updated 3-5 year Product Supply Strategy to optimize asset utilization and cost.
- Supported new product introduction by leading scale-up efforts, identifying supply locations, and determining cost, capability, and capacity.

Cytec Industries | Six Sigma Master Blackbelt **Jul 2001–Jan 2004**
- Certified Master Blackbelt who promoted Six Sigma efforts across Cytec Industries Inc.
- Lead experimental efforts thru Six Sigma methodology, leveraging capabilities worldwide.

Cytec Industries | Production Superintendent **Jan 1999–Jun 2001**
- Led the emulsions, hydroximated polyacrylamide, and dry polyacrylamide production units.
- Commissioned and started-up a major expansion of the emulsions unit.
- Led cycle and waste reduction efforts.

Cytec Industries | Process Engineer **Jan 1998–Dec 1998**
- Constructed new dry polyacrylamide production unit at the site.
- Lead commissioning and start-up of new dry polyacrylamide unit.
- Led process development efforts on new dry polyacrylamide processing routes.

Cytec Industries | Production Engineer **Sep 1994–Dec 1998**
- Production engineer who focused on process support and improvement for the water treating business.
- Improved quality on emulsion production.
- Provided exploration phase capital assessments for new emulsion unit. Provided plant relief supervision.

Monsanto | Production Specialist/Process Engineer **May 1990–Aug 1994**
- Managed production of 3 manufacturing units
- Designed and implemented a 1 Mlb debottlenecking project.
- Facilitated a $1.8M consolidation project
- Designed and developed a proposal for a 15 Mlb/yr expansion project

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
Not Applicable

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Thomas Wilson—Key Personnel

Education	Contact Information
▪ Stanford Graduate School of Business | Management | M.S. 2019 ▪ Imperial College London – Royal School of Mines | Petroleum Engineering | M.S. 2005 ▪ Birmingham University | Natural Sciences | M.S. 2004	lmtomwilson@gmail.com [redacted] (b) (6)

Current Positions

Lilac Solutions, Inc., Oakland, CA | Chief Development Officer **2019–present**

- Executive team role engaged in fundraising, project development and resource assessments
- Operational lead for Lilac's field program in the Western US including the successful rollout of the 2020-21 pilot
- EPC and vendor engagement for multiple 25ktpa projects across three continents

Research and Professional Experience

IGas Energy, London, UK | Technical Director **2014–2017**

- Overseeing operations for a 150+ employee company listed on London AIM, directly reporting to the COO
- Managed cross-functional project delivery across 28 oilfields with the support of 12 direct technical reports
- Led portfolio underwriting and negotiation for Kerogen Capital's $35m private equity investment in 2017
- Evaluated, lobbied, and secured 16 awards in the UK Government's 2016 license round
- Oversaw technical, financial, and legal due diligence for $200m farm-in by INEOS in 2015
- Strategy and execution lead for Dart Energy acquisition in 2014. Secured $80m funded work program and doubled portfolio acreage, positioning IGas as the largest onshore oil & gas operator in the UK

IGas Energy, London, UK | Strategy Manager **2013–2014**

- Responsible for consolidating opportunities across a $400m portfolio of international assets
- Prepared and delivered IGas's $40m business plan to the Board, investors and financial analysts
- UK Government Advisor supporting regulation development for the UK's Oil and Gas Authority

Hess Corporation, London, UK and Perth, Australia | Senior Developments Petroleum Engineer **2011–2013**

- Engineer defining $4bn appraisal programs across Australasia, Europe and Africa
- Coordinated $50m offshore Australia operation with results driving a $2bn LNG development decision
- Principal engineer for the assessment of a billion-barrel North Atlantic oil discovery

Hess Corporation, Houston, TX and Williston, ND | Global Strategic **2009–2011**

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[[**Planning, Production Operations**

- Central corporate strategy team reporting directly to Hess' Global Head of Strategic Planning
- Coordinated and delivered a $6bn Global Corporate Budget and business plan
- Oversaw multi-rig Bakken Shale operations in North Dakota, applying multi-variable analytics and Six Sigma lean practices to cut shale program costs 10% in first year

Hess Corporation, Stavanger, Norway and Copenhagen, Denmark | 2006–2009
Petroleum Engineer

- Underwrote technical and financial assessments for operations across Scandinavia
- Technical representative for JVs and management committees including BP, Shell, Total and Statoil
- Delivered a $2bn development plan for the Valhall field in the North Sea

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
Not Applicable

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Qiang Dai, Ph.D.—Principal Investigator

Education	Contact Information
▪ The University of Michigan | Environmental Engineering | Ph.D. 2014 ▪ The University of Michigan | Environmental Engineering | M.S.E. 2010 ▪ Tianjin University, Tianjin, China | Environmental Engineering | B.E. 2007	qdai@anl.gov [redacted] (b) (6)

Current Positions

Argonne National Laboratory | Energy Systems Analyst **Jul 2017–present**

- Evaluated cost and environmental impacts of battery materials production, battery manufacturing and recycling

Research and Professional Experience

Argonne National Laboratory | Postdoctoral Appointee **Nov 2014–Jun 2017**

- Evaluated environmental impacts of material production, alternative fuel pathways, and vehicle light-weighting

University of Michigan | Graduate Student Research Assistant **May 2009–Oct 2014**

- Life cycle assessment of natural gas utilization in light-duty passenger vehicles

Research and Professional Experience

Awards and Honors
▪ Impact Argonne Award, Enhancement of Argonne's Reputation, Aug 2021 ▪ Impact Argonne Award, Program Development, Jul 2021 ▪ Impact Argonne Award, Extraordinary Effort, Jan 2020 ▪ R&D 100 Awards, in Software/Services, San Francisco, Nov 2019 ▪ American Institute of Chemical Engineers Environmental Division Graduate Student Paper Award, 1st Place, Atlanta, Nov 201

Publications
1. Winjobi, O., Kelly, J.C., **Dai, Q.** (2022). Life-cycle analysis, by global region, of automotive lithium-ion nickel manganese cobalt batteries of varying nickel content. Sustainable Materials and Technologies 32, e00415. https://doi.org/10.1016/j.susmat.2022.e00415 2. Kelly, J.C., Wang, M., **Dai, Q.**, Winjobi, O. (2021). Energy, Greenhouse gas, and Water Life Cycle Analysis of Lithium Carbonate and Lithium Hydroxide Monohydrate from Brine and Ore Resources and Their Use in Lithium Ion Battery Cathodes and Lithium Ion Batteries. Resour. Conserv. Recycl., 2021, 174, 105762. 3. Xu, C., **Dai, Q.**, Gaines, L., Hu, M., Tukker, A., Steubing, B. (2020). Future Material Demand for Automotive Lithium-based Batteries. Commun. Mater., 2020, 1, 1–10. 4. Kelly, J.C., **Dai, Q.**, and Wang, M. (2020). Globally Regional Life Cycle Analysis of Automotive Lithium-ion Nickel Manganese Cobalt Batteries. Mitig. Adapt. Strateg. Glob. Change, 2020, 25, 371-396. 5. **Dai, Q.**, Kelly, J.C., Gaines, L., and Wang, M. (2019). Life Cycle Analysis of Lithium-ion Batteries for Automotive Applications. Batteries, 2019, 5, 48-63.

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Synergistic Activities
1. Software/Database Development. Since 2017, Led the development of Argonne's EverBatt model.
2. Mentor/Supervisor. I have supervised multiple student and postdoc research projects.
3. Service to the Scientific Community. Actively involved in the scientific community through presentations and attendance at conferences and workshops. I also serve as a peer reviewer for the following journals: Joule, Applied Energy, Resources Conservation and Recycling, Sustainable Chemistry & Engineering, Journal of Industrial Ecology, International Journal of Life Cycle Assessment

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[[PARTHIV KURUP—KEY PERSONNEL

Education	Contact Information
• Imperial College London, United Kingdom | Mechanical Engineering | B.S. and M.S. 2008	Parthiv.Kurup@nrel.gov [redacted] (b) (6)

Current Positions

National Renewable Energy Laboratory | Cost and Systems Analyst, Researcher IV
2015–Present

Principle Investigator (PI) on the SETO Labcall project "Modelling platform for Pathways for Solar Thermal Desalination" (Oct. 2021 to Present) :

- $2.4M total. $2.25M FY22 to FY24 to NREL
- NREL with sub-contractors (3 universities and NETL), will add to and develop a flexible, open-source platform for evaluating solar thermal desalination technologies
- The NREL team are leading the project, and the development of the techno-economic analysis (TEA) platform which will allow potential SETO awardees to be evaluated

Task Lead on the CSP Cost Analysis task (Oct. 2018 to present):

- Led the bottom-up costing team
- Team undertook detailed manufacturing cost, assembly and construction analysis of commercial and advanced parabolic trough and heliostat designs to benchmark costs
- Our manufacturing analysis has utilized the commercial Design for Manufacturing and Assembly (DFMA) tool, and close collaboration with CSP suppliers

PI on the SA and AMO funded 'Thermal Energy Systems' project (2018 to present):

- $0.92M present total, with additional $0.4M being negotiated for FY22
- Team is evaluating the opportunities and potential of hybrid Renewable Thermal Systems. We are developing hybrid renewable thermal models to perform analysis
- We are performing TEA for case studies for industrial decarbonization e.g., current cost competitiveness, R&D pathways, and carbon cost.

"CSP for High Temperature Steam Electrolysis" (HTSE) project (Sept. 2020 to present):

- Provided support for the TEA
- Team is undertaking analysis of low temperature hydrogen electrolysis (grid connected and PV) compared to HTSEs coupled with CSP

HelioCon (Sept. 2021 to Present):

- Supporting task lead for TEA, and co-lead for the Advanced Manufacturing task

Technical lead in the Solar Industrial Process Heat (Solar IPH) project (2018 to Jan. 2021):

- Led determining solar IPH potential (e.g. economic, market, geo-spatial and risks) for PV, CSP and heat-pumps

Cost modelling (incl. bottom-up) and cost projections of current and future CSP technologies:

- Projections part of the Annual Technology Baseline, which feeds into SAM.

Undertook cost and potential (e.g. economic, manufacturing, supply chain, and market) of technologies e.g., Small Hydropower and Geothermal turbines.

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Research and Professional Experience

Renewable Energy Projects London Ltd., London | Founder & Director **Apr 2013–Dec 2014**

- Consulted, assessed and developed projects with CSP companies entering India
- Built top-down and bottom-up project costings for new potential projects (e.g. 5MWe CSP integration to Waste Heat turbine and 25MWth TES), to allow for investment decisions
- Managed Engineering and Procurement interfaces to potential Engineering, Procurements and Construction (EPC) players that could be used for new projects

E.ON New Build & Technology, Nottingham, UK.| Gas Turbine Engineer **Sep 2008–Apr 2013**

CSP work and responsibilities with E.ON Climate & Renewables (EC&R):

- "Optimization of CSP tower, solar field and heat storage" project (06 – 08/2012)
  - Analyzed and investigated system interdependencies, scale and power block efficiency.
- "EC&R's potential entry into Indian CSP market" project (03/2011 – 04/2012)
  - Analyzed market potential, CSP landscape, and investment risks
  - Developed EC&R's CSP Market Entry Strategy for India that allowed Go/No-Go

Awards and Honors
Not Applicable

Publications
1. NREL. (2022). "2022 Annual Technology Baseline." NREL. https://atb.nrel.gov/
2. Miller et al. (2022). "Mine Water Use, Treatment, and Reuse in the United States: A Look at Current Industry Practices and Select Case Studies." ACS ES&T Engineering. https://pubs.acs.org/doi/abs/10.1021/acsestengg.1c00244
3. Akar et al. (In press). "Renewable Thermal Energy Systems Designed for Industrial Process Solutions in Multiple Industries." Presented at Solar World Congress 2021.
4. Kurup, P et al. 2021. "Commercial and Advanced Heliostats Collector Cost Update." NREL. https://www.nrel.gov/docs/fy22osti/80482.pdf. NREL/TP-7A40-80482.
5. McMillan et al. (2021). "Opportunities for Solar Industrial Process Heat in the United States." NREL. https://www.nrel.gov/docs/fy21osti/77760.pdf.
6. Schoeneberger, C. et al. (2020). "Solar for Industrial Process Heat: A review of technologies, analysis approaches, and potential applications in the United States." Energy. https://www.sciencedirect.com/science/article/pii/S0360544220311907?via%3Dihub
7. Kurup et al. (2018). "Analysis of Supply Chains and Advanced Manufacturing of Small Hydropower Systems." NREL. https://www.nrel.gov/docs/fy18osti/71511.pdf.
8. Chung, D, Horowitz, K and Kurup, P. (2016) "On the Path to SunShot: Emerging Opportunities and Challenges in U.S. Solar Manufacturing." NREL. https://www.nrel.gov/docs/fy16osti/65788.pdf.
9. Turchi, C. et al. (2015), "Domestic Material Content in Molten-Salt Concentrating Solar Power Plants." NREL. https://www.nrel.gov/docs/fy15osti/64429.pdf
10. Kurup, P and Turchi, C. (2015). "Initial Investigation into the Potential of CSP Industrial Process Heat for the Southwest United States." NREL. https://www.nrel.gov/docs/fy16osti/64709.pdf.

Synergistic Activities
1. Led NREL's efforts in the IEA 'Solar Process Heat', known as Task 64 (https://task64.iea-shc.org/). This is a 4-year international collaboration helping to commercialize Solar IPH technologies.

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[[Colin A. McMillan—Key Personnel

Education	Contact Information
• University of Michigan, Ann Arbor, MI | Natural Resources | Ph.D • University of Michigan, Ann Arbor, MI | Applied Economics, concentration in international trade and econometrics • Certificate Program in Industrial Ecology | M.A. • University of Michigan, Ann Arbor, MI | Environmental Engineering, concentration in environmental sustainability | M.S.E. • Miami University, Oxford, OH | Engineering Management, concentration in environmental science | B.S.	colin.mcmillan@nrel.gov [redacted] (b) (6)

Current Positions

National Renewable Energy Laboratory **Jul 2013–Present**

- Developed modeling and analysis of energy use in the U.S. economy to assist decision makers in improving energy efficiency and reducing emissions

Research and Professional Experience

Lockheed Martin, Rockville, MD \| Sustainable Practices Analyst **Nov 2010–Jun 2013**

- Pioneered economic-environmental footprint analysis to estimate supply chain energy use and emissions, and worked cross-functionally to share results and develop new corporate initiatives.
- Created novel methods, tools, and engagement strategies for streamlined life cycle assessment (LCA) in engineering design

First Environment, Inc., Boonton, NJ \| Environmental Engineer **Aug 2005–Aug 2006**

- Supported the USDA's Federal Biobased Products Preferred Procurement Program and NIST's Building for Environmental and Economic Sustainability Program by constructing LCAs of biobased products and construction products with SimaPro

Center for Sustainable Systems, University of Michigan \| Research Associate **Jan 2005–Jul 2005**

- Co-developed a data repository program to assemble and calculate annual environmental indicator data for the University of Michigan's Campus Sustainability Report

Limno-Tech, Inc., Ann Arbor, MI \| Project Engineer **May 2001–Nov 2002**

- Provided technical guidance through paper mill operations evaluations, development of system mass balances, and analysis of residual disposal areas for cost allocation litigation

Awards and Honors
Not Applicable

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Publications
1. Schoeneberger, C., J. Zhang, **C. A. McMillan**, J. B. Dunn, and E. Masanet. "Electrification Potential of U.S. Industrial Boilers and Assessment of the GHG Emissions Impact." *Advances in Applied Energy*, February 16, 2022.
2. **McMillan, C.A.**, W. Xi, J. Zhang, E. Masanet, P. Kurup, C. Schoeneberger, S. Meyers, and R. Margolis. "Evaluating the Economic Parity of Solar for Industrial Process Heat." *Solar Energy Advances* 1 (January 1, 2021): 100011.
3. **McMillan, C. A.**, C. Schoeneberger, J. Zhang, E. Masanet, P. Kurup, S. Meyers, R. Margolis, and W. Xi. "Opportunities for Solar Industrial Process Heat in the United States." Golden, CO: NREL, 2021.
4. **McMillan, C. A.**, and M. Ruth. 2019. "Using Facility-Level Emissions Data to Estimate the Technical Potential of Alternative Thermal Sources to Meet Industrial Heat Demand." *Applied Energy* 239 (April): 1077–90.
5. **McMillan, C. A.**, and V. Narwade. 2018. "The Industry Energy Tool (IET): Documentation." NREL/TP-6A20-71990. Golden, CO: NREL.
6. Jadun, P., **C. McMillan**, D. Steinberg, M. Muratori, L. Vimmerstedt, and T. Mai. (2017). "Electrification Futures Study: End-Use Electric Technology Cost and Performance Projections through 2050." NREL/TP-6A20-70485. Golden, CO: NREL.
7. Steinberg, D., D. Bielen, J. Eichman, K. Eurek, J. Logan, T. Mai, **C. McMillan**, A. Parker, L. Vimmerstedt, and E. Wilson. (2017). "Electrification & Decarbonization: Exploring U.S. Energy Use and Greenhouse Gas Emissions in Scenarios with Widespread Electrification and Power Sector Decarbonization." NREL/TP-6A20-68214. Golden, CO: NREL.
8. **McMillan, C.**, Boardman, R., McKellar, M., Sabharwall, P., Ruth, M., and Bragg-Sitton, S. (2016). "Generation and Use of Thermal Energy in the U.S. Industrial Sector and Opportunities to Reduce its Carbon Emissions" (NREL/TP-6A50-6673). Golden, CO: NREL.

Synergistic Activities
Not Applicable

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[[Darlene M. Steward—Key Personnel

Education	Contact Information
• University of Colorado at Boulder | Chemical Engineering | M.S. 1989 • University of Colorado at Boulder | Chemical Engineering, Biomedical Minor | B.S. 1989	darlene.steward@nrel.gov [redacted] (b) (6)

Current Positions

National Renewable Energy Laboratory | Engineer, Strategic Energy Analysis Center **2007–Present**

- Specialization in environmental and energy systems techno-economic analysis and lifecycle cost modeling, policy analysis, and research in sustainability and the circular economy.
- Developed a new version of the WaTER excel-based water treatment system techno-economic model for the Bureau of Reclamation (BoR).
- Research lead for development of lithium-ion battery recycling techno-economic analyses focusing on supply chain and market impacts of battery end-of-life management and materials flows.
- Performed various analyses of energy and lifecycle cost for deployment of renewable energy technologies, including combined heat and power (CHP) systems, biogas generation, and biofuels.
- Led analysis effort to quantify the value of hydrogen for energy storage with respect to power system services such as providing spinning reserve and demand management.

Research and Professional Experience

Boulder Research Enterprises, LLC | Principal Engineer, President **2000–2007**

- Developed the WTCost commercial software application in collaboration with the U.S. Bureau of Reclamation.
- Developed safe and cost-effective strategies for transport and disposal of difficult-to-handle mixed radioactive and hazardous waste streams for the Rocky Flats Environmental Technology Site.

S.M. Stoller Corp.| **1991–2000**

- Small business provider of waste management, remediation, and ecological services in Broomfield, CO

Hauser Chemical Research | Chemical Engineer/Chemist **1989–1990**

- Contract research and manufacturing from natural raw materials in Boulder, CO.

Radian Corporation | **1988–1989**

- Provider of chemical management, analytical, and environmental consulting services in RTP, NC

Awards and Honors
Not Applicable

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Publications
1. Steward, Darlene. 2020. "The Role of Innovation in the Circularity of EV Lithium-Ion Batteries." ISSST 2020, June 9-12, 2020. 22p. Virtual.
2. Mayyas, Ahmad, Darlene Steward, and Margaret Mann. 2019. "The Case for Recycling: Overview and Challenges in the Material Supply Chain for Automotive Li-Ion Batteries." *Sustainable Materials and Technologies* 19 (April): e00087.
3. Steward, Darlene, Ahmad Mayyas, and Margaret Mann. 2019. "Economics and Challenges of Li-Ion Battery Recycling from End-of-Life Vehicles." *Procedia Manufacturing*, Sustainable Manufacturing for Global Circular Economy: Proceedings of the 16th Global Conference on Sustainable Manufacturing, 33 (January): 272–79. https://doi.org/10.1016/j.promfg.2019.04.033.
4. Steward, Darlene. 2017. "Critical Elements of Vehicle-to-Grid (V2G) Economics." https://www.nrel.gov/docs/fy17osti/69017.pdf.
5. Steward, D.; Doris, E.; Krasko, V.; Hillman, D. (2014). Effectiveness of State-Level Policies on Solar Market Development in Different State Contexts. 60 pp.; NREL Report No. TP-7A40-61029.
6. Melaina, M. W.; Heath, G.; Sandor, D.; Steward, D.; Vimmerstedt, L.; Warner, E.; Webster, K. W. (2013). Transportation Energy Futures Series: Alternative Fuel Infrastructure Expansion: Costs, Resources, Production Capacity, and Retail Availability for Low-Carbon Scenarios. 118 pp.; NREL Report No. TP-6A20-55640; DOE/GO-102013-3710.
7. M. W. Melaina, D. Steward. 2012. *Hydrogen Infrastructure Market Readiness: Opportunities and Potential for Near-Term Cost Reductions; Proceedings of the Hydrogen Infrastructure Market Readiness Workshop and Summary of Feedback Provided through the Hydrogen Station Cost Calculator*. https://www.nrel.gov/docs/fy12osti/55961.pdf.

Synergistic Activities
Not Applicable

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Dustin Weigl—Principal Investigator

Education	Contact Information
• Massachusetts Institute of Technology, Cambridge, MA | Transportation | M.S. 2019 • Massachusetts Institute of Technology, Cambridge, MA | Technology and Policy | M.S. 2019 • Middlebury College, Middlebury, VT | Physics| B.S. 2013	dustin.weigl@nrel.gov [redacted] (b) (6)

Research and Professional Experience

National Renewable Energy Laboratory, Golden, CO |2019–Present
Mobility Research Analyst

- Primary areas of research include: 1) the modeled growth and analysis of the domestic US lithium-ion battery circular economy; and 2) analysis of EV adoption and associated impacts and shifts in travel behavior
- Primary modeler for the Lithium-Ion Battery Resources Assessment (LIBRA) model, a learning-based system dynamics model analyzing the buildout of the US battery supply chain based on techno-economic projections and policy considerations
- Collaborate with DOE Battery Recycling Prize winners to evaluate the techno-economic impact of their technologies for the development of the US battery supply chain in the context of the domestic political landscape

Awards and Honors
Not Applicable

Publications
1. Energy Storage Grand Challenge Energy Storage Market Report. 2020 December; :65. Available from: https://www.energy.gov/energy-storage-grand-challenge/downloads/energy- storage-market-report-2020
2. MIT Energy Initiative. Insights into Future Mobility. 2019 November; :220. Available from: https://energy.mit.edu/wp-content/uploads/2019/11/Insights-into-Future-Mobility.pdf
3. Henao A, Sperling J, Weigl D, Atnoorkar S, Wilson A, Nobler E, Shankari K, Smith S. Toward Human-Centric Transportation and Energy Metrics: Influence of Mode, Vehicle Occupancy, Trip Distance, and Fuel Economy. Transportation Research Record: Journal of the Transportation Research Board. 2022 April 28. Available from: http://journals.sagepub.com/doi/10.1177/03611981221086932
4. Weigl Dustin, Sperling Josh, Henao Alejandro, Duvall Andrew, Young Stanley. Sustainability, Scalability and Resiliency of the Town of Innisfil Mobility-on-Demand Experiment: Preliminary Results, Analyses, and Lessons Learned: Preprint. c2022. Available from: https://www.osti.gov/biblio/1863937-sustainability-scalability-resiliency-town-innisfil-mobility-demand-experiment-preliminary-results-analyses-lessons-learned-preprint
5. Hou Y, Garikapati V, Weigl D, Henao A, Moniot M, Sperling J. Factors Influencing Willingness to Pool in Ride-Hailing Trips. Transportation Research Record: Journal of the Transportation Research Board. 2020 May 01; 2674(5):419-429. Available from: http://journals.sagepub.com/doi/10.1177/0361198120915886

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Publications
6. Smart John, Bi Zicheng, Birky Alicia, Borlaug Brennan, Burrell Erin, Koutou Eleftheria, Lee Dong-Yeon, Lipman Timothy, Meintz Andrew, Miller Eric, Mohamed Ahmed, Moniot Matthew, Moore Amy, Motoaki Yutaka, Needell Zachary, Onar Omer, Rames Clement, Reincke Nicholas, Roni Mohammad, Salisbury Shawn, Sheppard Colin, Toba Danho Ange Lionel, Walker Victor, Weigl Dustin, Wood Eric, Xie Fei, Yi Yonggen, Zeng Teng, Zhang Hongcai, Zhou Yan, Zhou Zhi. SMART Mobility. Advanced Fueling Infrastructure Capstone Report. 2020 July. Available from: https://www.osti.gov/biblio/1656701-smart-mobility-advanced-fueling-infrastructure-capstone- report
7. Hou Yi, Garikapati Venu, Weigl Dustin, Henao Alejandro, Moniot Matthew, Sperling Joshua. Factors Influencing Willingness to Share in Ride-Hailing Trips. 2020. Available from: https://www.osti.gov/biblio/1669392-factors-influencing-willingness-share-ride-hailing-trips

Synergistic Activities
Not Applicable

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[[Richard Bartholet —Key Personnel

Education	Contact Information
▪ University of Nevada, Reno | Business Administration | MBA 1975 ▪ Montana State University | Business Administration | B.S. 1973	richardb@unr.edu [redacted] (b) (6)

Current Positions

University of Nevada, Reno, University Center for Economic Development | Research Associate — **2016–Present**

University of Nevada, Reno, Ozmen Center for Entrepreneurship | Director, Sontag Entrepreneurship Competition — **2016–Present**

Research and Professional Experience

University of Nevada, Reno | Director of Bureau of nter Business & Economic Research, Nevada Small Business Ce — **1997–2015**

Pennington & Associates | President and Corporate Broker — **1984–1996**
- Valuation and sale of closely-held businesses in Northern Nevada

SUMMIT Engineering Corporation | A founders, Shareholder, Secretary /Treasurer and Business Manage — **1978–Date**

Awards and Honors
Not Applicable

Publications

1. M. Taylor, **R. Bartholet,** S. Banerjee (2018), *Recommendation For Increasing the Supply and Lowering the Cost of Native Plant Materials in Nevada Through Strategic Support of the Native Plant Material Industry*, UCED Technical Report 2018-19-00, University Center for Economic Development, University of Nevada, Reno
2. **Bartholet, R**. and T. Harris (2017) *Feasibility Study of a Teff Flour Mill in Fallon, Nevada, UCED Technical Report 2016-17-15,* University Center for Economic Development, University of Nevada, Reno
3. Steinmann, F. and **R. Bartholet** (2016) *A Strategic Plan for the City of Fernley, Nevada for Fiscal Year 2017 through Fiscal Year 2021 UCED Technical Report 2016-17-01*, University Center for Economic Development, University of Nevada, Reno
4. ***Bartholet, R***. and F. Steinmann (2016) *A Summary of Social Issues Pertaining to the 2016 One Truckee River Management Plan - UCED 2015-16-20,* University Center for Economic Development, University of Nevada, Reno
5. **Bartholet, R**., (2016) *Case for a Carbon Tax in Nevada,* Nevada Governor's Office of Energy
6. **Bartholet, R**. and C. Lynch (2013) *Assessment and Recommendations: Alignment of Nevada Economic Development Policy & Energy Policy*, Business Environmental Program, University of Nevada, Reno

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Synergistic Activities
1. Lead Judge, Rural Nevada Pitch Competition (Launch Rural Nevada), Sponsored by the Governor's Office for Economic Development and the Northeast Nevada Regional Development Authority, 2020–2022
2. Entrepreneurship Nevada member, 2019–2022
3. Entrepreneur Support Organization, 2020–2022

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Brian P. Bonnenfant—Key Personnel

Education	Contact Information
▪ University of Nevada, Reno, NV | Geological Engineering | M.S. 1996 ▪ California State University, Chico, CA | Geology | B.S. 1992	bonnen@unr.edu [redacted] (b) (6)

Current Positions

Center for Regional Studies University of Nevada. Reno, NV | Project Manager **2007–present**

Research and Professional Experience

Nevada Small Business Development Center University of Nevada, Reno, NV | GIS Analyst **1993–2007**

Homestake Mining Company, Sparks, NV | Junior Geologist **1989–1993**

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
1. 2022 Reno-Sparks MSA/Fernley Housing Needs Assessment | Economic Development Authority of Western Nevada | 2022 | Calculated workforce housing needs based on trends of new employed residents in the region and average workers per household. The analysis also focuses on home affordability based on average wage by type of industry, number of earners per household, and housing costs by product type.
2. Housing Needs Assessment | Humboldt Development Authority | 2020 | Conducted an extensive housing assessment in Humboldt County, Nevada in light of projected growth from the proposed Lithium Nevada mine and Salmon Nevada fish farm. The study included a detailed overview of economic activity and demographics, including population and employment projections, demographic and income characteristics, housing preferences, and commuting flows in the region. Residential unit supply was also discussed including existing housing inventory and sales/rental rates and proposed future housing. Market demand was also projected for new industries using existing wage information.
3. Housing Needs Assessment | Churchill County, | 2019 and 2021 | Conducted an extensive housing assessment in Churchill County, Nevada in light of projected growth from the expansion of Fallon Naval Air Station and expected activity at Churchill-Hazen Industrial Parks. The study included a detailed overview of economic activity and demographics, including population and employment projections, demographic and income characteristics, housing preferences, and commuting flows in the region. Residential unit supply was also discussed including existing housing inventory and sales/rental rates and proposed future housing. Market demand was also projected for new industries using existing wage information.
4. Economic Recovery Analysis | City of Reno | 2021 | Analyzed industry and wage trends by city ward to calculate pandemic impacts. The analysis, broken down geographically by city ward, included construction trends, housing pipeline activity and affordability, and vacant land availability by land use.

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Eric Florio—Key Personnel

Education	Contact Information
▪ Vermont Law School, South Royalton, VT | Law | Juris Doctor 2015 ▪ Adelphi University, Garden City, NY | Environmental Science | M.S. 2011 ▪ Dickinson College, Carlisle, PA | Anthropology | B.A. 2009	eflorio@unr.edu [redacted]

Current Positions

University of Nevada, Reno Business Environmental Program | Air Quality Specialist — **Jan 2018–Present**

Research and Professional Experience

Vermont Electric Power Producers Inc., Manchester Center, Vermont | Renewable Energy Program Specialist — **Sep 2016–Mar 2017**

Environmental and Natural Resources Law Clinic, South Royalton, Vermont | Student Clinician — **Jan 2015–May 2015**

Environmental Protection Agency, Denver, Colorado | Internship — **Jun 2014–Aug 2014**

Vermont Agency of Natural Resources: Vermont Fish and Wildlife, Montpelier, Vermont | Internship — **Jun 2013–Aug 2013**

Department of Environmental Conservation, Long Island City, New York | Internship — **Apr 2010–Dec 2010**

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
Not Applicable

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Daphne Emm Hooper—Key Personnel

Education	Contact Information
▪ Harvard Kennedy School of Government | Public Leadership | Public Leadership Credential 2022 ▪ Southern New Hampshire University | Community Economic Development | M.S. 2008 ▪ University of Phoenix | Organizational Management | M.A. 2004 ▪ University of California, Davis | Political Science | B.A. 2001	daphnehooper@unr.edu [redacted] (b) (6)

Current Positions

University of Nevada, Reno | Director of Indigenous Community Relations, Division of the President	**2022–Present**

Research and Professional Experience

City of Fernley, Fernley, Nevada | City Manager	**2015–2022**
City of Fernley, Fernley, Nevada | Assistant City Manager	**2013–2015**
City of Fernley, Fernley, Nevada | Administrative Services Manager	**2011–2013**
Nevada Urban Indians, Reno, Nevada | Executive Director	**2009–2011**

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
1. Nevada Tribal Leadership Development Program, Cohort 1; January 2020 through June 2020; Reno, Nevada
2. Nevada Native American Community and Economic Development Strategy; December 2021 through Current; State of Nevada (Statewide)
3. Comprehensive Economic Development Strategy for the City of Fernley, Nevada; March 2022 through Current; Fernley, Nevada
4. Strategic Plan for the Fallon Paiute Shoshone Tribe December 2021 through May 2022; Fallon, Nevada

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[[Christopher J. Lynch—Key Personnel

Education	Contact Information
▪ Vermont Law School | Law | Juris Doctor ▪ Vermont Law School | Environmental Law | M.S. ▪ St. Lawrence University | Economics and Government | B.A.	clynch@unr.edu (b) (6)

Current Positions

University of Nevada, Reno, College of Business | Director of the Nevada Business Environmental Program — **Jan 2011–Present**

- Manages a statewide client advisory services organization that assists small and medium sized businesses with environmental regulatory compliance and permitting, environmental management, pollution prevention, energy efficiency, and sustainability/green business strategic planning.
- Develops collaborative partnerships to leverage resources and develop new programs; identifies and develops funding opportunities; prepares grant and contract proposals; administers and manages grant and contract projects; and manages professional staff in Reno and Las Vegas
- Provides outreach and assistance to the Nevada business community through the College of Business at the University of Nevada, Reno and is affiliated with the Nevada Small Business Development Center
- Served as a founding member of the Advisory Board for the Center for Small Business and the Environment in Washington, DC. and also served as past chair of the national Association of Small Business Development Centers' Sustainability and Environmental Regulatory Interest Section and as an advisor for the Pew Center on Global Climate Change's Corporate Energy Efficiency project

Research and Professional Experience

Energy, Climate Change, and Environmental Sustainability — **2009–2010**
Glen Mills, PA Advisor |Independent Advisor

The Wharton School of the University of Pennsylvania | Senior Fellow, Initiative for Global Environmental Leadership — **2009–2011**

The Wharton School of the University of Pennsylvania, Pennsylvania Small Business Development Centers | Director, Environmental Management Assistance Program — **1996–2009**

Concurrent Technologies Corporation, National Defense Center or Environmental Excellence, Johnstown, PA | Environmental Attorney and Regulatory Analysis Team Leader — **1993–1996 f**

Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
Not Applicable

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Sandra Rentas—Key Personnel

Education	Contact Information
▪ University of Nevada, Reno | Policy, Economics | M.A. ▪ Pontificia Universidad Católica de Puerto Rico | Marketing | B.A.	srentas@unr.edu (b) (6)

Current Positions

University of Nevada, Reno, Nevada Small Business Development Center | Business Development Advisor — **Sep 2007–Present**

- Provided in-depth, direct counseling with clients by interviewing and assessing clients' needs and capabilities, that includes making first contact and establishing the outline of each new project; work closely with clients to foster a referral system that brings new target customers to our agency for multiple services.
- Provided management and technical assistance that include: business plan development, accounting, marketing, financial planning, cost-analysis, legal business structures, loan packaging, e-commerce, entering international markets, employee management.
- Analyzed specific business and industry data in finance, marketing, management, operations, exporting and importing; problem solving to identify areas of improvement and opportunity; provide guidance in capital access for pre-venture, startup and existing businesses.
- Taught/facilitated/presented (English and Spanish) on a multiple of platforms, including seminars, keynote speaker slots, workshops and formal classroom environments; have taught the 15-week "NxLeveL for Entrepreneurs" since 2009 in Spanish.
- Enhanced the quality of business development activities for the Hispanic business community in Nevada.
- Developed relationships with key stakeholders and partners including, but not limited to, U.S. Small Business Administration, lending institutions, chambers of commerce, economic development authorities, non-profit organizations, and education institutions and more.

Northern Nevada International Center | Independent Contractor — **Sep 2005–Present**

- Provided professional translation services that include; legal documents, business contracts, academic instruction material, financial statements and more.

Nevada Art Museum | Independent Contractor — **Mar 2006–Present**

- Instructor in the "hands/ON!" Saturday Family Program

Research and Professional Experience

University of Nevada, Reno | Graduate Assistantship, Community Outreach Coordinator, Student Access & Opportunity Services — **Nov 2003–Aug 2007**

- Provided outreach to community members interested in helping the students of color pursuing a higher education.
- Organized, oversaw, assisted, and collaborated in numerous University events that included: A.S.C.E.N.T. (All Students College Educated in Nevada Today) (in affiliation with Hug High School); Stories of Success Dinner; S.T.A.C. (Start Thinking About College); Parent & Family Orientation Weekend and Community of Color Meetings.
- Provided outreach to middle and high school students interested in pursuing higher education.
- Conducted assessments of multiple programs.
- Collaborated with the University of Nevada Alumni Association to organize graduation receptions for African American, Native American and Latino Alumni Chapters.

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Awards and Honors
Not Applicable

Publications
Not Applicable

Synergistic Activities
1. Advisory Board Member of Audacity Institute
2. Member of (DEC) District Export Council
3. Member of NASBITE (National Association of Small Business International Trade Educators)
4. Certified Instructor NxLeveL™ for Entrepreneurs
5. Certified SBA (Small Business Administration) beginner and intermediate Export Certification

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Frederick Steinmann, Ph.D.—Principal Investigator

Education	Contact Information
▪ University of Southern California, Sol Price School of Public Policy | Policy, Planning and Development | Ph.D 2010 ▪ University of Nevada, The College of Business | Economics | M.S. 2004 ▪ University of Nevada, The College of Business | Economics | B.S. 2002	fred@unr.edu [redacted] (b) (6)

Current Positions

University Center for Economic Development, The College of Business; University of Nevada, Reno | Assistant Research Professor	**2012–Present**

Research and Professional Experience

University of Nevada Cooperative Extension | Assistant Professor, Extension Educator, Eureka County	**2010–2012**
City of Carson, Business Development Services | Administrative Intern III	**2008–2010**
Nevada Small Business Development Center, University of Nevada, Reno | Project Manager	**2006–2008**
City of Reno, Reno Redevelopment Agency | Special Projects Manager	**2004–2006**

Awards and Honors
Not Applicable

Publications
1. **Steinmann, F.** 2020. *A Comprehensive Economic Development Strategy for the Northeastern Nevada Regional Development Authority, 2020 through 2025*; University Center for Economic Development; UCED Technical Report 2019/20-11
2. **Steinmann, F.** 2021. *The 2021 Annual Update to the Comprehensive Economic Development Strategy for Lincoln County, Nevada, 2017 through 2021*; University Center for Economic Development; UCED Technical Report 2021/22-16
3. **Steinmann, F.** 2021. *An Overview of Labor and General Macroeconomic Conditions as a Result of the COVID-19 Global Pandemic, Past and Future Projected Trends*; University Center for Economic Development; UCED Technical Report 2021/22-19
4. **Miller, C., and F. Steinmann.** 2022. *An Examination of Economic Distressed Community Levels for Nevada's Native American Communities*; University Center for Economic Development; UCED Technical Report 2021/22-20
5. **Steinmann, F. and T. Harris, et al.** 2022. *A Comprehensive Examination of Nevada's Mining, Quarrying, and Oil and Gas Extraction Industry Sector's Value Network and Supply Chain*; University Center for Economic Development; UCED Technical Report 2021/22-27

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Synergistic Activities
1. Nevada Tribal Leadership Development Program, Cohort 1; January 2020 through June 2020; Reno, Nevada
2. Comprehensive Economic Development Strategy for the Southwest Central Regional Economic Development Authority; June 2021 through Current; Esmeralda County, Nevada and Nye County, Nevada
3. Nevada Native American Community and Economic Development Strategy; December 2021 through Current; State of Nevada (Statewide)
4. Nevada Mining and Natural Resource Extraction Industry Sector Value Network and Supply Chain Mapping Initiative; January 2022 through May 2022; State of Nevada, Statewide
5. Comprehensive Economic Development Strategy for the City of Fernley, Nevada; March 2022 through Current; Fernley, Nevada

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Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

1. **Type of Federal Action:** a. contract _b___ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	2. **Status of Federal Action:** a. bid/offer/application __a___ b. initial award c. post-award	3. **Report Type:** a. initial filing _a____ b. material change

4. **Name and Address of Reporting Entity:** __a__ Prime _____ Subawardee Tier_____, if Known: 1700 20th St. Oakland, CA 94607 **Congressional District, if known:** CA 13	5. **If Reporting Entity in No. 4 is Subawardee,** Enter Name and Address of Prime: **Congressional District, if known:**
6. **Federal Department/Agency:** Department of Energy	7. **Federal Program Name/Description:** Funding Opportunity Announcement (FOA) Number: DE-FOA-0002678 CFDA Number, *if applicable*: _____
7. **Federal Action Number,** *if known:*	9. **Award Amount**, *if known:* **$ 50 million**
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI):* N/A	**b. Individuals Performing Services** *(including address if different from No. 10a)* *(last name, first name, MI):*
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	**Signature:** DocuSigned by: David Snydacker C92B52C806EF42E... _____ **Print Name:** David Snydacker, Ph.D **Title:** CEO **Telephone No.:** [redacted] (b) (6) **Date:** June 8, 2022
Federal Use Only	**Authorized for Local Reproduction** **Standard Form - LLL (Rev. 7-97)**

Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

1. Type of Federal Action: a. contract __b__ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	**2. Status of Federal Action:** a. bid/offer/application __b__ b. initial award c. post-award	**3. Report Type:** a. initial filing __a__ b. material change

4. Name and Address of Reporting Entity: ____ Prime ___X__ Subawardee Tier_____, if Known: **UChicago Argonne, LLC** **9700 S Cass Ave** **Lemont, IL 60439** **Congressional District, if known: IL-003**	**5. If Reporting Entity in No. 4 is Subawardee,** Enter Name and Address of Prime: **Lilac Solutions** **1700 20th St.** **Oakland, CA 94607** **Congressional District, if known:**
6. Federal Department/Agency: Dept of Energy (DOE) - MESC and EERE	**7. Federal Program Name/Description:** Bipartisan Infrastructure Law (BIL) Battery Materials Processing and Battery Manufacturing CFDA Number, *if applicable*: 81.086
7. **Federal Action Number,** *if known:* DE-FOA-0002678	**9. Award Amount**, *if known:* **$**
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI):* n/a	**b. Individuals Performing Services** *(including address if different from No. 10a)* *(last name, first name, MI):* n/a
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	**Signature:** Diane Hart Digitally signed by Diane Hart Date: 2022.06.28 09:10:14 -05'00' **Print Name: Diane M Hart** **Title: Mgr., Sponsored Research & Contract Admin** **Telephone No.:** [redacted] (b) (6) **Date: 6/24/2022**
Federal Use Only	**Authorized for Local Reproduction** **Standard Form - LLL (Rev. 7-97)**

DISCLOSURE OF LOBBYING ACTIVITIES

Approved by OMB
4040-0013

Complete this form to disclose lobbying activities pursuant to 31 U.S.C.1352

Review Public Burden Disclosure Statement

1. * Type of Federal Action:
- [ ] a. contract
- [ ] b. grant
- [x] c. cooperative agreement
- [ ] d. loan
- [ ] e. loan guarantee
- [ ] f. loan insurance

2. * Status of Federal Action:
- [ ] a. bid/offer/application
- [x] b. initial award
- [ ] c. post-award

3. * Report Type:
- [x] a. initial filing
- [ ] b. material change

4. Name and Address of Reporting Entity:

[ ] Prime [x] SubAwardee Tier if known:

** Name* Alliance for Sustainable Energy, LLC

** Street 1* 15013 Denver West Parkway *Street 2*

** City* Golden *State* CO: Colorado *Zip* 80401

Congressional District, if known: CO-07

5. If Reporting Entity in No.4 is Subawardee, Enter Name and Address of Prime:

** Name* Lilac Industries

** Street 1* 1700 20th Street *Street 2*

** City* Oakland *State* CA: California *Zip* 94607

Congressional District, if known:

6. * Federal Department/Agency:

U.S. Department of Energy

7. * Federal Program Name/Description:

EERE

CFDA Number, *if applicable:*

8. Federal Action Number, *if known:*

DE-FOA-000

9. Award Amount, *if known:*

$

10. a. Name and Address of Lobbying Registrant:

Prefix ** First Name* n/a - None *Middle Name*

** Last Name* n/a - None *Suffix*

** Street 1* *Street 2*

** City* *State* *Zip*

b. Individual Performing Services (including address if different from No. 10a)

Prefix ** First Name* n/a - None *Middle Name*

** Last Name* n/a - None *Suffix*

** Street 1* *Street 2*

** City* *State* *Zip*

11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when the transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

*** Signature** John Stolpa

***Name** *Prefix* ** First Name* John *Middle Name*

** Last Name* Stolpa *Suffix*

Title Secretary, Alliance for Sustainable Energy **Telephone No.** (b) (6) **Date** 6/21/2022

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Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

1. Type of Federal Action: a. contract X b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	**2. Status of Federal Action:** a. bid/offer/application X b. initial award c. post-award	**3. Report Type:** X a. initial filing b. material change
4. Name and Address of Reporting Entity: ____ Prime X Subawardee Tier_____, if Known: Board of Regents, NSHE obo University of Nevada, Reno 1664 N. Virginia St. MS 0325 Reno, NV 89557 **Congressional District, if known:** 002	**5. If Reporting Entity in No. 4 is Subawardee,** Enter Name and Address of Prime: Lilac Solutions, Inc. 1700 20th St. Oakland, CA 94607 **Congressional District, if known:**	
6. Federal Department/Agency: Department of Energy	**7. Federal Program Name/Description:** Bipartisan Infrastructure Law (BIL) Battery Materials Processing and Battery Manufacturing CFDA Number, *if applicable*: 81.086	
7. **Federal Action Number,** *if known:*	**9. Award Amount**, *if known:* $	
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI):* Not Applicable	**b. Individuals Performing Services** *(including address if different from No. 10a) (last name, first name, MI):* Not Applicable	
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	**Signature:** Tiffany Roller **Print Name:** Tiffany Roller **Title:** Senior Research Administrator **Telephone No.:** [redacted] (b) (6) **Date:** 6/29/2022	
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A4 — Statement of Project Objectives
Unlocking US Lithium Production

A. OBJECTIVES

Lilac Solutions, Inc. ("Lilac") has developed a proprietary ion exchange (IX) process, which incorporates patented IX beads, that increases extraction efficiency from the current 40% to over 80%, reduces production time from years to hours, and reduces environmental impact. The objective of this project is the acceleration and commercialization of Lilac's unique technology for extracting battery-grade lithium compounds from natural brine resources in the western United States.

B. SCOPE OF WORK

The project will be conducted in 5 budget periods:

Budget Period 1: Planning, Documentation, Process Design, Procurement, and Equipment Installation at Oakland, NV1, UT2, and Fernley Sites: This budget period will involve setting up the project management systems and the development, review and approval of the project control documents. This period also includes process engineering deliverables and construction in our Oakland fabrication facility and the NV1, UT2, and Fernley locations.

Budget Period 2: NV1 and UT2 Operations, NV2 and UT2 Preparation, and Fernley Procurement and Construction: This budget period includes 1,000 hours of operations at both NV1 and UT2, equipment preparation for NV2 and UT1, and procurement and construction at Fernley.

Budget Period 3: Construction at NV2 and UT1 and Operations at Fernley: This budget period includes major equipment procurement and construction at NV2 and UT1 and operations at Fernley.

Budget Period 4: NV2, UT1, and Fernley Operations: This budget period includes operations at NV2, UT1, and Fernley.

Budget Period 5: NV2, UT1 and Fernley Operations: This budget period includes operations at NV2, UT1, and Fernley.

C. TASKS TO BE PERFORMED

The following tasks will be conducted:

All Budget Periods

Overall Project Management and Planning – Lilac 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 00 – Project Management:

Lilac will maintain the Project Management Plan (PMP) and will manage and implement the project in accordance with the PMP. This includes regular status and Earned Value Management reports.

Budget Period 1 (Task 01): Budget Period 1 (BP1) Activities

Task 01.01 – Project Initiation:

Subtask 01.01.01: Mobilization – Mobilize personnel and resources required for Budget Period 1. Mobilization will be phased in at the project locations according to the baseline schedule. This task includes establishing Lilac's Project Management Systems including accounting, time reporting, procurements, etc.

Subtask 01.01.02: Kickoff Meeting – Participate in a project kickoff meeting with DOE within 30 days of project initiation. This kickoff meeting will identify lines of communication and reporting within the project team; establish understanding and expectation for each budget period; review and update the preliminary schedule; and establish the reporting parameters, format, and frequency.

Subtask 01.01.03: Project Management Plan (PMP) – Develop the PMP, submit it for review, and incorporate review comments.

Task 01.02 – BP1 NV1 Activities:

Subtask 01.02.01: BP1 NV1 Engineering Design – Develop BP1 NV1 Engineering Design.

Subtask 01.02.01.01: BP1 NV1 Process Design – Develop process engineering deliverables such as material balances, P&IDs, and equipment sizing.

Subtask 01.02.01.02: BP1 NV1 Discipline Engineering – Develop other engineering discipline designs such as mechanical, controls, and civil.

Subtask 01.02.02: BP1 NV1 Procurement – Perform BP1 NV1 procurement activities.

Subtask 01.02.02.01: BP1 NV1 Purchasing Equipment – Submit RFQs with design specifications and Place purchase orders.

Subtask 01.02.02.02: BP1 NV1 Equipment Verification – Verify received equipment fulfill contract and specifications.

Subtask 01.02.03: BP1 NV1 Construction – Perform BP1 NV1 construction activities.

Subtask 01.02.03.01: BP1 NV1 Module Fabrication – Build modular equipment in Oakland fabrication facility.

Subtask 01.02.03.02: BP1 NV1 Module Installation – Transport from Oakland to Site and Install module equipment on site.

Subtask 01.02.04: BP1 NV1 Site Operations – Perform BP1 NV1 operations.

Subtask 01.02.04.01: BP1 NV1 Commissioning – Commission installed equipment and verify equipment operates within design specifications.

Subtask 01.02.04.02: BP1 NV1 Operations – Operate equipment/collect data.

Task 01.03: BP1 UT2 Activities:

Subtask 01.03.01: BP1 UT2 Engineering Design – Develop BP1 UT2 Engineering Design.

Subtask 01.03.01.01: BP1 UT2 Process Design – Develop process engineering deliverables such as material balances, P&IDs, and equipment sizing.

Subtask 01.03.01.02: BP1 UT2 Discipline Design – Develop other engineering discipline designs such as mechanical, controls, and civil.

Subtask 01.03.02: BP1 UT2 Procurement – Perform BP1 UT2 procurement activities.

Subtask 01.03.02.01: BP1 UT2 Purchasing Equipment – Submit RFQs with design *specifications and place purchase orders.*

Subtask 01.03.02.02: BP1 UT2 Equipment Verification – Verify received equipment fulfill contract and specifications.

Subtask 01.03.03: BP1 UT2 Construction – Perform BP1 UT2 construction activities.

Subtask 01.03.03.01: BP1 UT2 Module Fabrication – Build modular equipment in *Oakland fabrication facility.*

Subtask 01.03.03.02: BP1 UT2 Module Installation – Transport from Oakland to Site and Install module equipment on site.

Task 01.04: BP1 NV2 Activities:

Subtask 01.04.01: BP1 NV1 Engineering Design – Develop BP1 NV2 Engineering Design.

Subtask 01.04.01.01: BP1 NV2 Process Design – Develop process engineering deliverables such as material balances, P&IDs, and equipment sizing.

Subtask 01.04.01.02: BP1 NV2 Discipline Engineering – Develop other engineering discipline designs such as mechanical, controls, and civil.

Task 01.05: Fernley Activities:

Subtask 01.05.01: Fernley Small Commercial Construction – Perform BP1 Fernley small commercial construction activities.

Subtask 01.05.01.01: Fernley Equipment Installation – Install Small commercial equipment.

Subtask 01.05.01.02: Fernley Electrical Installation – Install Small Commercial electrical infrastructure.

Subtask 01.05.01.03: Fernley Control System Installation – Install small commercial control system and infrastructure.

Subtask 01.05.02: Fernley Small Commercial Commissioning – Perform BP1 Fernley small commercial commissioning activities.

Subtask 01.05.02.01: Fernley Equipment Commissioning – Commission small commercial equipment.

Subtask 01.05.02.02: Fernley Electrical Commissioning – Commission small commercial electrical infrastructure.

Subtask 01.05.02.03: Fernley Control System Commissioning – Commission small commercial control system.

Subtask 01.05.03: Fernley Large Commercial Engineering – Perform BP1 Fernley large commercial engineering activities.

Subtask 01.05.03.01: Fernley Front End Engineering and Design (FEL2) – Develop conceptual design of entire Large Commercial Project (both phase 1 and 2).

Subtask 01.05.03.02: Fernley Detailed Design (FEL3) – Develop detailed design of entire Large Commercial Project (both phase 1 and 2).

Subtask 01.05.04: Fernley Large Commercial Phase 1 Procurement – Perform BP1 Fernley large commercial Phase-1 procurement activities.

Subtask 01.05.04.01: Fernley Major Equipment Procurement – Perform specification and purchase of Phase 1 major equipment.

Subtask 01.05.05: Fernley Large Commercial Phase 1 Construction – Perform BP1 Fernley large commercial Phase 1 construction activities.

Subtask 01.05.05.01: Fernley Pre-Construction – Construct Phase 1 civil, structural, and foundations.

Subtask 01.05.05.02: Fernley Equipment Installation – Install large commercial Phase 1 equipment.

Subtask 01.05.05.03: Fernley Electrical Installation – Install large commercial Phase 1 electrical infrastructure.

Subtask 01.05.05.04: Fernley Control System Installation – Install large commercial Phase 1 control system and infrastructure.

Milestone	Type	Description
[redacted] (b) (4)	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

Milestone	Type	Description
(b) (4) [redacted]	[redacted]	[redacted]

Continuation: After completion of each BP1 Go/No-Go Decision criteria, Lilac will obtain authorization prior to proceeding with any scope in the next budget period.

Budget Period 2 (Task 02): Budget Period 2 (BP2) Activities Design

Task 02.01: BP2 UT2 Activities:

Subtask 02.01.01: BP2 UT2 Site Operations – Perform BP2 UT2 operations.

Subtask 02.01.01.01: BP2 UT2 Commissioning – Commission installed equipment and verify equipment operates within design specifications.

Subtask 02.01.01.02: BP2 UT2 Operations – Operate equipment/collect data.

Task 02.02 BP2 NV2 Activities:

Subtask 02.02.01: BP2 NV2 Procurement – Perform BP2 NV2 procurement activities.

Subtask 02.02.01.01: BP2 NV2 Purchasing Equipment – Submit RFQs with design specifications and place purchase orders.

Subtask 02.02.01.02: BP2 NV2 Equipment Verification – Verify received equipment fulfill contract and specifications.

Subtask 02.02.02: BP2 NV2 Construction – Perform BP2 NV2 construction activities.

Subtask 02.02.02.01: BP2 NV2 Module Fabrication – Build modular equipment in Oakland fabrication facility.

Subtask 02.02.02.02: BP2 NV2 Module Installation – Transport from Oakland to Site and Install module equipment on site.

Task 02.03: BP2 UT1 Activities:

Subtask 02.03.01: BP2 UT1 Engineering Design – Develop BP2 UT1 Engineering Design.

Subtask 02.03.01.01: BP2 UT1 Process Design – Develop process engineering deliverables such as material balances, P&IDs, and equipment sizing.

Subtask 02.03.01.02: BP2 UT1 Discipline Design – Develop other engineering discipline designs such as mechanical, controls, and civil.

Subtask 02.03.02: BP2 UT1 Procurement – Perform BP2 UT1 procurement activities.

Subtask 02.03.02.01: BP2 UT1 Purchasing Equipment – Submit RFQs with design specifications and place purchase orders.

Subtask 02.03.02.01: BP2 UT1 Equipment Verification – Verify received equipment fulfill contract and specifications.

Subtask 02.03.03: BP2 UT1 Construction – Perform BP2 UT1 construction activities.

Subtask 02.03.03.01: BP2 UT1 Module Fabrication – Build modular equipment in Oakland fabrication facility.

Subtask 02.03.03.02: BP2 UT1 Module Installation – Transport from Oakland to Site and Install module equipment on site.

Task 02.04: BP2 Fernley Activities:

Subtask 02.04.01: BP2 Fernley Large Commercial Phase 1 Procurement – Perform BP2 Fernley large commercial Phase 1 procurement activities.

Subtask 02.04.01.01: BP2 Fernley Major Equipment Procurement – Develop specification and purchase of Phase 1 major equipment.

Subtask 02.04.01.02: BP2 Fernley Bulks Procurement – Purchase large commercial bulk materials.

Subtask 02.04.02: BP2 Fernley Large Commercial Phase 1 Construction – Perform BP2 Fernley large commercial Phase 1 construction activities.

Subtask 02.04.02.01: BP2 Fernley Pre-Construction – Construct Phase 1 civil, structural, and foundations.

Subtask 02.04.02.02: BP2 Fernley Equipment Installation – Install large commercial Phase 1 equipment.

Subtask 02.04.02.03: BP2 Fernley Electrical Installation – Install large commercial Phase 1 electrical infrastructure.

Subtask 02.04.02.04: BP2 Fernley Control System Installation – Install large commercial Phase 1 control system and infrastructure.

Subtask 02.04.03: BP2 Fernley Large Commercial Phase 1 Commissioning – Perform BP2 Fernley large commercial Phase 1 commissioning activities.

Subtask 02.04.03.01: BP2 Fernley Equipment Commissioning – Commission large commercial Phase 1 equipment.

Subtask 02.04.04: BP2 Fernley Large Commercial Phase 2 Procurement – Perform BP2 Fernley large commercial Phase 2 procurement activities.

Subtask 02.04.04.01: BP2 Fernley Major Equipment Procurement – Develop specification and purchase of Phase 2 major equipment.

Subtask 02.04.04.02: BP2 Fernley Bulks Procurement – Purchase large commercial bulk materials.

Subtask 02.04.05: BP2 Fernley Large Commercial Phase 2 Construction – Perform BP2 Fernley large commercial Phase 2 construction activities.

Subtask 02.04.05.01: BP2 Fernley Pre-Construction – Construct Phase 2 civil, structural, and foundations.

Subtask 02.04.05.02: BP2 Fernley Equipment Installation – Install large commercial Phase 2 equipment.

Subtask 02.04.05.03: BP2 Fernley Electrical Installation – Install large commercial Phase 2 electrical infrastructure.

Subtask 02.04.05.04: BP2 Fernley Control System Installation – Install large commercial Phase 2 control system and infrastructure.

<u>Subtask 02.04.06: BP2 Fernley Large Commercial Phase 2 Commissioning</u> – Perform BP2 Fernley large commercial Phase 2 commissioning activities.

Subtask 02.04.06.01: BP2 Fernley Equipment Commissioning – Commission large commercial Phase 2 equipment.

Subtask 02.04.06.02: BP2 Fernley Electrical Commissioning – Commission large commercial Phase 2 electrical infrastructure.

Subtask 02.04.06.03: BP2 Fernley Control System Commissioning – Commission large commercial Phase 2 control system.

Milestone	Type	Description
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[redacted]	SMART	[redacted]
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[redacted]	Go/No-Go	[redacted]
[redacted]	Go/No-Go	[redacted]

Continuation: After completion of each BP2 Go/No-Go Decision criteria, Lilac will obtain authorization prior to proceeding with any scope in the next budget period.

Budget Period 3: Budget Period 3 (BP3) Activities

Task 03.01: BP3 NV2 Activities:

Subtask 03.01.01: BP3 NV2 Site Operations – Perform BP3 NV2 operations.

Subtask 03.01.01.01: BP3 NV2 Commissioning – Commission installed equipment and verify equipment operates within design specifications.

Subtask 03.01.01.02: BP3 NV2 Operations – Operate equipment/collect data.

Task 03.02: BP3 UT1 Activities:

Subtask 03.02.01: BP3 UT1 Site Operations – Perform BP3 UT1 operations.

Subtask 03.02.01.01: BP3 UT1 Commissioning – Commission installed equipment and verify equipment operates within design specifications.

Subtask 03.02.01.02: BP3 UT1 Operations – Operate equipment/collect data.

Task 03.03: BP3 Fernley Activities:

Subtask 03.03.02: BP3 Fernley Site Operations – Perform BP3 Fernley site operations.

Subtask 03.03.02.01: BP3 Fernley Operations – Perform BP3 Fernley operations.

Milestone	Type	Description
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[redacted]	SMART	[redacted]
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[redacted]	SMART	[redacted]
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[redacted]	SMART	[redacted]
[redacted]	Go/No-Go	[redacted]
[redacted]	Go/No-Go	[redacted]
[redacted]	Go/No-Go	[redacted]

(b) (4)

Continuation: After completion of each BP3 Go/No-Go Decision criteria, Lilac will obtain authorization prior to proceeding with any scope in the next budget period.

Budget Period 4: Budget Period 4 (BP4) Activities

Task 04.01: BP4 NV2 Activities:

Subtask 04.01.01: BP4 NV2 Site Operations – Perform BP4 NV2 operations.

Subtask 04.01.01.01: BP4 NV2 Operations – Operate equipment/collect data.

Task 04.02: BP4 UT1 Activities:

Subtask 04.02.01: BP4 UT1 Site Operations – Perform BP4 UT1 operations.

Subtask 04.02.01.01: BP4 UT1 Operations – Operate equipment/collect data.

Task 04.03: BP4 Fernley Activities:

Subtask 04.03.01: BP4 Fernley Site Operations – Perform BP4 Fernley site operations.

Subtask 04.03.01.01: BP4 Fernley Operations – Perform BP4 Fernley operations.

Milestone	Type	Description
[redacted]	SMART	[redacted]
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[redacted]	SMART	[redacted]
[redacted]	[redacted]	[redacted]
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[redacted]	SMART	[redacted]
[redacted]	Go/No-Go	[redacted]
[redacted]	Go/No-Go	[redacted]

(b) (4)

Continuation: After completion of each BP4 Go/No-Go Decision criteria, Lilac will obtain authorization prior to proceeding with any scope in the next budget period.

Budget Period 5: Budget Period 5 (BP5) Activities

Task 05.01: BP5 NV2 Activities:

Subtask 05.01.01: BP5 NV2 Site Operations – Perform BP5 NV2 operations.

Subtask 05.01.01.01: BP5 NV2 Operations – Operate equipment/collect data.

Task 05.02: BP5 UT1 Activities:

Subtask 05.02.01: BP5 UT1 Site Operations – Perform BP5 UT1 operations.

Subtask 05.02.01.01: BP5 UT1 Operations – Operate equipment/collect data.

Task 05.03: BP5 Fernley Activities:

Subtask 05.03.01: BP5 Fernley Site Operations – Perform BP5 Fernley site operations.

Subtask 05.03.01.01: BP5 Fernley Operations – Perform BP5 Fernley operations.

Milestone	Type	Description
[redacted]	SMART	[redacted]
[redacted]	SMART	[redacted]
[redacted]	SMART	[redacted]

(b) (4)

Milestone	Type	Description
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[redacted] (b) (4)	SMART	[redacted]
[redacted]	SMART	[redacted]
[redacted]	SMART	[redacted]
[redacted]	SMART	[redacted]
[redacted]	SMART	[redacted]

D. DELIVERABLES

In addition to the reports specified in the "Federal Assistance Reporting Checklist", Lilac will provide the following to the DOE Project Officer:

- Summary of accomplishments and project work report will be prepared for inclusion in the Vehicle Technologies Office annual programmatic progress report. Report will be due by October 31 of each year.
- Project Management Plan (PMP)
- NV1 Design
- UT2 Design
- NV2 Design
- UT1 Design
- Fernley Design

E. BRIEFINGS AND TECHNICAL PRESENTATIONS

Lilac will provide the following briefings and technical presentation as requested by DOE:

- A technical presentation at the Vehicle Technologies Annual Merit Review Meeting held in Washington, DC.
- Detailed project status update briefings at Washington, DC or via communication/conferencing media approximately twice per year. Briefings will explain the plans, progress, and results of the technical effort.
- Technical paper(s) and presentations as appropriate at technical society meetings, or at technical exchange meetings.

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

FOA Area of Interest 5
Demonstration of Innovative Separation Processing of Battery Materials Open Topic

July 1, 2022

Unlocking U.S. Lithium Production

Application Title Page/Cover Sheet

Proposer:
Lilac Solutions, Inc.

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David Gelinas, KP, Lilac Solutions CFO
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Dustin Weigl, PI, National Renewable Energy Laboratory
Frederick Steinmann, PI, University of Nevada, Reno

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A1.1—Project Overview

A1.1.1—Background

Company Background and Mission. Lilac Solutions, Inc. was founded by Dr. David Snydacker in 2016 with the objective of transforming our country's lithium supply chain. His vision encompassed an efficient and quickly-deployable technology that maximized lithium production while minimizing impact on the environment. Since then, Lilac has successfully demonstrated economic lithium extraction using its technology, scaled-up to field pilot production scale, and grown to 90 full-time employees across two sites in the United States (Oakland, CA and Fernley, NV) and in 5 different countries across the Americas. Lilac's technology group is divided into three technical divisions, including its Lithium Production EPCM Division, Ion-Exchange Bead Manufacturing Division and Lithium Production Technology Division. Lilac has also gained the backing of major clean technology investors including Breakthrough Energy Ventures, Lowercarbon Capital, and T. Rowe Price.

R&D Efforts and Results. Lilac Solutions has developed and patented the world's first modern, high-performance, and environmentally friendly lithium extraction technology. The technology has been rigorously tested on over sixty brines with consistently excellent results. The technology and associated patents (8 granted and 5 pending) cover its unique ion exchange beads, lithium extraction modules incorporating the beads, and lithium production systems surrounding the modules for efficient usage and recycling of reagents. The result is a new lithium extraction system with extraordinary performance that will play a critical role in significantly increasing lithium supply for the electric vehicle era.

The core of Lilac's technology is an ion exchange (IX) process that selectively recovers lithium from brines. The conceptual description of Lilac's technology is shown in *Exhibit A1.1-1*.

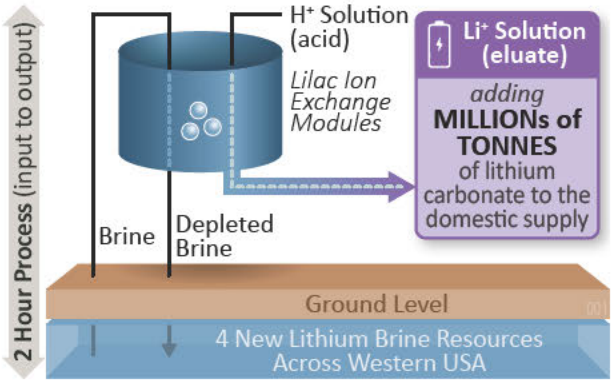

Exhibit A1.1-1. *Lilac's Lithium Extraction Technology*

Its scientific working principles and advances over existing approaches to lithium extraction are discussed in detail in section A1.2.

The heart of Lilac's technology offering is proprietary ion-exchange beads that selectively absorb Li from liquids, and which are engineered and manufactured by Lilac and covered by our patent portfolio. These beads are loaded into proprietary IX modules (also designed by Lilac) where they are used to extract lithium. In our process, liquid streams—typically a naturally occurring brine that contains lithium—are contacted with the IX beads, which selectively extract lithium ions. These lithium ions are then released from the IX beads by contact with acid, leading to a purified lithium stream. Lilac's technology selectively captures >80–98% of lithium in the brine (depending on the brine resource), while rejecting > 99.0–99.9% of the other salts found in solution. The purified lithium stream produced by Lilac is readily polished to remove minor impurities, and converted to battery-grade lithium products—namely lithium carbonate ($Li2CO_3$) and lithium hydroxide monohydrate (LiOH).

Lilac's approach can be applied to a vast swath of lithium resources which are currently not economically viable with existing lithium extraction technologies. Our approach has the potential to increase lithium recovery by 2-3

times over the existing lithium extraction technology based on evaporation ponds, and has a dramatically lower land and water footprint.

Status of Research and Product. Our R&D status, including demonstrations already conducted, is summarized in *Exhibit A1.1-2*, which highlights technical stage-gates, IX bead production rates, and associated lithium production rates at each scale. The company has successfully extracted lithium from over 60 different brine resources from four different continents and demonstrated viable technical performance and favorable process economics of its technology. [redacted] This served to demonstrate the technology's ability to be deployed in a complex operational environment. In addition, Lilac is involved in several lithium projects in the US and abroad where it has established itself as both a potential lithium extraction technology provider and lithium project developer.

A1.1.2—Project Goal

Overall Goals. The goal of this project is the demonstration of Lilac's unique lithium extraction technology at commercial-relevant production scales. This demonstration will pave the way for producing battery-grade lithium compounds in the Western United States, a critical material for building a robust domestic battery supply chain. The roadmap and technical stage-gates to commercialization of Lilac's lithium production technology is summarized in *Exhibit A1.1-3* and discussed below.

	successfully demonstrated		this funding opportunity	
CapEx, $MM USD	10^0	10^1	10^2	10^3
IX bead Production, TPA*	10^{-2}	10^1	10^2	10^3
LCE Production, TPA*	10^{-3}	10^1	10^3	10^4
Development Status	60+ projects completed	1 project complete 2 complete by Q4 '22	Design complete 1 deployment by 2025	Design ongoing, construction 2024
Production Scale	Lab-Scale	Field Pilot	Demo	Commercial
Technical Stage-Gate	*test chemistry*	*demonstrate scale-up continuous field operation*	*validate commercial-scale modular design*	*production*

**IXM: Lilac proprietary Ion-Exchange Material. LCE: Lithium carbonate equivalents. TPA: tonnes per annum.*

Exhibit A1.1-2. *R&D Status of Lilac IX Product*

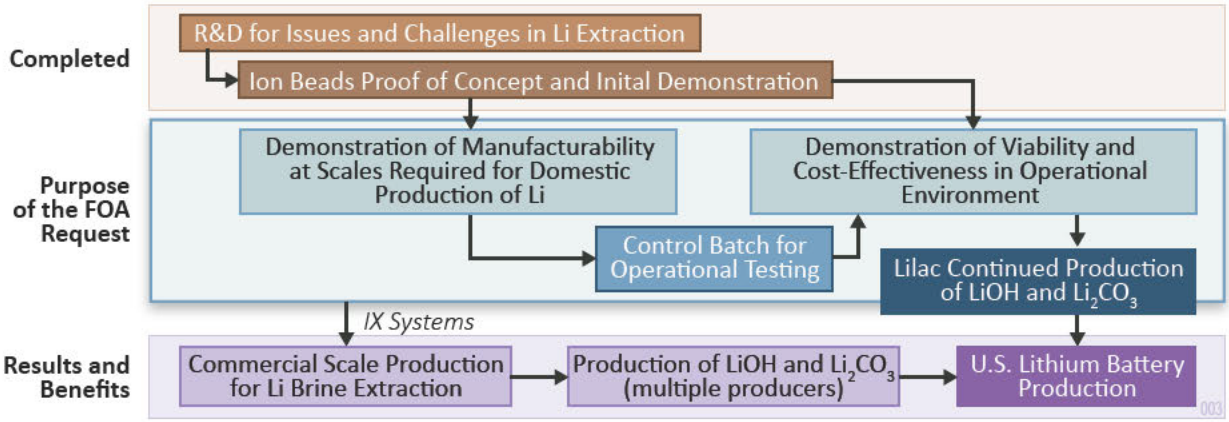

Exhibit A1.1-3. *Lilac's proposed improvements.*

Purpose of funding. Project funding will be used to accelerate procurement and construction of two complementary and parallel activities:

- Procurement, construction, and commissioning of a demonstration-scale production line for Lilac's ion-exchange beads. Conceptual design of this production line is complete, and an industrial facility in Fernley, NV has been secured by Lilac to establish this capability.
- Deployment and operation of two field pilots and two larger-scale demonstration plants for production of lithium compounds in the Western United States. Design of the lithium extraction modules using Lilac IX beads is complete, and land-use rights for deployment of lithium-extraction plants at the proposed locations have been secured.

Proposed Improvements. To accomplish these goals, we propose the following improvements to our existing technologies and processes. These improvements are aimed at demonstration of lithium production technology in equipment design to produce lithium in commercial quantities, setting the Lilac technology in a TRL of 8–9.

First. Building on lab R&D and pilot production efforts, Lilac's IX Bead Manufacturing Division will scale-up the manufacturing process for the IX beads to demonstrate the viability and reliability of a commercial-scale multi-production line facility. This will require the establishment of production capabilities at our Fernley NV facility, to be accomplished in three stages: construction and commissioning of [redacted] (b) (4) [redacted]

Second. Building on the lab-scale and field pilot demonstrations already accomplished, the Lithium Production Technology division will design and build four lithium extraction modules that use the IX beads produced by the objective above. These IX modules will be operated in four field lithium extraction plants:

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

Note: TPA_{LCE} is defined as tonnes per year of lithium carbonate equivalent.

The [redacted] pilot plants (TRL 7) will evaluate the potential to produce lithium from new US brine resources, potentially bringing two new US lithium resources online. The [redacted] demonstration plants (TRL 8-9), will demonstrate lithium production using Lilac's technology at commercially relevant scales. Results (including environmental impact analyses) will be used to then refine the design of two larger facilities capable of supporting commercial production of 20,000 to 50,000 tonnes per annum of Lithium carbonate equivalents (TPA_{LCE}).

Third. Working with our FFRDC teammates, Lilac will use technical results from the two improvements above to conduct rigorous life-cycle and technoeconomic analysis of Li production using Lilac's technology. This will demonstrate the economic and environmental improvement of Lilac's technology over existing or proposed technologies for lithium production (see A1.2.3 for details on these) and identify areas of further optimization to support the domestic battery supply chain.

Critical Success Factors. Critical success factors for the IX Bead Manufacturing plant at Fernley include the capability to produce the IX beads at the [redacted] (b) (4) [redacted]

Critical success for the Lithium Production Technology includes successfully extracting lithium with the demonstration scale plants at a TRL of 8. This will include meeting pro-

duction targets, demonstrating that process performance is maintained at scale, and using performance data to produce a Definitive Feasibility Study (DFS) that demonstrates large volumes of lithium can be commercially produced at a cost of < USD $ 6,000 per tonnes of LCE at US sites.

A1.1.3—DOE Impact

Planned application of DOE Funds. The funding provided under this FOA will substantially accelerate the deployment of Lilac's technology for lithium production in the United States. The direct benefit to the country is an expeditious increase in domestic lithium production capacity, accelerated time to market and significant lowering of the environmental impact of lithium production. Lilac anticipates that commercial lithium production resulting from our proposed projects will be delayed by at least two years without the additional support of DOE funding, causing significant negative downstream impact on on the domestic battery supply chain. The allocation of DOE funds is detailed in the Budget Justification Workbook and summarized in *Exhibit A1.1-4*.

Funds will be allocated to accelerate the expansion of Lilac's IX bead manufacturing capacity, support Lilac's field site validation for domestic lithium production, demonstrate scale-up of lithium production using Lilac's IX technology at a TRL of 9, and financially support collaboration with FFRDCs and universities. Funding for these will be essential in assessing and optimizing Lilac's technology, demonstrating positive environmental impact, and supporting our equity plan objectives.

Funding for the manufacturing demonstration will enable Lilac's Ion-Exchange Bead Manufacturing Division to establish the LC Phase 1 (b) (4) IX bead manufacturing facility, described in section A1.2. It will provide timely start of the construction efforts for this manufacturing facility, so that initial commissioning will occur in Q2 of 2024. Funds will also accelerate the procurement, construction, and commissioning of LC Phase 2 to expand total IX bead production capacity to (b) (4) so that commissioning can occur in Q3 2024. This acceleration will be achieved through the availability of funds for procurement and the ability to accelerate hiring and training of personnel. The additional production capacity of ion exchange beads will enable Lilac to supply the four lithium extraction projects (the second part of the scope of this project) as they expand beyond the initial pilot demonstrations.

Other non-FOA funding has been secured for two (b) (4) pilot plants to be located in Utah Project 1 and Nevada Project 2 within the project period. These external funds will be used to complete site surveys, complete drilling operations, and establish the pilot facilities and infrastructure. The FOA funding will expand these projects to full demonstration scale (b) (4) plants; scale-up to commercial lithium production can begin immediately if testing results from these two projects is successful, accelerating Lilac's current timeline by two years.

FOA funds will further enable deployment of two additional [redacted] pilot plans in Utah Project 2 and Nevada Project 1. Lilac currently has exploration rights to these resources, but cannot pursue pilot studies in the absence of FOA funding. These studies will enable Lilac to evaluate two additional domestic lithium resources which currently have no definitive timeline for production, which could signifi-

(b) (4)

Participants	Funding from DOE	Lilac Cost Share	Total Costs
Lilac Solutions	$50M	$129.3M	$176.9M
FFRDCs and Universities	$0	$0	$2.4M
Totals	$50M	$129.3M	$179.3M

Exhibit A1.1-4. *Planned Funding Allocation*

cantly expand domestic lithium production if field piloting demonstrates economic viability.

Taken together, funding will accelerate commercial production of lithium using Lilac's IX technology, thereby helping secure the domestic battery-materials supply chain while ensuring that this occurs in a way that optimizes scientific, environmental, and socio-economic impacts.

A1.1.4—Equity Plan

Lilac Solutions, Inc.'s planned operational sites in California, Nevada, and Utah will provide direct economic benefits to local communities and DACs. All sites are in low-income or rural areas that will benefit from establishment of quality jobs. Lilac plans to provide growth opportunities to areas that are often overlooked. Lilac's business ventures combined with local partnerships will provide economic opportunities, elevate local minority-owned businesses, while supporting improvements to the economic landscape of each area.

The benefits to DACs and SDBs are vast. Lilac brings stable, long-term, quality jobs with high pay, good benefits, and workplace training opportunities across a wide variety of disciplines. Lilac's business, rooted in the clean technology evolution, provides opportunity for workers to establish careers in a long-term growth industry as opposed to declining industries such as fossil fuels. Lilac's emphasis on identifying and cultivating business and supplier relationships with minority-owned businesses will help magnify the impact on DACs and local communities. Lilac believes in building a business that promotes clean energy, better environment, and stronger communities.

To ensure that Lilac continues to attract and retain quality workforce talent from DACs and other underrepresented groups, Lilac will partner with local community organizations, universities and community colleges, and use their networks to advertise available jobs.

Lilac focuses on building a strong harassment free and safety-first culture that creates an environment where all feel included and engaged to do their best work. In addition, Lilac believes in the importance of strong wages for current employees and new hires alike. We are dedicated to retaining quality talent and continuously reevaluating salaries to ensure pay scales match or exceed the market. We value our staff and recognize that quality wages are vital for retention and positive quality of life for employees.

Workforce training programs both within Lilac and with community partners, will lay the foundation for long-term career growth with a career track and stability. Lilac's culture allows every employee to contribute their greatest capabilities. Lilac recognizes that continuous learning leads to engaged employees who achieve their greatest potential. Lilac focuses on promoting from within and creates opportunities for upward career mobility whenever possible.

Lilac upholds the highest labor standards in everything we do. We go through an intensive interviewing process, and set culture, technical, and safety standards across the company's multiple locations. We believe in long-term job opportunities and retention of quality staff. We plan to do this by partnering closely with the University of Nevada, Reno economic development department. Lilac can provide the business structure and opportunity with guidance from our partners who know what local communities need to thrive.

A1.2—Technical Description, Innovation, and Impact

A1.2.1—Relevance and Outcomes

Principles of the Lilac Technology. Lilac Solutions has developed and patented the world's leading lithium extraction technology. This technology is capable of extracting lithium from a wide range of liquid resources with high-performance, is modular, quickly deployable, and fully integrated to maximize energy efficiency while minimizing environmental impact.

Most the world's lithium resources are found in naturally occurring salt solutions, also known as brines. Brines consist of lithium co-dissolved with other metal salts, where lithium constitutes a small minority of the salt species. Efficiently separating the small amount of lithium from the vast excess of other salts is the grand challenge of lithium extraction. Lilac's technology achieves this through its protonated Li-selective ion-exchange (IX) process. Because its technology directly extracts lithium from a liquid, Lilac's technology is classified as direct lithium extraction (DLE).

The basic working principle of this IX process is shown in *Exhibit A1.1-1* while the chemistry of the IX process is shown in *Exhibit A1.2-1*. Lithium extraction is achieved by contacting a brine with Lilac's ion-exchange beads (denoted IX beads), which selectively absorb lithium from the brine while releasing H^+. Lilac's IX beads comprise coated oxide particles formed into porous beads, as shown in *Exhibit A1.2-1*. The oxide selectively adsorbs Li^+ ions from a salt solution, while rejecting other ions in co-solution with Li^+. Therefore, contacting the IX beads with a lithium containing solution results in uptake of lithium from the solution, which is loaded into the solid beads.

Upon removal of the brine, the lithium remains within the solid IX beads, while other co-dissolved ions are flushed out with the brine. After absorbing Li^+, IX beads are typically washed with water to remove any brine entrained between the solids. Subsequently, a lithium stripping (also termed elution) step is performed, where the lithium-rich solid is contacted with an acidic solution containing protons. These protons (H^+) displace lithium within the ion-exchange beads and release the Li^+ into solution, resulting in an acidic lithium solution being produced as the product. The IX beads now contain protonated crystallographic lattice sites that are selective to lithium and are ready for uptake of lithium again. This loading-stripping cycle can be repeated hundreds of times with the same IX beads.

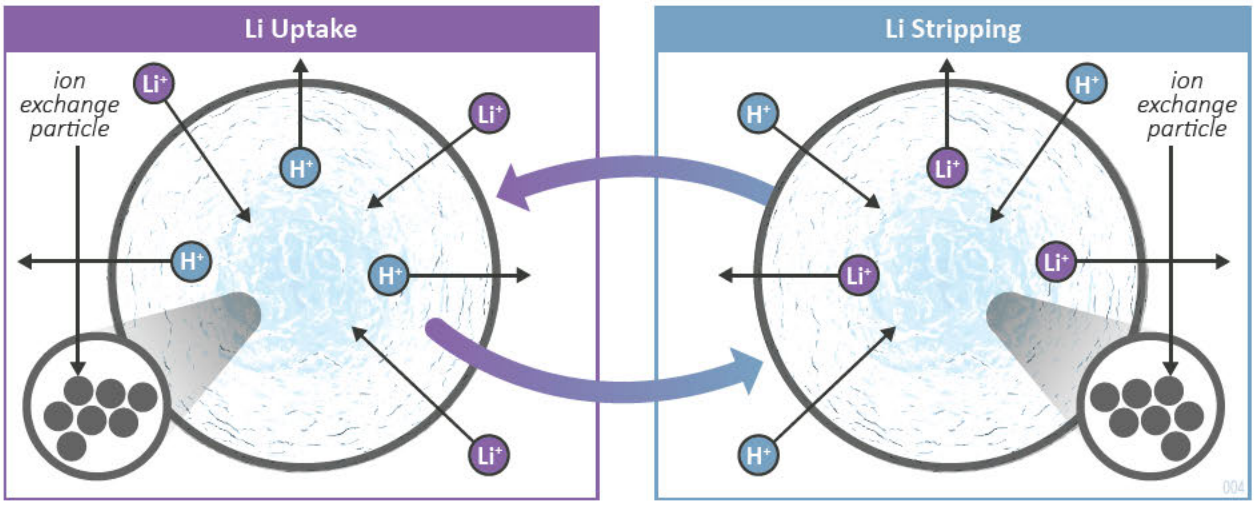

Exhibit A1.2-1. *Lilac Technology ion-exchange chemistry basics*

The acidic lithium solution produced, also termed an 'eluate', consists of lithium and a minor quantity of cationic impurities. This solution is neutralized with base to a neutral pH, and this neutralized stream constitutes the product of Lilac's direct-lithium extraction technology. Lilac has demonstrated both hydrochloric acid and sulfuric acids as viable sources of protons to drive this process, demonstrating the versatility of the technology.

The Lilac IX Beads. Lilac's proprietary ion-exchange beads comprise a lithium-selective ion-exchange material, as shown in *Exhibit A1.2-1*. This material is synthesized by reaction of a lithium salt and a transition metal precursor material, forming a lithium-intercalated oxide. Upon removal of lithium from this oxide structure by treatment with acid, protons (H^+) occupy the crystal lattice sites formerly occupied by lithium (Li^+). When this material is re-exposed to lithium, the lattice sites provide thermodynamically favorable environments for re-intercalation of Li and exchange with protons. This phenomenon is similar to the intercalation and de-intercalation of Li^+ within traditional Li-ion battery cathode materials during discharge and charge cycles, respectively. The crystal structure of the oxide rejects ions other than lithium and protons due to the size of the available lattice sites (lithium is the smallest/lightest solid element) and ionic interactions between the transition metal oxide and the intercalated cations. This results in the ion exchange material being selective for lithium uptake over other cations typically found in co-solution with lithium.

IX beads are essentially 'agnostic' to the brine from which Li is being extracted: IX beads selectively absorb Li^+ independent of the particular Li^+ concentration or impurity profile of the brine from which lithium is extracted, enabling it to be used for a wide range of lithium resources with different chemical profiles. The coating on the oxide particles provides a protective layer that inhibits dissolution of the material upon exposure to brine and acid. This results in a long-life of the beads during lithium production, leading to favorable process economics. The porous IX bead structure allows for manufacturing of the beads with a large media size, reducing pressure drop from fluid flow in the IX modules, while retaining good diffusion kinetics and mechanical strength. This allows for efficient design of IX modules with minimal operating costs.

Chemistry of Natural Brines. Lithium containing liquid resources comprise a wide range of chemical compositions. They range in Li concentrations from 50–2500 mg/L, contain co-dissolved ions consisting of Na, K, Mg, Ca, Sr, and B, and counter anions that include chlorides, sulfates, and carbonates. These brines contain co-dissolved ions in vast molar excess to Li, are oftentimes at saturation of salt concentrations, and can reach a density of up to 1.35 g/L. Typical cation concentrations in a variety of brines from which Lilac has produced lithium using its proprietary IX are shown in *Exhibit A1.2-2*. Li concentrations in these brines span an order of magnitude, with a wide range of impurity profiles including Na-rich brines and Mg-rich brines, and a variety of brine resource types including salar brines, geothermal brines, industrial effluents, and lithium-ion battery recycled leachate.

The Lilac Technology as a Lithium Production Package. Lilac's IX beads are loaded into IX modules. These modules incorporate the IX beads within the chemical processing equipment required for contacting the IX beads with brine, washing, and Li stripping using acid to produce a lithium eluate. These IX modules are standardized for rapid and low-cost production, and can therefore be quickly deployed or scaled-up to meet the lithium production requirements of different projects.

(b) (4)

The values above are defined by the following equations where X is an impurity cation (Na, K, Mg, Ca, B, Sr).

Equation 1.

Equation 2. $\frac{\text{moles of X recovered as XCl in eluate}}{\text{moles of X supplied in brine sample}}$

Equation 3.

Exhibit A1.2-2 Phase 1 Lilac Ion-Exchange Technology. *Chemistry of lithium uptake and stripping within an IX bead. * BDL = below detection limit.*

The role of the Lilac IX module in a lithium production project is shown in *Exhibit A1.2-3*. Lilac IX modules are part of a fully-integrated lithium production plant that can be largely powered by solar energy, while maintaining a net water balance of zero. As can be seen, the Lilac IX modules constitute only a small portion of the Lilac IX plant, yet they are responsible for removing >99% of impurities and for the large savings in operating costs.

In a lithium production plant, a lithium-containing brine, for example from a salt-flat resource, is pretreated to remove any naturally occurring solids. The brine is then fed into a Lilac IX module, which extracts lithium from it while releasing protons. Acid (typically HCl) is used to elute Li^+ absorbed by the beads, while base (typically NaOH) correct the pH of the brine for reinjection. Process water is also used for washing and providing water to the eluate stream. The produced eluate is then fed to a downstream processing system that converts it to lithium products.

Water used in IX is sent to a water recovery system. Water consumption is minimized through efficient process design, and most

[redacted]

Exhibit A1.2-3. *Lilac's fully integrated lithium production flowsheet.*

of the process water is [redacted] Any water that is too high in salt content to be reused can be returned to the brine-containing aquifer, resulting in a net-zero water balance. Only a small amount of fresh water needs to be obtained to drive the process. This careful water management constitutes a significant improvement over evaporation ponds, which remove water from the environment into the atmosphere through evaporation. Such careful management of water is especially important in the desert and water-lean environment where the four projects contemplated in this FOA are located. Furthermore, it is aligned with DOE's goals of increasing the supply of battery-critical materials while doing so in a manner that minimizes the impact on the environment.

The brine from which Li is extracted is depleted in lithium where Li^+ cations have been replaced by Na^+. This depleted brine can therefore be reinjected into the aquifer from which it was originally extracted, thereby maintaining the water balance in the salt flat.

The eluate from the Lilac IX, a purified lithium stream, is processed into battery-grade lithium products—namely lithium carbonate (Li_2CO_3) or lithium hydroxide (LiOH). The processing of this eluate is summarized in *Exhibit A1.2-3*. It is:

- [redacted]
- [redacted]

The resulting lithium products are washed, dewater, dried, and packaging for sale.

The downstream processing of the Lilac process, comprising treatment of the eluate for final production of lithium carbonate or lithium hydroxide, consists of well-established processing technologies that are conventionally used for lithium production or water treatment. Therefore, the technical risk in producing lithium products from the Lilac product eluate is minimal. Lilac has engaged with a variety of partners with extensive expertise in these technologies, as detailed in Teaming.

[redacted] s part of the collaboration with FFRDCs funded by this FOA Lilac, the Argonne Lab and the National Renewable Energy Lab will explore further integration of renewable energy resources into its lithium production

projects and downstream supply chain. The objective will be the further minimization of possible environmental impact associated with lithium extraction.

Relevance to the Goals and Objectives of the FOA. Our efforts under this FOA will substantially accelerate the deployment of Lilac's technology for lithium production in the United States, and demonstrate Lilac's ability to manufacture the IX beads required to extract lithium using Lilac's IX technology. In addition, the piloting and demonstration lithium extraction plants contemplated will:

- Demonstrate the scale-up of Lilac's technology to the commercially-relevant equipment scale
- Demonstrate economical production of lithium from domestic lithium resources that cannot be economically exploited with existing technologies
- Support the establishment of a domestic supply chain associated with lithium production by engaging with local partners and performing life-cycle and technoeconomic analysis together with FFRDC partners contemplated in this FOA.

The result is an acceleration in the time-to-market of domestic lithium production, and the unlocking of domestic lithium resources that are not available with other existing technologies.

The expected outcomes of our project include:

- For IX bead manufacturing:
  - Construction and commissioning of [redacted]
  - Design, construction, and commissioning of [redacted]
  - Validate viability of scaled-up reactors, vessels and reagent recycling streams
  - Expansion of [redacted]
  - Qualification of the scaled-up IX bead manufacturing process to ensure same level of Li uptake capacity and durability as beads produced in the Oakland pilot production line.
  - Cumulative production of [redacted]
  - Demonstration of full commercial-scale IX bead production by Q4 2024 to build investor and lithium resource partner confidence in developing commercially-relevant domestic lithium extraction projects.
- For Lithium extraction at U.S. sites
  - Two field pilot plants in Nevada Project 1 and Utah Project 2 sites. These will assess and demonstrate the economic viability of extracting lithium from two previously unexplored lithium resources; this will enable a decision on whether commercial lithium production from these sites is possible. Expected completion of piloting is September of 2024.
  - Two demonstration plants in Nevada Project 2 and Utah Project 1 sites, with TRL 8 capabilities as an objective. [redacted] These plants will be operational by July 2025, and will continue delivering lithium to the domestic market while being scaled-up to a full commercial facility.
  - Results (including environmental impact analysis) will be used to then refine the plant and equipment design to construct two larger facilities capable of supporting commercial operations of 20,000–50,000 TPA_{LCE} at two or more of the sites evaluated in this project.
  - Acceleration of Lilac's commercial production of lithium in the United States by at least two years.
- Production of Li with a OPEX < 6,000 USD per tonne of lithium carbonate

Lilac will use technical results and collaborate with FFRDCs to conduct rigorous life-cycle and technoeconomic analysis of Li production using Lilac's technology. This will demonstrate the economic and environmental improvement of Lilac's technology over existing or proposed technologies for Li production (see

A1.2.3 for details on these), and identify areas of further optimization to support the domestic battery supply chain.

A1.2.2—Feasibility

Technical feasibility based on prior R&D. Lilac has demonstrated extraction of lithium from over 60 different brine resources from four different continents, uniformly producing high-purity lithium eluate streams. Lilac has demonstrated scale-up (by a factor of 10,000x) of its technology from laboratory-scale to pilot-scale, based on brine-processing capacity. Throughout testing, Lilac has partnered with external engineering companies (mainly Hatch Engineering) to assess the economic viability of lithium production using Lilac's process, obtaining favorable economic analyses that shows its approach is less expensive than most commercial lithium producers.

Lilac has devoted significant R&D and engineering design efforts to developing its lithium extraction technology. The formulation and manufacturing of the IX-beads has been optimized over the six years of the company's existence, and their performance for ion-exchange has been thoroughly tested to validate their highly stable performances with excellent lithium recoveries and purities. The substantial knowledge/experience and R&D results accumulated through this work uniquely positions Lilac to continue low-risk scale-up and advancement of Lilac's lithium extraction technology.

To test the performance of its IX process, Lilac loads IX beads into lithium extraction modules. Lilac has designed, fabricated, and commissioned the IX modules shown in *Exhibit A1.2-4* for continuous processing of brine into lithium eluate. [redacted]

Technical Feasibility: Lithium extraction performance in Laboratory-scale testing. The performance of Lilac's IX beads has been extensively demonstrated across different

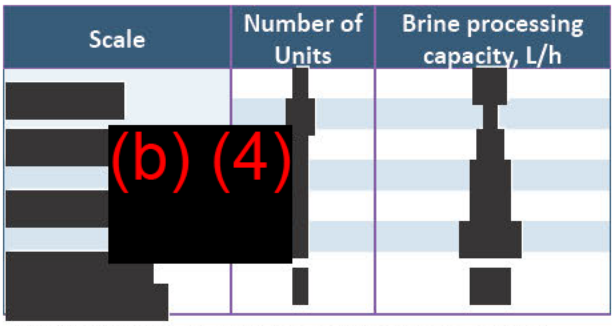

Exhibit A1.2-4. *Lithium Extraction Testing*

brines and differing operational scales, as shown in *Exhibit A1.2-2*. This exhibit shows the concentration profile of the eluate product produced by Lilac's IX technology from different brines studied during Phase 1 Engineering studies, together with associated lithium recoveries, impurity rejections, and product purities. Studies with brine processed at 1 litter/hr correspond to laboratory-scale studies.

Brines in *Exhibit A1.2-2* originate from a wide variety of source types, including salar brines, geothermal brines, industrial effluents, and lithium-ion battery recycled leachate. [redacted] and include a wide range of cation contaminants including high amounts of Mg and Ca – divalent cations that are challenging to separate from Li with existing technologies. Despite this wide range in compositions, the lithium eluate produced from all these brines is uniformly high purity (> 90%), and represents a recovery of > 90% Lithium in the brine. This high recovery is achieved while rejecting the vast majority of impurities. For the particular case of the salar (salt-flat) brine example in *Exhibit A1.2-2*, this rejection of impurities is > 98 %, reaching up to 99.98 % for Na. [redacted] While no brine samples have been directly tested from the four lithium processing project sites contemplated in this FOA (because drilling to obtain this brine is ongoing), the uniform perfor-

mance of Lilac's technology across the wide variety of brine samples with similar characteristics to those expected in the four project sites indicate a strong feasibility of Lilac's technology for producing lithium at these sites.

Economical lithium extraction from brines with ion exchange requires that the ion-exchange beads, once loaded into an IX module, maintain performance over longs periods of time. This is because the cost of IX beads directly impacts the cost of lithium produced; therefore, the longer the same IX beads can be used for lithium production, the lower the operating cost. Lilac has devoted significant efforts to long-term testing of its IX beads by performing hundreds of cycles of IX (loading lithium from a brine followed by releasing lithium using acid to produce an eluate) with the same IX beads. Individual long-term testing studies have comprised over [redacted]

Exhibit A1.2-5 shows results from these long-term cycling experiments. The results at the left demonstrate that Lilac's IX beads [redacted] (b) (4) Results at the right demonstrate a [redacted] (b) (4) [redacted] This is consistent with the robust performance of Lilac's IX across varying brine composition discussed based on results in *Exhibit A1.2-2*.

Taken together, the results demonstrate the feasibility of Lilac's IX technology for producing a pure lithium from a variety of brine resources.

Technical Feasibility: Lithium Extraction Scale-up to a Field Pilot. The scalability of Lilac's IX technology represents the second-key technical stage-gate for the commercialization of Lilac's technology. Lilac has designed, fabricated, and operated five pilot-scale modules, two in relevant field operations – meaning continuous operation at the location where brine is being sourced. At the field pilot scale, Lilac has completed a successful [redacted]

(b) (4) [redacted]

Results in *Exhibit A1.2-2* (Industrial effluent brine) correspond to performance of one of the field Pilot-scale IX modules, and exhibit performance that is consistent with bench scale results. This demonstrates that the performance of Lilac's IX technology scales uniformly to pilot scale, establishing a successful de-risking in the second technical stage-gate to technology commercialization (*Exhibit A1.1-2*). Two additional pilot-plants are contemplated to be supported by this FOA. Based on the [redacted] demonstrated in *Exhibit A1.2-2*, Lilac anticipates linear scale-up to the demonstration-scale modules that will be supported by this FOA.

Lilac has provided multiple lithium eluate samples to third-party labs for conversion to lithium carbonate and lithium hydroxide, and each of these samples were successfully converted to battery-grade products with purities as high as 99.97%. Specifically, Hazen Research, Inc has demonstrated the production of battery-grade lithium carbonate from Lilac's lithium eluate, indicating that the eluate produced by Lilac is of sufficient purity and does not impurities of concern for production of battery-grade lithium product. Hatch Engineering, one of the world's top mining engineering firms and the foremost such firm in the lithium sector, has reviewed Lilac's test work and lithium eluate streams. Lilac believes, based on this Hatch review, the streams are highly amenable to refinement into battery-grade lithium chemicals.

Technical Feasibility: Proposed Scale-up to demonstration scale. A key objective of this FOA is the demonstration of Lilac's novel lithium extraction technology at commercial-relevant production scales. Lilac's IX Bead Manufacturing Division has operated [redacted] (b) (4) [redacted] The process development work completed with this production line has facilitated the completion of conceptual design of the [redacted]. All major process equipment has been procured for this scale. Factory assurance testing has been performed with several pieces of equipment, with one major piece of bead formation equipment tested with actual in-process materials and achieved the expected materials processing characteristics and yield. Lilac is on schedule to complete bid review and sign an agreement with a major US-based EPCM firm in July 2022 to begin detailed design of the [redacted] line for installation and commissioning in the Fernley, NV facility. The same EPCM firm will validate conceptual design and complete detailed design and construction for the [redacted] scale-up and second expansion to the final [redacted] scale.

Lilac has designed a commercial-scale lithium extraction module, which corresponds to the size of the module that will be delivered to the [redacted]$_{LCE}$ demonstration plants. This commercial-scale module will be deployed at two sites in the United States, which will be supported by this FOA. After successful deployment of these demonstration-modules, multiple demonstration-modules will be deployed in parallel to reach the commercial-scale production of 20,000– 50,000 TPA$_{LCE}$ in each facility. This modular approach—where a single module is first demonstrated and then multiplied to result in a commercial production plant, instead of building a single larger commercial module—substantially de-risks the scale-up to commercial production.

Economic feasibility. Lilac commercial deployment strategy combines extensive laboratory and pilot-scale test work with rigorous engineering studies to develop a complete chemical process for producing lithium carbonate or lithium hydroxide. Lilac performs its own engineering work for IX-bead manufacturing and IX modules, and works with external engineering companies to develop entire lithium production projects from brine to lithium product.

Lilac has worked with Hatch Engineering to complete two FEL-1 (preliminary economic assessment) and FEL-2 pre-feasibility studies (PFS), one for the Kachi project in Argentina, and a second for a major brine resource in the United States; four other PFS studies are ongoing. PFS rely on extensive lab-scale test work as well as field piloting. The Lilac-Hatch team is currently performing an FEL-3 (definitive feasibility) study for producing Lithium in the Kachi salar in Argentina. These studies are intended to provide highly accurate projections of costs of producing lithium, demonstrating the feasibility of Lilac's lithium production technology based on experimental evidence of Lilac's process performance.

Exhibit A1.2-6 summarizes the scale, capital cost, and operating cost associated with two completed DFS studies, one in Argentina and another in the United States. These costs are an estimate of the capital expenditure (CapEx) needed for a commercial-scale lithium production plant that uses Lilac's direct extraction technology and are based on engineering estimates that incorporate the performance of Lilac's IX technology for the brines considered in each study. OpEx calculations were performed using lithium IX performance and bead durability data collected from experiments using real brine samples, as well as a detailed bead production cost estimate based on commercial-scale materials and process flow sheets. [redacted] (b) (4) [redacted] which is lower than most lithium projects currently in operation (Benchmark Mineral Intelligence, 2022). This cost estimate, based on rigorous engineering estimates validated by third parties, demonstrates the robust economic feasibility for commercialization of lithium production with Lilac's technology.

Based on the robust technical demonstration of performance and scale-up of Lilac's IX technology, combined with repeated validations of process economics by third parties, Lilac is in a strong position to advance in the technical stage-gates that will lead to commercialization of its technology. Design and test-work continues to validate engineering design for demonstration-scale lithium production, which will be deployed and supported by this FOA.

Brine Resource Feasibility. Lithium production from natural brine resources necessitates that extractable quantities of lithium be demonstrated in the four brine resources where lithium extraction with the Lilac technology will be performed as part of this FOA. This assessment requires a thorough understanding of the geology of the lithium deposit, development of a wellfield to extract brine and reinjected lithium-depleted brine, estimation and validation of resource size, and definition of a resource exploitation plan. While no funding from this FOA will be directly allocated to these efforts, these studies are essential to the ultimate feasibility of lithium production and the FOA results. Lilac is well equipped to tackle this study, and currently has a team of five technical personnel, led by Chief Development Officer Tom Wilson, with extensive experience in resource assessment and development. This expertise ensures that resource assessment and development will not constitute a bottleneck to the success of this FOA and lithium production with Lilac's IX technology.

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

*Exhibit A1.2-6. Summary of key economic performance indicators. *ton_{LCE} = tonne of lithium carbonate equivalent*

Environmental Feasibility. Engineering analyses within these studies demonstrate the net-zero water usage of Lilac's technology, which is a key technical improvement over existing technologies as depicted in *Exhibit A1.2-5*. This demonstrates the feasibility of Lilac's technology for reducing the environmental impact of Lithium production. Lilac has formed key partnerships with FFRDCs to perform detailed life cycle and technoeconomic analyses. These analyses will rigorously validate the feasibility of Lilac's technology for reducing the environmental impact of lithium extraction, and identify approaches to further reduce this impact while maximizing positive impact on the economy of local communities.

Socioeconomic Feasibility. Key to the feasibility and success of this project is the training and development of a workforce that is able to operate Lilac's ion exchange technology, and is generally ready to support the domestic production of lithium. Domestically this workforce is currently limited to one small lithium extraction operation in Nevada. Lilac is rapidly building out a technical team capable of supporting the vastly expanded lithium operations that will result from progress in the four projects contemplated in this FOA. This includes early recruitment of Key Personnel that have extensive experience in materials development, process development, project deployment, and lithium production. Our key leadership personnel will be actively involved in the training of junior engineers, managers, and operators required to expand the qualified workforce.

In addition, our FFRDC partnerships will train personnel (who will perform life-cycle analysis) to further understand the market for critical battery materials, and to become leaders in the market development. Further, the partnership with University of Nevada at Reno will target research into the socioeconomic impacts and opportunities that will be afforded by the projects supported by this FOA. This includes the target demographics whose livelihoods can be enhanced by these projects, as well as the training they need to support battery materials production. By engaging in these studies and identifying community needs early, Lilac anticipates that this FOA will accelerate the training of the workforce that will be employed in lithium production at these sites, leading to a more rapid ramp-up of lithium production.

A1.2.3—Innovation and Impacts

State of Domestic Lithium Supply. The United States currently imports the majority of lithium required for its domestic lithium-ion battery manufacturing. The lithium comes mostly from Australia and South America, and the latter includes an increasing number of resources that are being acquired by Chinese suppliers. These regions possess abundant lithium resources where lithium can be extracted economically. In the case of Australia, spodumene ore (also known as hard rock resources) is exploited to produce lithium. By contrast, most of the world's lithium reserves are found in brine resources in South America, and all lithium production from brine resources today relies on evaporation ponds.

Only one domestic project is currently producing lithium in the United States, Albemarle's Silver Peak mine, but its production capacity of < 5,000 TPA_{LCE} is inadequate to supply domestic demand, which is already an order of magnitude higher than current domestic lithium supply and will grow by a factor of 6 over the next 10 years (*Boston Consulting Group, 2022*). Numerous projects are advancing, but they all face significant technical and economic challenges.

Domestic resources tend to contain lithium concentrations that are much lower than those found in hard-rock deposits in Australia or high-grade South American brine resources, making lithium extraction uneconomical using existing lithium extraction methods. Numerous

Characteristic	Lilac Solutions	Evaporation Ponds	Solid Mineral Deposits	Geothermal Resources
Li Resource	Any liquid stream (e.g. brine)	Brine	Rock/mineral	Geothermal brine
Li extraction method	Li-selective ion-exchange	Evaporative concentration; impurity precipitation	Ore open-pit mining, crushing, and Li leaching	Undemonstrated direct-extraction technology
Li Extraction Time	Hours	Years	Days	Hours
Lithium Recovery (full flowsheet)	70 - 95%	30-50%	High	High (claimed, not publicly demonstrated as economically viable)
Lithium Grade Flexibility	> 50 mg/L of Li in brine	> 500 mg/L of Li in brine	> 1,500 mg/kg of Li in rock	> 50 mg/L of Li in brine (claimed, not publicly demonstrated as economically viable)
TRL	7 Successful field-pilot	Mature technology	Mature technology	< 4 Never publicly demonstrated beyond lab
Open Pit?	No	Yes	No	No
Solid Waste	Minimal	Yes. Precipitated impurities	Ore tailings	Yes. Precipitated impurities, radioactive waste, lead, arsenic
Footprint	10's acres	10,000's of acres	1,000's of acres	10's acres
ESG Risk	Low; net zero water balance, brine chemistry intact	High water loss through evaporation; permanent changes to environment.	High water use for leaching; open pits cause permanent changes to environment.	High. Hazardous brine compositions; solid waste; groundwater contamination.

Exhibit A1.2-7. *Lilac Technology vs. Other Domestic Lithium Sources and Extraction Methods*

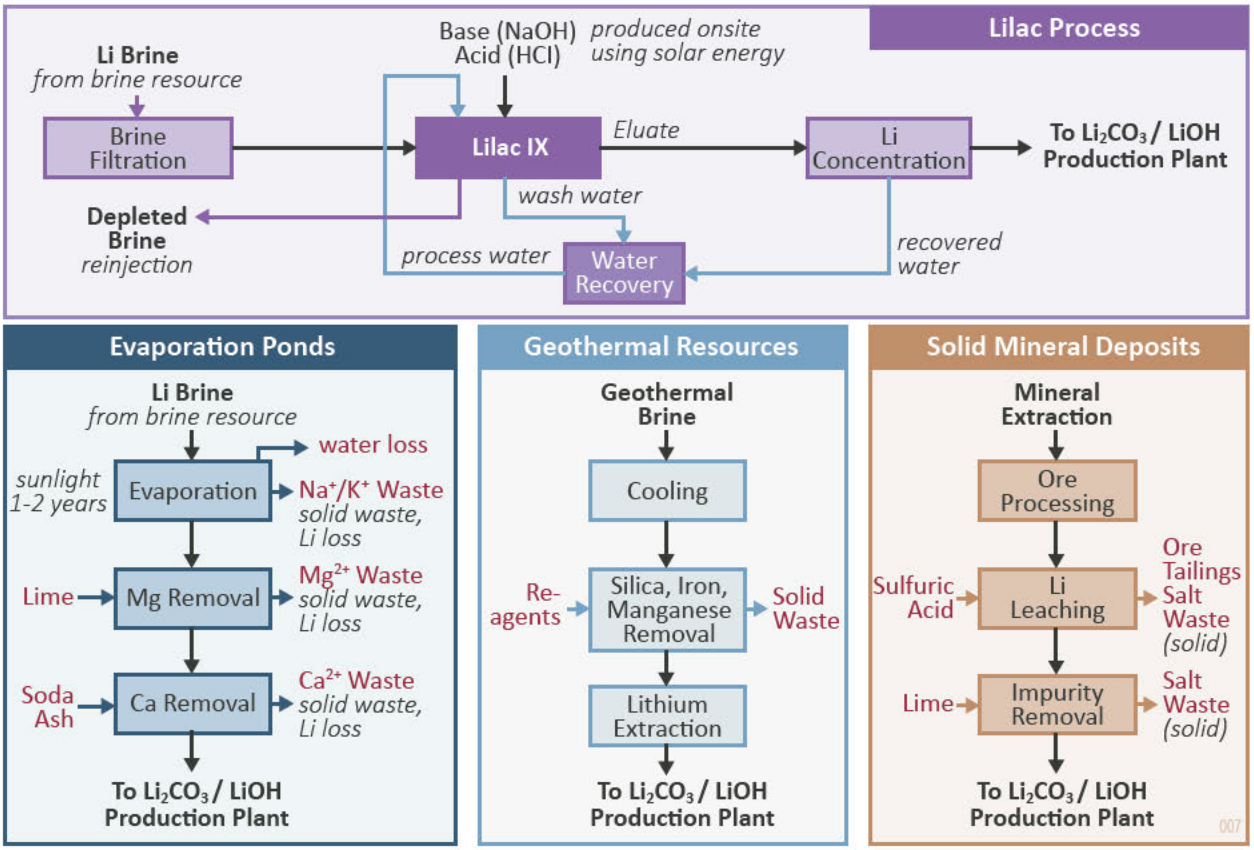

Exhibit A1.2-8 L007. *Comparison of Lilac's Technology to Common Technologies.*

resource and technology companies have attempted to develop novel or improved methods to produce lithium from these resources. However, none have been successful. A technology capable of expanding the domestic lithium supply chain economically, quickly and with a low environmental impact approach, is therefore essential to securing the United States energy transition goals. Lilac's technology meets these criteria.

Current Domestic Projects and Technologies in Development. *Exhibit A1.2-7* summarizes the major technologies and lithium resources that are being proposed to develop domestic lithium production. This exhibit compares Lilac's technology and three other approaches to lithium extraction from different lithium resources. *Exhibit A1.2-8* provides an overview of different lithium-extraction flowsheets, from the extracted lithium-resource to the production of a crude lithium stream. This crude stream can be fed into a downstream lithium carbonate or lithium hydroxide production plant (for all flowsheets) and consists of well-established processing technologies that are conventionally used in lithium production.

The three major technologies, and Lilac's innovations, are discussed in the following paragraphs.

Evaporation Ponds—Brine. Most of the world's lithium reserves are found in brine resources, and all lithium production from brine resources today relies on evaporation ponds. The traditional evaporation pond process for lithium extraction is summarized in *Exhibit A1.2-8*. The brine resource is extracted from the aquifer and deposited in massive evaporating ponds, where sun radiation causes evaporation of water. This results in precipitation of Na and K impurities as solid salt (disposed as solid waste), while increasing the concentration of lithium in the liquid. This is followed by subsequent treatments to precipitate Mg, Ca (disposed as waste), remove B (disposed as liquid waste) and finally obtain crude lithium chloride. This process requires very large footprints for evaporation ponds, long residence times in evaporation ponds (in the order of years, and subject to inclement weather), and suffers from low lithium recoveries because lithium is entrained in the waste solids.

From the environmental point of view, it depletes the water balance from the aquifer (through evaporation), leading to permanent alterations to the environmental water balance. It also results in large amounts of solid waste from precipitation of the impurities. Finally, the initial grade (concentration) of lithium in the brine must be sufficient to offset the cost of impurity removal and evaporation; [redacted] For the above economic and environmental reasons, combined with the low grade of existing domestic lithium brine resources, no evaporation ponds have been suggested for the >30 new lithium brine projects proposed in Nevada, further highlighting the need for direct lithium extraction technologies (*Nevada Division of Minerals Commission of Mineral Resources. Lithium Exploration and Mining in Nevada. State Land Use Planning Advisory Council. June 3 2022 (Mike Visher))*.

Solid Mineral Deposits. In this process, lithium is extracted from a lithium-bearing rock or mineral. Ore is extracted from open pit mines and processed (which can include crushing, concentration with surfactants, and roasting). The lithium is extracted from the processed ore by leaching with sulfuric acid; this results in a liquid stream containing lithium, but also requires large amounts of acid and water. The leachate is purified with large quantities of lime to produce a crude lithium concentrate, which can be refined into lithium chemicals.

This process is simple and reliable; however, it is also very expensive because of the need to support an open-pit mining operation and leach the lithium into solution (as opposed to

having it in solution in the first place, as is the case for brine). Additionally, it suffers from significant environmental risks that include the need to permit an open-pit mind and the handling of large ore tailings and solid waste.

Lithium Americas' Thacker Pass project in Nevada is a prime example of a project currently in the early stages of study and development; however, significant hurdles and environmental concerns exist and are a risk to moving this forward *(Ref: Ivan Penn, Eric Lipton. New York Times. The Lithium Gold Rush: Inside the Race to Power Electric Vehicles. 5/6/2021).*

Geothermal Resources. Geothermal resources have attracted considerable attention because of the potentially vast size of the resource, and the fact that they are found domestically. The prime example of potential projects is in Imperial County, CA, near the Salton Sea *(William T. Stringfellow and Patrick F. Dobson. Technology for the Recovery of Lithium from Geothermal Brines. Energies 2021, 14, p. 6805)*. Lithium extraction from such resources faces significant technical challenges. Firstly, the chemistry of the brine is complex: it is hot, and it contains vast amounts of calcium (which causes challenges with existing/non-Lilac Li absorbents), radioactive species, toxic substances including lead and arsenic, and scaling impurities—which include iron, silica, manganese. These latter must be removed by pH treatment and cooling, resulting in precipitation of these impurities as large amounts of solid waste. Secondly, the lithium concentrations found in geothermal brines is low. This makes the volumes of brines that are processed very large, impacting process economics. The low concentration also requires that a direct-extraction technology be used to absorb the lithium and separate it from other impurities. Direct lithium extraction technologies that have been tested so far for extraction of lithium from geothermal brines use alumina sorbents, which have never been demonstrated at scale for economic extraction of lithium from these high impurity and low lithium-grade geothermal brines.

For these reasons, and despite significant attention, there have been no successful demonstrations of lithium production from geothermal sources. As example, Simbol Materials reportedly spent in excess of $100M on a pilot project in Southern California that failed due to rapid degradation of Simbol's direct-extraction Li absorbent.

Other Direct Lithium Extraction Companies. Direct lithium extraction (DLE) technologies such as Lilac's directly extract lithium from a liquid resource while discarding the impurity-containing liquid. This is in contrast to evaporation ponds, where the liquid resource is treated to remove all impurities and refine the lithium. Other direct extraction technology companies exist and are working to commercialize technologies to selectively separate lithium from other impurities in a liquid resource. None of these technologies have successfully scaled-up and reached Lilac's TRL level. An overview of these is incorporated in the market transformation plan (section A1.3.10).

Innovations offered by Lilac's IX Technology, and Advantages Offered. Lilac's technology comprises a fully-contained lithium extraction operation which maximizes economic lithium extraction while minimizing environmental impact. Details of the basic lithium production strategy using Lilac's ion-exchange technology is described in Section A1.2, including the chemistry governing the ion-exchange process. The technological and economic innovations, and the advantages conferred by Lilac's technology portrayed in *Exhibit A1.2-7* are discussed below.

Li Resource. Lilac's IX technology extracts lithium from any liquid resource containing lithium. Lilac focusses this FOA work on lithium extraction from salt-flat and surface-lake brine resources, because these have the great-

est potential for economic lithium extraction. Brines contain lithium in liquid form that requires only minor pretreatment before extraction, as compared to (a) rock/mineral resources that require expensive open-pit mining, ore processing and lithium leaching to produce a liquid lithium stream, (b) geothermal brines that require significant processing to remove impurities, and (c) evaporation pond technologies that are limited to high-grade brines.

Notably, Lilac's technology is flexible and can extract lithium from brines with low lithium concentration (as well as those with higher concentration); this flexibility allows Lilac to propose lithium extraction from the four different projects in this FOA, despite the different chemistry and lithium grade in each. In fact, Lilac has successfully demonstrated extraction of lithium from mineral/ore leachate and from geothermal brine resources at the bench-scale; thus, its technology can be adapted to these types of resources in the future (but is not part of this FOA).

Process Performance. Lilac's IX technology exhibits consistently high recoveries (70–95%) and product purities while reducing processing time for the brine (on the order of hours). In contrast, evaporation ponds (currently the only technology in operation) require processing times on the order of years and suffers from lithium losses in entrained brine, leading to poor overall lithium recoveries of only 30–50%. Using Lilac technology in the current projects that use evaporation ponds (the only ones in domestic production) could double domestic lithium production and accelerate expansion of brine projects.

Technology Readiness Level. Lilac has successfully demonstrated scaled-up economical lithium extraction at a field pilot in the United States, putting its technology readiness level at 7. To Lilac's knowledge, no other direct extraction companies have demonstrated lithium extraction at this scale without the use of evaporation ponds. A core objective of this FOA is scale-up of Lithium extraction to a demonstration-scale level, leading to a TRL of 8–9. This increase in TRL, spanning Lilac's IX Bead Manufacturing and Lithium Production Technology division, constitutes a major improvement over the current product. Achieving this target will ready Lilac's for deployment of commercial lithium production plants

Environmental Impact and ESG Risk. Lilac's technology is superior to existing and proposed lithium extraction process as it: (a) does not require the large land alterations associated with open-pits and tailing ponds required for lithium extraction from mineral sources, vast evaporation ponds for existing brine production, and disposal of solid waste for geothermal projects; and (b) has a net water-balance of zero, because no water is removed through evaporation or required for leaching lithium from rocks (all brine used is reinjected and process water is recovered using a water recovery cycle). This minimizes the ESG and permitting risk for our lithium extraction operations.

Process Economics. The modular nature of Lilac's technology, together with the high achievable recoveries results in low lithium production cost (see section A1.2.2). In addition, Lilac's reagent consumption is minimal while evaporation ponds require vast quantities of lime and soda ash for removal of calcium and magnesium impurities. In addition, Lilac's reagent consumption is minimal. As a comparison, the mineral extraction Thacker Pass project, currently under study by Lithium Americas in NV, contemplates a 23.8 tons of H_2SO_4 (100%) per ton of Li_2CO_3; Lilac's process would use < 2 tons of H_2SO_4 (100%) per ton of Li_2CO_3 if elution was performed with sulfuric acid (*Lithium Americas, Technical Report on the Pre-Feasibility Study for the Thacker Pass Project, Humboldt County, Nevada, USA Aug 1st 2018*). Similarly, evaporation ponds require vast quantities of lime and soda ash for removal of calcium and magnesium impurities.

Overall Impacts of Successful Results. Taken together, Lilac's technology represents a major leap forward in the technical feasibility of direct lithium extraction and can unlock lithium production from a range of domestic lithium resources. The overall impact on the United States domestic supply chain of battery material is substantial. Our project combining bead technology and its production coupled with successful demonstrations of its application to US-based brine sources can expand domestic lithium supply by millions of tonnes lithium carbonate equivalents and accelerate the speed at which this lithium is delivered to the domestic market (based on geological survey and 6 months of domestic Lithium resource analysis by Lilac's resource development team). In addition, the accelerated hiring of personnel across the six geographic locations contemplated in this project will increase the readiness and training of the domestic workforce for supporting this energy transition.

A1.3—Workplan and Market Transformation Plan

A1.3.1—Project Objectives

The goal of this project is the acceleration and commercialization of Lilac's unique technology for extracting battery-grade lithium compounds from natural brine resources in the western United States. Project funding will be used to facilitate procurement and construction of two complementary and parallel activities critical to supporting DOE's objectives:

- Procurement, construction, and commissioning of a demonstration-scale production line for Lilac's ion-exchange beads. Design of this production line is complete, and an industrial facility in Fernley, NV has been secured by Lilac to establish this capability.
- Deployment and operation of two field pilots and two larger-scale demonstration plants for production of Lithium compounds. Design of the lithium extraction modules using our IX beads is complete, and we have secured land-use rights for deployment of lithium-extraction plants at these locations.

Proposed Improvements. The baseline technology for this project is described in Section A1.1.1 above. The goals and impact on the commercialization of Lilac's lithium production technologies are summarized in *Exhibit A1.1-2*. Our IX Bead Manufacturing Division will produce IX beads necessary for lithium production. and ship these to the Lithium Production EPCM sites. The IX modules will be supplied with the beads to produce lithium compounds at our selected field locations.

A1.3.2—Technical Scope Summary

To accomplish our project goals, we plan to achieve the following improvements to our existing technologies and processes.

Utilizing our lab-scale and pilot-scale R&D efforts as a baseline, we will extend the manufacturing process for the IX beads to a multi-line production. This will require the establishment of production capabilities at our Fernley NV facility and be accomplished in three stages: initial production volume [redacted] (b) (4) [redacted]

The second major goal of our project will utilize the lab-scale and initial field pilot demonstrations already accomplished to establish Lithium extraction plants at 4 locations within the western United States. This will demonstrate the feasibility and adaptability of the bead technology at sites with unique brine characteristics. It will start with the construction and operation of two pilot extraction plants (with TRL 8 capabilities as an objective). Results (including environmental impact analysis) will be used to then refine the plant and equipment design to construct two larger facilities capable of supporting commercial operations of 20,000–50,000 TPA_{LCE}.

Planned Achievements by Performance Periods. Performance periods for the project are defined in the Statement of Project Objectives (SOPO, Section A4) task descriptions, the WBS in the Section A1.3.3, and the milestone summary in Section A1.3.4.

Budget Period 1 (BP1) Summary Work Scope and Approach. All project management tasks will be initiated and continued through all performance periods. [redacted] (b) (4) [redacted]

(b) (4)

[redacted]

Expected End Result and Decision Points.

[redacted]

Equity Plan Milestone. Planning and activities to perform community assessment, develop information materials, community information briefings, working with labor unions and engaging local businesses, and negotiating a CBA will be completed in BP1. Specific dates will be established during negotiation and specified after award.

Budget Period 2 Summary Work Scope and

(b) (4)

[redacted]

(b) (4)

[redacted]

Equity Plan Milestone. Specific activities, including those initiated during the previous BP will be specified after award.

(b) (4)

[redacted]

Equity Plan Milestone. Specific activities, including those initiated during the previous BP will be specified after award.

[redacted]

Equity Plan milestone. Specific activities, including those initiated during the previous BP will be specified after award.

Budget Period 5 Work Scope and Approach.

[redacted]

(b) (4)

[redacted] (b) (4)

Expected End Result and Decision Points.

[redacted] (b) (4)

Equity Plan Milestone. Specific activities, including those initiated during the previous BP will be specified after award.

A1.3.3—WBS and Task Description Summary

The Lilac initial WBS is presented in *Exhibit A1.3-2*. The WBS identifies a unique WBS number for the major tasks within the project, a task title or name, and a description of each task. Activities are grouped first by budget period, then by location, then by related activities.

WBS No.		Activity	Description
00		[redacted]	[redacted]
[redacted] (b) (4)		[redacted]	[redacted]
[redacted]		[redacted]	[redacted] (b) (4)
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]		[redacted]	[redacted]
[redacted]		[redacted]	[redacted]

Exhibit A1.3-2. WBS Task Descriptions. *Lilac's WBS identifies discrete tasks and task groups in a visible framework for activities and milestones.*

WBS No.		Activity	Description
[redacted]		[redacted]	[redacted]
[redacted]		[redacted]	[redacted]
[redacted]		[redacted]	[redacted]

WBS No.		Activity	Description
Budget Period 2			
[redacted]		[redacted] (b) (4)	[redacted]
[redacted]		[redacted]	[redacted]
[redacted]		[redacted]	[redacted] (b) (4)
[redacted]		[redacted]	[redacted]

Exhibit A1.3-2. WBS Task Descriptions. *Lilac's WBS identifies discrete tasks and task groups in a visible framework for activities and milestones.*

WBS No.		Activity	Description
[redacted]		[redacted] (b) (4)	[redacted] (b) (4)
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Exhibit A1.3-2. WBS Task Descriptions. *Lilac's WBS identifies discrete tasks and task groups in a visible framework for activities and milestones.*

WBS No.	Activity	Description
[redacted]	[redacted] (b) (4)	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted] (b) (4)

Exhibit A1.3-2. WBS Task Descriptions. *Lilac's WBS identifies discrete tasks and task groups in a visible framework for activities and milestones.*

A1.3.4—Milestone Summary

Exhibit A1.3-3 lists the milestone summary.

Milestone	Period	Type	Completion Criteria
[redacted]	[redacted]	[redacted]	[redacted]

(b) (4)

(b) (4)

Exhibit A1.3-3. Milestone Summary. *Lilac identified both progress milestones and SMART milestones to track project progress and the criteria to determine the milestone completion.*

Milestone	Period	Type	Completion Criteria
[redacted] (b) (4)	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted] (b) (4)
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]

A1.3.5—Go/No-Go Decision Points

Exhibit A1.3-4 lists the Go/No-Go Decision Points associated with the project activities. These critical decisions are points where Lilac demonstrates to DOE that the project is ready to proceed to the next phase, and DOE decides to authorize further work.

A1.3.6—End-of-Project Goal

The goal of this project is the acceleration and commercialization of Lilac's unique technology for extracting battery-grade lithium compounds from natural brine resources in the western United States. This will be demonstrated by the construction and operation of two large facilities (NV2 and UT1) capable of supporting commercial operations of 20,000 to 50,000 TPA with targeted performance metrics [redacted] (b) (4) [redacted]

A1.3.7—Project Schedule

Exhibit A1.3-5 Project Schedule is found on the following page.

A1.3.8—Buy American Statement

Section 1605 of the American Recovery and Reinvestment Act states, "*None of the funds appropriated or otherwise made available by this Act may be used for a project for the construction, alteration, maintenance, or repair of a public building or public work unless all of the iron, steel, and manufactured goods used in the project are produced in the United States.*"

Whereas this project does not include any public infrastructure, the requirements of the American Recovery Act do not apply, and no Buy American Waiver will be required.

A1.3.9—Project Management

A1.3.9.1—Overall Approach and Organization

Lilac Solutions will use best management practices found in the Project Management Institute's (PMI's) Project Management Body of Knowledge (PMBOK) and in DOE O 413.3B (Program and Project Management for the Acquisition of Capital Assets) as the framework for organizing and managing our "Unlocking U.S. Lithium Production" (ULP) project. Both identify universally accepted best practices for managing projects. Lilac Solutions understands that DOE O 413.3B specifically does not apply to grants, but we believe there is value in using the project management rigor and structure it provides. Project management best practices will be tailored to meet the specific needs of our project, but, at a minimum, project management activities will 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. The primary goal of using the PMBOK and DOE O 413.3B as a project management framework is to deliver the ULP project within the original performance baseline, cost, and schedule, while maintaining the project management rigor to be fully capable of meeting performance objectives and environmental, safety, and health requirements.

As the ULP project matures in planning, design, procurement, and construction evolutions, it will be organized into five budget periods where project activities will take place:

- Budget Period 1: Planning, Documentation, Process Design, Procurement, and Equipment Installation at Oakland, NV1, UT2, and Fernley Sites
- Budget Period 2: NV1 and UT2 Operations, NV2 and UT2 Preparation, and Fernley Procurement and Construction
- Budget Period 3: Construction at NV2 and UT1 and Operations at Fernley
- Budget Period 4: NV2, UT1, and Fernley Operations
- Budget Period 5: NV2, UT1 and Fernley Operations

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WBS	Activity	Sub-Activity	Sub-Subactivity	Duration (Days)
00	Project Mgmt.			1,300.00
01	BP1			270
01.01		Prjt Initiation		40
01.01.01			Mobilization	20
01.01.02			Project Meeting	0
01.01.03			PMP	40
01.02		BP1 NV1		270
01.03		BP1 UT2		180
01.04		BP1 NV2		50
01.05		BP1 Fernley		228
02	BP2			524
02.01		BP2 UT2		259
02.02		BP2 NV2		260
02.03		BP2 UT1		220
02.04		BP2 Fernley		245
02.05		BP2 NV1		100
03	BP3			262
03.01		BP3 NV2		260
03.02		BP3 UT1		262
03.03		BP3 Fernley		260
04	BP4			260
04.01		BP4 NV2		260
04.02		BP4 UT1		260
04.03		BP4 Fernley		260
05	BP5			260
05.01		BP5 NV2		260
05.02		BP5 UT1		260
05.03		BP5 Fernley		260

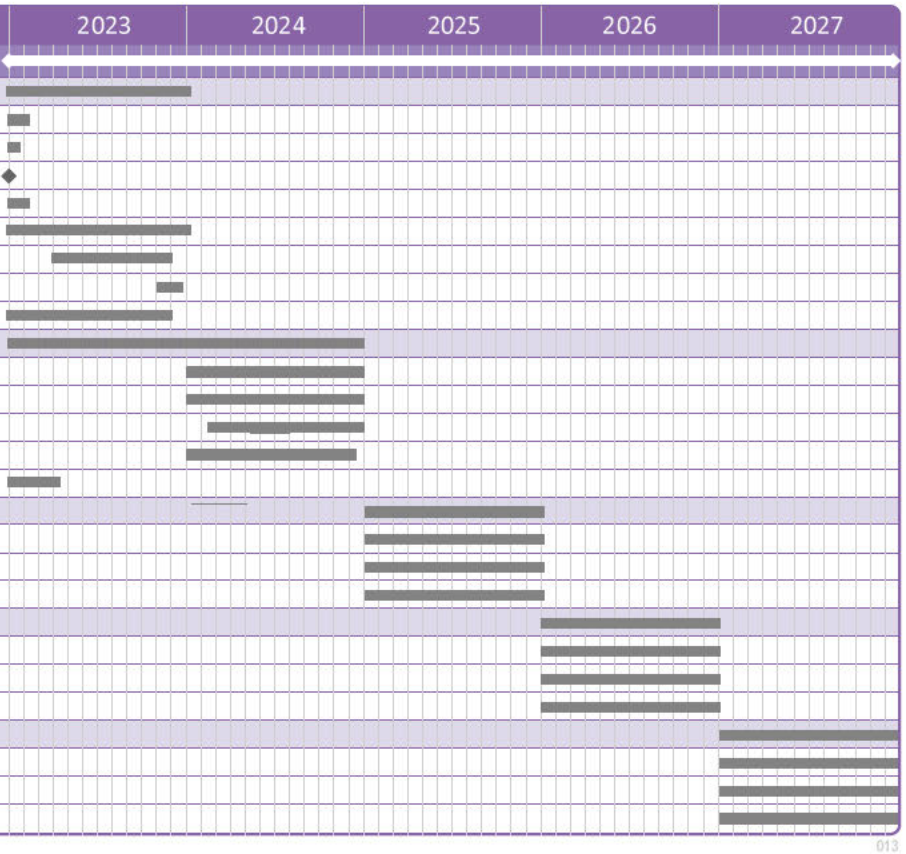

Exhibit A1.3-5. Project Schedule

This entire page contains trade secrets, confidential, proprietary, or privileged information exempt from public disclosure, and is subject to the restriction on the title page.

Milestone	Period	Completion Criteria
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

be used throughout all subsequent budget periods to track project performance.

Lilac Solutions has identified go/no-go decision points for the first four budget periods, which are listed in the SOPO and Integrated Master Schedule. After completion of each budget period go/no-go decision criteria, Lilac Solutions will obtain authorization from the DOE Contracting Officer prior to proceeding with any scope in the next budget period.

After completion of all scheduled activities identified for the five budget periods, Lilac Solutions will have achieved project completion criteria as defined in the PMP.

A1.3.9.2—Project Team Member Roles

Lilac Solutions' team member roles for our ULP project include David Snydacker, Ph.D., Chief Executive Officer; David Gelinas, Chief Financial Officer; William Timothy, Vice President of Manufacturing; Matthew McCall, Vice President of Operations; Jerry Sullivan, Vice President of Technology; Thomas Pecoraro, Principal Process Engineer; Nicolas Grosso Giordano, Ph.D., Process Engineer; and Garrett Lau, Ph.D., Process Engineer. Upon project initiation, additional team members will be added with expertise in safety, quality assurance, environmental compliance, and other specialties, as well as managers and supervisors who will manage day to day operations. All team member roles and responsibilities will be identified in the ULP Project Management Plan (PMP) which will be developed during the up-front planning.

A1.3.9.3—Critical Handoffs/Interdependencies

The life cycle analysis and technoeconomic analysis work conducted by ANL and NREL will require process data on materials balances, energy, and water usage for both the bead manufacturing process and the four lithium extraction projects. This handoff of data will be initiated at the beginning of the project and any updates to process data from Lilac will be conducted informally on a frequent basis and formally on a quarterly basis. The ANL and NREL teams will produce a final report by January 2028. The critical interdependency of this work is largely one-way, with ANL and NREL analysis requiring data and feedback from Lilac Solutions. While the results of the analysis will help improve and validate Lilac's low environmental impact and cost, it is not critical for Lilac to receive these results to continue its work on the bead manufacturing plant or the four proposed lithium processing sites.

A1.3.9.4—Management Plan Overview

One of the primary documents that Lilac Solutions will develop and use to manage the ULP project will be the Project Management Plan (PMP). The PMP will serve as the main communication vehicle to ensure that everyone is aware and knowledgeable of project objectives and how they will be accomplished. It will establish the policies and procedures to be followed to manage and control project planning, initiation, definition, execution, and transition to operations. It also uses the outcomes and outputs from all project planning processes and integrates them into a formally approved document. The PMP includes an accurate reflection of how the project will be completed, resource requirements, technical considerations, risk management, configuration management, how communications will be conducted (internal and external), Quality Assurance Program, and the Integrated Project Team roles and responsibilities. Lilac Solutions will describe in the PMP the financial processes for carrying out activities associated with funds management, accounting, work authorization, and performance reporting. It will also specifically describe how earned value management will be used for project performance reporting and how the WBS structure will be used to create control accounts to capture and report on cost accounting. The PMP is a living document and Lilac Solutions will develop a preliminary PMP early in project development and continue to refine it throughout the duration of the project.

A1.3.9.5—Risk Management

Lilac Solutions considers risk management an essential element of the ULP project and will use risk management processes that are analytical, forward looking, structured, and continuous throughout the project lifecycle. As a first step, a Risk Management Plan will be developed as part of the PMP that will describe the process for how Lilac Solutions will identify risks and opportunities (actions that will save time and money) and how risk mitigations and handling strategies will be identified. As a part of the Risk Management Plan, Lilac Solutions will create a risk breakdown structure to highlight the chain of authority, communication structure, and management framework for how risk management and the decision processes will occur. The risk breakdown structure also provides the means to map risks organizationally to determine where the greatest number of risks and the highest rated risks reside. Lilac Solutions will meet with subject matter experts to identify all known risks and opportunities as well as their respective mitigations and handling strategies. The risks that are identified will be captured in a risk register, which will also be used throughout the ULP project lifecycle to document their status.

Lilac Solution's plan for securing a qualified workforce will include a holding a job fair, extensive use of social media to attract candidates (e.g., LinkedIn and Facebook), and using mainstream digital recruitment companies like Monster.com and Indeed. A potential mitigation to prevent a labor dispute will be to meet with applicable labor unions and craft an agreement well in advance of project initiation. After all acceptable risks and their mitigations and handling strategies have been identified, the costs for executing the mitigations and handling strategies will be estimated and a Management Reserve (MR) budget will be developed. The MR budget will be a part of the total project cost for the ULP project. Note that in addition to the Risk Management Plan and Risk Register, the risk management process is also described in the PMP.

A1.3.9.6—Change Management

Lilac Solutions will use a rigorous integrated contract and project change control process to ensure that project baseline thresholds are not exceeded. A charter will be developed that identifies the baseline change control framework which includes applicable change management processes, threshold requirements, and the procedures to be followed. The process will identify when a change is required, ensure that the change is agreed upon, manage the actual change when it occurs, and ensure that the contract aligns with the project. The charter will also identify the change control board members and their roles and responsibilities including the approval authority for scope, schedule, and cost. Lilac will appoint an overall change control board chair who will have decision making authority. The overall change control board chair may delegate the decision authority based on the cost thresholds identified in the charter. A summary of the change control process and a table with threshold requirements will be included in the PMP.

A1.3.9.7—QA/QC

Lilac Solutions will develop a Quality Assurance/Quality Control (QA/QC) Program as part of the PMP to ensure systems and processes associated with the ULP project have work control procedures associated with them. The procedures will be developed with an integrated safety mindset embedded to ensure that not only will work be completed efficiently with a focus on continuous improvement, but also with a focus on worker safety. As part of the QA/QC program, an Environmental Management System (EMS) will be developed in accordance with ISO 14001 standards and will provide the framework to systematize and improve environmental management efforts.

The ISO 14001 standard is based on the Plan-Check-Do-Review-Improve cycle, which is a key component of Lilac's QA/QC program.

A1.3.9.8—Team Member Communication Plan

For Lilac Solutions, frequent and effective communication at all levels of the project management team will be the cornerstone for the success of the project. At the project level, team member communication will be proactive and frequent. The primary conduit for team communications will be through the Integrated Project Team (IPT), which will meet on a weekly basis. The IPT members and roles and responsibilities are identified in the IPT charter and the PMP. Each site will have its own IPT and at least monthly, all teams will combine to meet virtually. Communication will include programmatic reporting (scope, schedule, and cost) as well as ad hoc subjects such as lessons learned, risk management, safety, quality assurance, and environmental compliance. A communication plan describing how communications will flow to project team members will be developed and incorporated into the PMP.

A1.3.10. Market Transformation Plan

A1.3.10.1. Target Market

As described in previous sections, lithium is a critical mineral with a significant supply chain deficit that threatens US production of lithium-ion batteries and the electrification of US transportation. In 2021, lithium constituted less than 8% of the total cell cost for lithium-ion batteries. With the recent >600% increase in lithium spot prices, lithium is poised to reach ~30% of total cell cost and present a $1000 increase in average electric vehicle prices. Correspondingly, the International Energy Agency has projected up to a 15% increase in the cost of lithium-ion batteries for 2022, the first increase after over a decade of falling production costs.

In parallel to the rising global cost and supply deficit of lithium, the US has virtually no domestic production of raw lithium, with the sole operational commercial lithium production site in Silver Peak, NV accounting for <3% of current demand. Even with the best-case scenario of including raw lithium production from recycling and all possible and probable lithium projects, only ~50% of US projected demand will be met by domestic supply in 2030, as shown in *Exhibit A1.3-6*. Thus, increasing the domestic supply of lithium is imperative to securing the country's position as a leader in the green energy transition and security from reliance on foreign import of lithium.

Section A1.2.3 of this Application describes the types of domestic lithium resources available in the US and the techno-economics and environmental impact of exploiting each type.

[redacted]

(b) (4)

Exhibit A1.3-6 L009. *Global and US LithiumSupplies*

Exhibit A1.3-7 show a summary of all current and potential domestic lithium production projects with projected capacities, as identified by Benchmark Mineral Intelligence

As explained previously, mining lithium from solid mineral deposits incurs high operating costs and environmental impact and can suffer correspondingly from long >10 year permitting and development timelines. This leaves continental brines and geothermal brines as the main candidates for rapidly developing new low-cost and low-environmental impact domestic lithium extraction projects.

The commissioning of new lithium-producing projects in the United States is currently limited by the lack of technologies capable of extracting lithium economically from low-grade domestic brine resources. None of the potential brine projects listed in *Exhibit A1.3-7* have demonstrated technological readiness and economic viability of their extraction processes. Lilac's IX technology is poised dramatically expand US domestic production of raw lithium by enabling extraction from the available low-grade brine resources. Initial estimates from Lilac's internal resource exploration team identified over 4 million tonnes-LCE of domestic resources extractable with Lilac's technology and a potential increase in domestic production rate by 200 $kTPA_{LCE}$.

A1.3.10.2. Competition

Other direct lithium brine extraction technologies are the main competitors for the brine resources Lilac is targeting within the US. These technologies can be grouped into five categories.

Alumina Absorbents. These selectively absorb Li and are used in Livent's Hombre Muerto lithium production facility. However, Lilac believes that to pre-concentrate the brine, vast quantities of natural gas are needed to heat the brine, the process suffers from low recoveries (reportedly ~ 55%), and the technology requires vast amounts of fresh water. For that reason, this technology has not been adopted successfully at commercial scale for new projects. Notably, Lilac believes that this class of adsorbents was tested and failed to be demonstrated by Simbol Materials in 2015 for extraction of lithium from Salton Sea geothermal resources. This failure is likely due to the

(b) (4)

complexity and cost associated with removal of iron-silicate impurities, as well as interference by manganese with the lithium absorption process.

More recently proposed projects involving alumina absorbents include companies such as EnergySource Minerals, and TerraLithium, Berkshire Hathaway. None of these companies have publicly demonstrated successful and economic recovery of lithium at commercial scales.

Phosphate Precipitation. This process precipitates lithium from brine as lithium phosphate. Multiple projects have explored this technology but failed at its scaleup because of technical challenges, and the requirement of evaporation ponds. Multiple companies have failed to advance this technology beyond the piloting stage, despite investing tens of millions of dollars across multiple high-quality resources. No significant domestic lithium projects have been proposed utilizing the phosphate precipitation technology.

Solvent Extraction. Using a selective water-immiscible solvent and molecular chelator to extract lithium, this technology is promising because of its high recovery and selectivity. But the toxic and flammable nature of the solvent and the potential contamination of brine with solvents and chelators has slowed permitting of new projects. Additionally, different chelators can offer selectivity over sodium or magnesium/calcium, but none offer selectivity over both sodium and magnesium/calcium. As a result, all solvent extraction processes require pretreatment or additional processing steps to remove these impurities, further reducing economic viability.

Other Ion Exchange. Two other companies in North America have publicly disclosed using IX technology for recovery of lithium from brines. To the best of Lilac's knowledge, neither have publicly demonstrated economic and successful extraction of lithium from fielded pilot or demonstration-scale systems.

Lilac has been successfully granted eight patents by the USPTO covering its lithium IX systems and beads and three more patents are pending. From Lilac's extensive experience, the patented formation of a coated, porous, and durable IX bead and its patented system designs and process controls are vital for economic and low environmental impact extraction of lithium from brine via IX.

Membrane Technologies. A variety of membrane technologies have also been proposed for lithium extraction, but none have shown promising results for efficient recovery of lithium from high salinity brines, because of technical challenges associated with membrane clogging and scaling when processing raw brine. However, certain membranes may be applicable for downstream processing of dilute lithium solutions.

Given Lilac's strong IP portfolio, deep experience in both bead manufacturing and IX system design, and previous work demonstrating technoeconomic viability across a wide range of brine chemistries, Lilac is confident in its ability to deliver substantially better performance, reliability, and environmental profile compared to other technologies in the lithium extraction space.

A1.3.10.3. Distribution Channels

Lilac plans to expand and deploy its technology both as a technology services partner for existing lithium resource owners and as a vertically integrated resource owner, extractor and refiner of final lithium products to sell to battery cathode and electrolyte manufacturers.

For partnerships with existing resource owners, our typical project workflow proceeds down the following path:

- Perform *PFS* work with brine samples and bench-scale IX modules in Oakland to determine extraction performance metrics and reagent usage.
- Design, fabricate and deploy containerized pilot IX modules to field well sites. IX beads

for these modules are manufactured on the Lilac pilot bead manufacturing line in Oakland.

- Perform DFS work based on real-world data from field pilot modules.
- [redacted] (b) (4) [redacted]. IX beads for these modules are to be manufactured at the Fernley bead manufacturing facility proposed in this application.
- [redacted] (b) (4) [redacted] (brine filtration, desalination for water production and zero-discharge recycling, chlor-alkali plant for acid regeneration, eluate neutralization, refining and concentration). Build out of the final lithium carbonate or hydroxide crystallization plant is dependent on location of the project and current crystallization capacity of the resource owner and partner.

A similar project workflow is followed for vertically integrated projects where Lilac is the resource owner, with additional resource exploration and drilling work prior to IX test work and flexibility to transport concentrated eluate to external customers or to Lilac's internal lithium carbonate/hydroxide crystallization facilities. The four lithium extraction projects proposed in this application are based on Lilac-owned resources, while Lilac has continued to work with other domestic resource owners to deploy its technology at existing oilfield and continental brine sites.

A1.3.10.4. Barriers, Mitigation Plan, Commercialization Timeline, US Manufacturing Plan

Lilac's main concern with its commercialization plan is speed of deployment. A battery manufacturing facility can be built in two years, while establishing a new lithium project can take up to a decade due to the resource exploration process, delays in permitting and environmental impact assessment, and spin up of equipment and extraction processes. In addition to the startup of operations at the lithium production sites, Lilac requires IX bead manufacturing capacity to commission and supply its lithium production projects. This manufacturing capacity is a chemical processing operation that requires significant timeline allocation towards permitting with the City of Fernley and the Nevada Department of Environmental Protection (NDEP).

Lilac's approach to mitigating project schedule risk is to pursue both piloting and demonstration of lithium production projects while simultaneously scaling up bead manufacturing capacity so that supply of IX beads is timed to match demand from its projects. To expedite permitting, Lilac has engaged environmental consultants with decades of experience to ensure accurate and streamlined permit application processes. The longest-lead application package for the bead manufacturing facility, the state air permit, has been assembled and Lilac is actively communicating with NDEP. As part of this FOA, Lilac has also proposed teaming with Argonne National Lab to perform life-cycle analysis work to validate the environmental impact of its bead manufacturing and lithium production processes. The results of this LCA work will be made available to local communities to build trust in Lilac's environmental stewardship and reduce risk of pushback by any local stakeholders and environmental groups. Lilac has also proposed teaming with the University of Nevada-Reno (UNR) to conduct outreach to local indigenous tribes and disadvantaged communities in Nevada. The workforce development and economic analysis work performed by UNR will also provide evidence of positive economic impacts to these indigenous tribes and disadvantaged communities.

As stated in the SOPO and WBS, Lilac aims to begin operation of demonstration-scale lithium production at domestic sites by Q3 2025.

Commissioning of the fina [redacted] (b) (4) [redacted] manufacturing line is scheduled to be complete by Q4 2024, providing more than sufficient supply of beads for all domestic lithium production projects.

For the foreseeable future, Lilac plans to continue manufacturing its IX beads and IX systems within the U.S. To the extent reasonably practicable, Lilac also aims to source its equipment from U.S. vendors and use U.S.-based fabricators for customized vessels and equipment.

A1.3.10.5. Legal/Regulatory/IP and Infrastructure Requirements, Data Dissemination, and Product Distribution

By owning the IP and manufacturing capacity for IX bead production, as well as operating its patented IX modules in the field, Lilac does not foresee any legal barriers for intellectual property ownership or dissemination and distribution. Details of Lilac's IP portfolio in section A1.4.1

A1.4—Technical Qualifications and Resources

A1.4.1—Team Unique Qualifications

Lilac benefits from a vertically integrated organization that spans the entire lithium production chain: from Li-bearing natural resource assessment, through lithium extraction through IX (IX Bead Manufacturing, Lithium Production Technology), through downstream processing into marketable lithium products (Lithium Division). This organizational structure is shown in *Exhibit A1.4-1*. Its vertically integrated nature ensures that all necessary parts for successful lithium production are coordinated within a single organization, ensuring the success of the demonstration project in this FOA, as well as its subsequent scale-up to commercial lithium production to support the domestic battery supply chain.

The unique technical qualifications of each division are discussed below.

IX Bead Manufacturing. Lilac's bead manufacturing division is responsible for development and manufacturing of Lilac's IX beads. This division has developed, patented, and produced a unique ion exchange bead through testing of hundreds of formulations and methods of formation. The bead manufacturing division, which features engineers with degrees from MIT, Northwestern, Stanford and UC Berkeley, has years of in-depth experience and understanding of process design and control to produce this high-performance bead at low-cost and environmental impact. [redacted] (b) (4) [redacted] day phase of manufacturing at the Fernley plant. [redacted] (b) (4) [redacted]

The bead manufacturing division is led by Jerry Sullivan (VP of Technology, Bead Division), William Timothy (VP of Manufacturing, Bead Division), and Matthew McCall (VP of Operations, Bead Division). Jerry Sullivan has over 30 years of experience in the chemical industry and has managed large capital projects globally to produce mining and extraction chemicals. William Timothy has over 40 years of experience in manufacturing and participated in 5 factory start-ups and 3 retro-fits globally for the semiconductor and chemicals industries. Matthew McCall has over 18 years of experience in manufacturing operations for resins and chemicals, and served for 8 years in the U.S. Navy, reaching the Lieutenant Commander rank. Their combined expertise across technology, manufacturing, and operations encompasses all key components to successful manufacturing of Lilac's IX beads. Garrett Lau, a PhD in Materials Science from Northwestern University and BS from MIT, leads the Bead Division's QC and New Process Development team to ensure quality and performance of the bead product as the manufacturing process is scaled up from the pilot scale to the [redacted] scale as part of this FOA.

Lithium Production Technology. Lilac's Lithium Production Technology is responsible for designing, fabricating, commissioning, and operating lithium extraction processes.

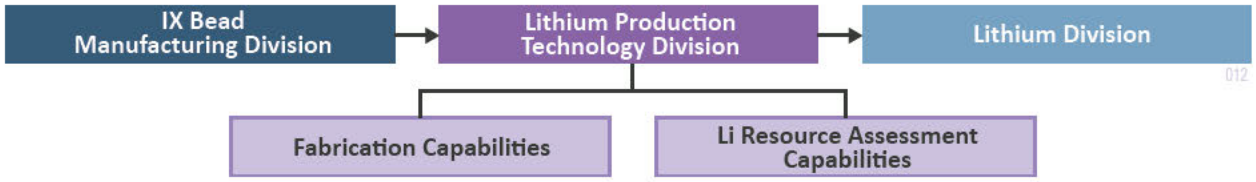

Exhibit A1.4-1 L012. *Lilac's unique technical divisions*

This division draws on years of R&D experience designing, testing, operating, and optimizing equipment for the extraction of lithium from brines using Lilac's IX technology. The team is currently led by David Snydacker (Founder and CEO), and Tom Wilson (Chief Development Officer, acting VP of Operations). David Snydacker has been researching lithium extraction using IX materials since his PhD at Northwestern University and created Lilac's core intellectual property after founding Lilac Solutions in 2016. He is the main inventor on all twelve of Lilac's published patents and leads all technical development of Lilac's technology. Thomas Wilson is Lilac's Chief Development Officer. His past achievements include running oil & gas development teams across the US, Australia, Europe and Africa, including resource strategy creation and team building. This engineering division includes three PhD engineers, Nicolas Grosso Giordano (part of the key technical personnel in this FOA), Tejal Sawant, and Eric Guyes, who lead R&D to continually improve Lilac's technology. This division also features a diverse group of 20 technical personnel including mechanical, electrical, and chemical engineers that support design, fabrication, and operational efforts.

This division integrates research development with engineering support and operations, for rapid prototyping and scale-up necessary to deploy the demonstration-scale plants in this FOA, and ultimately for success of a lithium production project in operational environments.

Lithium Division. This division focuses on managing engineering and engineering partnerships for integrated lithium carbonate and hydroxide production. The lithium division is led by David Alt (VP Engineering, Lithium Division), who brings over 26 years of experience in delivery of large, complex projects on a global basis with Fluor Corporation—a world-class EPC firm. His experience spans consulting, EPC companies and owner/operator organizations, managing both individual projects and multi-project programs, including in multi-national and geographically diverse locations. David Alt has commissioned several commercial scale chemical and mining facilities, and therefore brings the expertise to support Lilac's demonstration and commercialization efforts.

The Lithium Division coordinates closely with organizations within Lilac and external partners to ensure successful commercialization of lithium projects that leverage the Lilac technology.

All divisions are supported by Lilac's internal fabrication and resource assessment capabilities.

Lilac's Fabrication Capabilities. Lilac has, from the beginning of its operations, designed and fabricated its R&D and pilot equipment in-house. This has allowed it to iterate quickly and improve the performance of its equipment without delays from engaging with third-parties. These capabilities have expanded and improved over time. Lilac's fabrication division is currently led by Chuck Burgoon, Director of Fabrication, who brings over three decades of experience managing complex projects from chemicals industry to the military, delivering them on time and with an impeccable safety record. His and his team's expertise ensures timely completion of fabrication projects, including the lithium extraction modules contemplated in this FOA, while maintain the top standards in fabrication and safety.

Li Resource Assessment Capabilities. Successful lithium production requires analysis and understanding of the natural lithium resources from which lithium is extracted to develop a strong pipeline of extraction projects. Lilac has a resource exploration and validation team dedicated to this. This team is led by Tom Wilson, Chief Development Officer, and includes three other project geologists. Tom Wilson ran development teams across the

US, Australia, Europe and Africa, created the resource team strategy and built the team; he was one of the first engineers on the North Dakota Bakken Shale Formation with Hess Corporation, taking production 100X from when he started. This team brings extensive knowledge in land acquisition, exploration planning, appraisal drilling and development of resources across 6 continents, including 28 oil fields and 2.5 million acres of exploration in the UK

The expertise of this team in land acquisition, drilling, resource assessment ensures that Lilac can identify and validate the ability to economically extract lithium from natural resources. This ability is essential for success in all lithium extraction downstream activities.

FFRDCs: National Renewable and Argonne National Laboratories. These FFRDCs bring substantial expertise in life-cycle and technoeconomic analysis with their EverBatt and LIBRA models, which will support a rigorous assessment of the environmental and economic impact of Lilac's technology. NREL also has expertise with sizing solar technologies and developing water treatment models, using the NREL Renewable Energy Potential (reV) model, the NREL System Advisor Model (SAM) and the National Alliance for Water Innovation's (NAWI) water treatment modelling tool (WaterTAP).

Teaming Partner, University of Nevada at Reno (UNR). UNR is a Minority-Serving Institution and brings a thorough understanding of the local socioeconomic environment in Northwestern Nevada. Coordination with UNR will ensure that Lilac can maximize its impact on the local economy and disadvantaged communities when building the IX bead manufacturing facility and NV-based Li extraction projects supported by the FOA.

A1.4.2—Existing Equipment and Facilities

Lilac currently occupies two facilities within the United States, as shown in *Exhibit A1.4-2*.

Lilac HQ in Oakland, CA. Lilac's headquarters is based in Oakland, CA. The 92,000 sq. ft. facility hosts Lilac's corporate and administrative functions, as well as its core engineering and R&D teams. The main facilities available at Lilac HQ include:

- IX Bead Pilot R&D Production Line [redacted] (b) (4)
- Materials characterization and chemical analysis laboratory
- Lithium IX bench-scale cyclers
- Lithium pilot IX modules and commissioning station
- Brine library composed of hundreds of IBC totes and ~60 different brine chemistries
- Fabrication shop
- Offices with 10 conference rooms for private meetings

Lilac's IX Bead Pilot Production line contains all major unit operations of the IX bead manufacturing process, allowing for extensive formulation development, optimization of materials processing parameters, experimentation to

Exhibit A1.4-2 L010. *Lilac's current facilities at Oakland and Fernley.*

facilitate design of larger production lines, as well as production of beads for pilot-scale lithium IX projects throughout the US and the world. In parallel to the bead pilot line, Lilac HQ has an extensive materials characterization and chemical analysis capabilities, including the following instrumentation:

- LECO TGA701 Thermogravimetric Analyzer
- Mettler Toledo H53 Moisture Analyzer
- Mettler Toledo V20S Compact Karl Fisher Titrator
- Anton Paar PSA 1190 Particle Sizer
- Anton Paar MCR 302e Rheometer with powder rheology measurement systems
- Siemens D5000 powder X-Ray Diffractometer
- Thermo Fisher Phenom G6 Pure Desktop Scanning Electron Microscope with gold sputter coater
- Optical microscope
- Perkin Elmer Avio 500 Inductively Coupled Plasma—optical emission spectrometer (ICP-OES)
- Perkin Elmer Avio 200 ICP-OES

This analytical capacity has allowed Lilac to fully-characterize all in-process materials and reagents, as well as final bead products. Lilac also is able to characterize brine and concentrated lithium eluate streams in-house using its ICP-OES systems, allowing for rapid performance feedback from onsite IX experiments.

Lilac HQ also operates many lithium IX modules at several scales, summarized in Exhibit A1.4-3. These modules are all designed and fabricated in-house, allowing for agile addition of new features and processing capabilities.

Lilac HQ also operates its own internal fabrication shop. Its fabrication and machining capabilities include:

- MIG/TIG welding
- CNC mill and lathe
- CNC plasma cutter
- Sheet metal shearing and forming equipment
- Horizontal bandsaws

- These fabrication capabilities allow for on-site construction of containerized pilot brine, IX, and eluate processing modules for rapid deployment to field extraction sites.

Lilac Bead Manufacturing Facility—Fernley, NV (site for the bead manufacturing lines proposed in this FOA application). Lilac Solutions formed a subsidiary company (Western Ceramics Company 1) and signed a lease in December 2021 for a 450,000 sq. foot facility in Fernley, NV. The facility previously hosted a large printing company (Quad Graphics) and is well-suited for Lilac's bead manufacturing facilities. It has ~15 MW of switchgears and power transformer capacity, a ~3,000 sq. foot Class 1 Division 1-rated solvent handling room, deep concrete foundations to support heavy equipment, extensive boiler and chiller capacity, a rail spur for raw materials delivery, facilities and locker rooms for on-site operators and technicians, and remodeled offices for engineering and corporate support.

Domestic Extraction Sites In addition to the two facilities described above, Lilac's Resource Development Team is currently conducting geological surveys and drilling for brine samples at the four proposed extraction sites.

A depiction of our current facility locations and the proposed extraction sites is provided in *Exhibit A1.4-3.*

(b) (4)

[redacted]

A1.4.3—Relevant Previous Work

Bead Manufacturing Division. Lilac's Bead Manufacturing Division has designed, constructed and operated [redacted] (b) (4) [redacted]

The experience and technical knowledge accrued from this work has facilitated the conceptual design of the [redacted] line to be installed at the Fernley bead manufacturing facility. All major pieces of process equipment for this scale have already been procured and all but one major process unit has been delivered to Lilac facilities. Initial testing of one major bead formation process unit with real in-process materials successfully demonstrated analogous processing capabilities and material quality as the existing pilot equipment at a [redacted]

Lithium Production Division. Lilac's Lithium Production Division has successfully demonstrated economically-viable lithium extraction from over 60 different samples of lithium-bearing liquid using its technology. These samples are obtained directly from real lithium resources (for example, from a brine well in a salt flat) in order test the technology under realistic conditions, rather than relying on synthetic proxies of brines which may not contain all the chemical complexities of real brines. Lilac has tested its technology on lithium-bearing brines originate from sub-surface liquids in salt-flats, geothermal sources, leachate from lithium-bearing rocks, or even battery-recycling liquors, recovering > 90% of lithium while rejecting > 99% of impurities. Cumulatively, the [redacted] (b) (4) [redacted]

Scale	Number of Units	Brine Processing Capacity, L/h
[redacted] (b) (4) [redacted]		

Exhibit A1.4-4. *Lithium Extraction Testing*

[redacted]

Furthermore, Lilac's Lithium Production Division has also successfully completed a [redacted] The experience from deploying this pilot has fed into design improvements for all its pilot IX modules. [redacted]

The collective work of the Bead Manufacturing Division and the Lithium Production Division have led to 8 successfully granted US patents and 3 additional pending patents, as shown in *Exhibit A1.4-5*.

Lilac's Resource Development Team

While no drilling or resource development work is proposed as part of this FOA, the work completed by Lilac's Resource Development Team is critical for maintaining a strong pipeline of incoming projects for the Lithium Production Division, including the four proposed lithium IX projects. Many of these resources are solely owned by Lilac, providing the potential for greater revenue and control over project timelines. Internal expertise and control over the permitting process for drilling and exploiting brine resources is also critical for mitigating project delays associated with

Application Title	Patent No.	Issue/ Publication Date	Status
Lithium Extraction with Coated Ion Exchange Particles	US10150056B2	11-Dec-2018	Granted
Lithium Extraction with Coated Ion Exchange Particles	US10695694B2	30-Jun-2020	Granted
Lithium Extraction with Porous Ion Exchange Beads	US11253848B2	2022-Feb-22	Granted
Ion Exchange System for Lithium Extraction	US10439200B2	08-Oct-2019	Granted
Ion Exchange System for Lithium Extraction	US10505178B2	10-Dec-2019	Granted
Integrated System for Lithium Extraction and Conversion	US10648090B2	12-May-2020	Granted
Ion Exchange Reactor with Particle Traps for Lithium Extraction	US20210077990A1	18-Mar-2021	Pending
Process For Separating Undesirable Metals	US11339457B2	24-May-2022	Granted
Lithium Extraction In The Presence Of Scalants	US20210380429A1	09-Dec-2021	Granted
Lithium Production With Volatile Acid	US20220162082A1	26-May-2022	Pending
Ion Exchange Devices For Lithium Extraction	PCT/US22/25810	21-Apr-2022	Pending

Exhibit A1.4-5: Lilac's Patent Portfolio

permitting oversights. Some highlights of Lilac's resource team to date include:

- [redacted] (b) (4)

A1.4.4—Time Commitment of Key Players

Jerry Sullivan, William Timothy, Matthew McCall and Garrett Lau will devote their full-time work throughout the project towards the Fernley bead manufacturing plant, associated bead R&D, and pilot bead manufacturing to support the four proposed Li extraction projects. Tony DiNicola will allocate 25% of his time towards permitting and environmental affairs associated with the Fernley plant and four lithium extraction projects. Nicolas Grosso Giordano will allocate 50% of his time towards the four Li extraction projects and associated R&D. Tom Pecoraro will allocate 50% of his time towards the four Li extraction projects and associated R&D. David Snydacker will allocate 10% of his time towards management of all proposed activities in this application.

Qiang Dai of ANL will allocate 5% of her time towards life cycle analysis work and techno-economics of the Lilac Li extraction technology, with greater time allocation front-loaded to the beginning of the project during budget period 1. At NREL, Dustin Weigl will allocate 25% of his time and Darlene Steward will allocate 12.5% of her time towards technoeconomic analysis of lithium extraction technologies and broader impacts on the Li-ion battery market and downstream electric vehicle market. Colin McMillian will allocate 12.5% of his time toward alternative thermal resource analysis, and Parthiv Kurup will allocate 12.5% of his time towards desalination and water treatment modeling.

At UNR, Frederick Steinmann will allocate 15% of his time, Richard Bartholet will allocate an average of 7% of his time, Christopher Lynch will allocate ~3% of his time, Sandra Rentas will allocate 10% of her time, and Brian Bonnenfant will allocate ~3% of his time.

A1.4.5—Technical Services Provided by DOE/NNSA FFRDCs and University Teaming Partner

Lilac Solutions will serve as the organization leading and performing the work described in

the main project objectives. Lilac has two DOE FFRDC teaming partners for supporting analytical work and one university teaming partner to provide analysis of Lilac's economic and environmental impacts on minorities and disadvantaged communities:

National Renewable Energy Laboratory—NREL will be performing analysis of broader supply chain effects on the overall Li-ion battery ecosystem associated with Lilac's extraction technology entering the market, utilizing the LIBRA model as a framework. This analysis can be generally divided into sensitivity analysis to determine the impact of variations in lithium prices on the supply chain, and system material flow analysis to evaluate the impact of the increased availability of lithium materials made available by Lilac's extraction methods. It will also be performing analysis of alternative thermal energy resources for Lilac's lithium extraction process and downstream lithium product refinement. Desalination and water treatment modeling work will be performed to identify lower environmental impact and cost pathways for producing process water at Lilac's extraction projects. It will also be performing analysis of alternative thermal energy resources for Lilac's lithium extraction process and downstream lithium product refinement. Desalination and water treatment modeling work will be performed to identify lower environmental impact and cost pathways for producing process water at Lilac's extraction projects.

Argonne National Lab—ANL will be performing life-cycle analysis and technoeconomic analysis of Lilac's core bead manufacturing process and Li extraction operations, using the EverBatt model. These results will be integrated into NREL's supply chain model.

University of Nevada Reno—In addition to providing their expertise for analysis of Lilac's economic and environmental impacts on minorities and disadvantaged communities, Lilac's university teaming partner, UNR, will also provide training and workforce development of under-represented minorities and DACs as a Minority Serving Institution.

Lilac will serve as the focal point for providing data and guidance for each of the partner organizations' analyses and training. NREL and ANL will work collaboratively to develop their models, with an initial kickoff meeting to establish analytical frameworks and scope, formal quarterly meetings to share results and refine models, and informal communication to provide real-time updates and share data.

NREL and ANL will have independence in their approach to developing their technical analysis, but final review and approval is required by Lilac Solutions to ensure that no trade secrets are released with their publications.

A1.4.6—Declarations Regarding Critical Materials and FECs

Statement on exports of critical material to FECs. Lilac Solutions will not export recovered or critical raw materials to a foreign entity of concern.

Battery Material supplied by FECs. [redacted]

(b) (4)

A1.4.7—Multi-Investigator Collaboration

Roles and effort to be performed by each PI/KP. Lilac's efforts for developing its bead manufacturing facility and the four proposed extraction projects will be led by its PI, Dave Snydacker.

NREL's efforts and roles performed by PI/KP are divided as follows:

- Dustin Weigl and Darlene Steward: Analysis of the broader lithium-ion supply chain and its effects on the overall Li-ion battery ecosystem associated with Lilac's extraction technology entering the market, utilizing the LIBRA model as a framework.
- Colin McMillan: Analysis of alternative energy resources for the lithium eluate processing plants
- Parthiv Kurup: Desalination and water treatment modeling, using the National Alliance for Water Innovation (NAWI) WaterTAP model.

Qiang Dai will serve as the PI for ANL's LCA and technoeconomic analysis work. University of Nevada Reno—UNR will be providing analysis of Lilac's economic and environmental impacts on minorities and disadvantaged communities. It will also pro-vide training and workforce development of under-represented minorities and DACs as a Minority Serving Institution. Frederick Steinmann will serve as the PI and key point of contact, while supported by outreach and development work by Richard Bartholet, Christopher Lynch and Sandra Rentas. Brian Bonnenfant will serve as a project manager for the work.

Business agreements (e.g., SOW). All teaming partners have provided a scope of work document that has been reviewed and approved by Lilac Solutions. Lilac does not foresee any sources of revenue or competing financial interests resulting from its work with its teaming partners and has thus not established any business agreements with the three proposed teaming partners.

Integration of Efforts and Decision Process for Technical Direction. A kickoff meeting will be held after award to confirm timelines, scope of work, and key touch points for each of the teaming partners. Quarterly meetings will be held with the partners to share findings and integrate any relevant data. Each partner will have independence in technical direction, but the quarterly meetings along with informal conversations will be vital for alignment of assumptions in any technoeconomic and LCA modeling.

Publication Arrangements. All teaming partners have independence in their approach to developing their technical analysis, but final review and approval is required by Lilac Solutions to ensure that no trade secrets are released with their publications.

IP Issues. Lilac does not foresee any Intellectual Property issues, given that the teaming partners will be providing supporting analysis to validate Lilac's economic and environmental impact. Lilac will retain its core IP and suggestions for improving the implementation of its technology and operations will fall under non-patented industry-standard equipment and practices.

Communication Plan. A secure server with access control and data loss prevention practices will be used to share sensitive data between Lilac and its teaming partners. As stated above, an initial kickoff meeting will be scheduled after award, and partners will meet formally on a quarterly basis.