OMB Number: 2030-0020
Expiration Date: 06/30/2024

Preaward Compliance Review Report for All Applicants and Recipients Requesting EPA Financial Assistance

Note: Read Instructions before completing form.

I. A. Applicant/Recipient (Name, Address, City, State, Zip Code)

Name: The Enterprise Center, Inc.

Address: 1100 Market Street Suite 500

City: Chattanooga

State: TN: Tennessee Zip Code: 37402-2893

B. DUNS No. 149649670

II. Is the applicant currently receiving EPA Assistance? ☐ Yes ☒ No

III. List all civil rights lawsuits and administrative complaints pending against the applicant/recipient that allege discrimination based on race, color, national origin, sex, age, or disability. (Do not include employment complaints not covered by 40 C.F.R. Parts 5 and 7.)

None.

IV. List all civil rights lawsuits and administrative complaints decided against the applicant/recipient within the last year that allege discrimination based on race, color, national origin, sex, age, or disability and enclose a copy of all decisions. Please describe all corrective actions taken. (Do not include employment complaints not covered by 40 C.F.R. Parts 5 and 7.)

None.

V. List all civil rights compliance reviews of the applicant/recipient conducted by any agency within the last two years and enclose a copy of the review and any decisions, orders, or agreements based on the review. Please describe any corrective action taken. (40 C.F.R. § 7.80(c)(3))

None.

VI. Is the applicant requesting EPA assistance for new construction? If no, proceed to VII; if yes, answer (a) and/or (b) below.

☐ Yes ☒ No

a. If the grant is for new construction, will all new facilities or alterations to existing facilities be designed and constructed to be readily accessible to and usable by persons with disabilities? If yes, proceed to VII; if no, proceed to VI(b).

☐ Yes ☐ No

b. If the grant is for new construction and the new facilities or alterations to existing facilities will not be readily accessible to and usable by persons with disabilities, explain how a regulatory exception (40 C.F.R. 7.70) applies.

VII. Does the applicant/recipient provide initial and continuing notice that it does not discriminate on the basis of race, color, national origin, sex, age, or disability in its program or activities? (40 C.F.R 5.140 and 7.95) ☒ Yes ☐ No

a. Do the methods of notice accommodate those with impaired vision or hearing? ☒ Yes ☐ No

b. Is the notice posted in a prominent place in the applicant's offices or facilities or, for education programs and activities, in appropriate periodicals and other written communications? ☒ Yes ☐ No

c. Does the notice identify a designated civil rights coordinator? ☒ Yes ☐ No

VIII. Does the applicant/recipient maintain demographic data on the race, color, national origin, sex, age, or handicap of the population it serves? (40 C.F.R. 7.85(a)) ☒ Yes ☐ No

IX. Does the applicant/recipient have a policy/procedure for providing access to services for persons with limited English proficiency? (40 C.F.R. Part 7, E.O. 13166) ☒ Yes ☐ No

X. If the applicant is an education program or activity, or has 15 or more employees, has it designated an employee to coordinate its compliance with 40 C.F.R. Parts 5 and 7? Provide the name, title, position, mailing address, e-mail address, fax number, and telephone number of the designated coordinator.

Deb Socia
President & CEO
1100 Market Street Suite 500, Chattanooga, TN 37402
deb@theenterprisectr.org
Fax: 423-756-4945
Phone: 423-661-3300

XI. If the applicant is an education program or activity, or has 15 or more employees, has it adopted grievance procedures that assure the prompt and fair resolution of complaints that allege a violation of 40 C.F.R. Parts 5 and 7? Provide a legal citation or Internet Address for, or a copy of, the procedures.

Our policy is provided here: https://www.theenterprisectr.org/careers/

For the Applicant/Recipient

I certify that the statements I have made on this form and all attachments thereto are true, accurate and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law. I assure that I will fully comply with all applicable civil rights statutes and EPA regulations.

A. Signature of Authorized Official	B. Title of Authorized Official	C. Date
Geoffrey Millener	Chief Operating Officer	03/25/2022

For the U.S. Environmental Protection Agency

I have reviewed the information provided by the applicant/recipient and hereby certify that the applicant/recipient has submitted all preaward compliance information required by 40 C.F.R. Parts 5 and 7; that based on the information submitted, this application satisfies the preaward provisions of 40 C.F.R. Parts 5 and 7; and that the applicant has given assurance that it will fully comply with all applicable civil rights statures and EPA regulations.

A. *Signature of Authorized EPA Official	B. Title of Authorized Official	C. Date

*** See Instructions**

Instructions for EPA FORM 4700-4 (Rev. 06/2014)

General. Recipients of Federal financial assistance from the U.S. Environmental Protection Agency must comply with the following statutes and regulations.
Title VI of the Civil Rights Acts of 1964 provides that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. The Act goes on to explain that the statute shall not be construed to authorize action with respect to any employment practice of any employer, employment agency, or labor organization (except where the primary objective of the Federal financial assistance is to provide employment). Section 13 of the 1972 Amendments to the Federal Water Pollution Control Act provides that no person in the United States shall on the ground of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under the Federal Water Pollution Control Act, as amended. Employment discrimination on the basis of sex is prohibited in all such programs or activities. Section 504 of the Rehabilitation Act of 1973 provides that no otherwise qualified individual with a disability in the United States shall solely by reason of disability be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. Employment discrimination on the basis of disability is prohibited in all such programs or activities. The Age Discrimination Act of 1975 provides that no person on the basis of age shall be excluded from participation under any program or activity receiving Federal financial assistance. Employment discrimination is not covered. Age discrimination in employment is prohibited by the Age Discrimination in Employment Act administered by the Equal Employment Opportunity Commission. Title IX of the Education Amendments of 1972 provides that no person in the United States on the basis of sex shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance. Employment discrimination on the basis of sex is prohibited in all such education programs or activities. Note: an education program or activity is not limited to only those conducted by a formal institution. 40 C.F.R. Part 5 implements Title IX of the Education Amendments of 1972. 40 C.F.R. Part 7 implements Title VI of the Civil Rights Act of 1964, Section 13 of the 1972 Amendments to the Federal Water Pollution Control Act, and Section 504 of The Rehabilitation Act of 1973. The Executive Order 13166 (E.O. 13166) entitled; "Improving Access to Services for Persons with Limited English Proficiency" requires Federal agencies work to ensure that recipients of Federal financial assistance provide meaningful access to their LEP applicants and beneficiaries.

Items “Applicant” means any entity that files an application or unsolicited proposal or otherwise requests EPA assistance. 40 C.F.R. §§ 5.105, 7.25. “Recipient” means any entity, other than applicant, which will actually receive EPA assistance. 40 C.F.R. §§ 5.105, 7.25. “Civil rights lawsuits and administrative complaints” means any lawsuit or administrative complaint alleging discrimination on the basis of race, color, national origin, sex, age, or disability pending or decided against the applicant and/or entity which actually benefits from the grant, but excluding employment complaints not covered by 40 C.F.R. Parts 5 and 7. For example, if a city is the named applicant but the grant will actually benefit the Department of Sewage, civil rights lawsuits involving both the city and the Department of Sewage should be listed. “Civil rights compliance review” means any review assessing the applicant’s and/or recipient’s compliance with laws prohibiting discrimination on the basis of race, color, national origin, sex, age, or disability. Submit this form with the original and required copies of applications, requests for extensions, requests for increase of funds, etc. Updates of information are all that are required after the initial application submission. If any item is not relevant to the project for which assistance is requested, write “NA” for “Not Applicable.” In the event applicant is uncertain about how to answer any questions, EPA program officials should be contacted for clarification. * Note: Signature appears in the Approval Section of the EPA Comprehensive Administrative Review For Grants/Cooperative Agreements & Continuation/Supplemental Awards form.

EPA KEY CONTACTS FORM

OMB Number: 2030-0020
Expiration Date: 06/30/2024

Authorized Representative: *Original awards and amendments will be sent to this individual for review and acceptance, unless otherwise indicated.*

Name: Prefix: | First Name: Geoff | Middle Name:
Last Name: Millener | Suffix:

Title: Chief Operating Officer

Complete Address:

Street1: 1100 Market Street Suite 500
Street2:
City: Chattanooga | State: TN: Tennessee
Zip / Postal Code: 37402 | Country: USA: UNITED STATES

Phone Number: 4236195008 | **Fax Number:**

E-mail Address: geoff@theenterprisectr.org

Payee: *Individual authorized to accept payments.*

Name: Prefix: | First Name: Deb | Middle Name:
Last Name: Socia | Suffix:

Title: President and CEO

Complete Address:

Street1: 1100 Market Street Suite 500
Street2:
City: Chattanooga | State: TN: Tennessee
Zip / Postal Code: 37402 | Country: USA: UNITED STATES

Phone Number: 4236613300 | **Fax Number:**

E-mail Address: deb@theenterprisectr.org

Administrative Contact: *Individual from Sponsored Programs Office to contact concerning administrative matters (i.e., indirect cost rate computation, rebudgeting requests etc).*

Name: Prefix: | First Name: Geoff | Middle Name:
Last Name: Millener | Suffix:

Title: Chief Operating Officer

Complete Address:

Street1: 1100 Market Street Suite 500
Street2:
City: Chattanooga | State: TN: Tennessee
Zip / Postal Code: 37402 | Country: USA: UNITED STATES

Phone Number: 4236195008 | **Fax Number:**

E-mail Address: geoff@theenterprisectr.org

EPA Form 5700-54 (Rev 4-02)

EPA KEY CONTACTS FORM

Project Manager: *Individual responsible for the technical completion of the proposed work.*

Name: **Prefix:** **First Name:** Geoff **Middle Name:**

Last Name: Millener **Suffix:**

Title: Chief Operating Officer

Complete Address:

Street1: 1100 Market Street Suite 500

Street2:

City: Chattanooga **State:** TN: Tennessee

Zip / Postal Code: 37402 **Country:** USA: UNITED STATES

Phone Number: 4236195008 **Fax Number:**

E-mail Address: geoff@theenterprisectr.org

EPA Form 5700-54 (Rev 4-02)

Other Attachment File(s)

*** Mandatory Other Attachment Filename:** 1235-Section 5_Quality Assurance Statement_FINAL.p

Add Mandatory Other Attachment | Delete Mandatory Other Attachment | View Mandatory Other Attachment

To add more "Other Attachment" attachments, please use the attachment buttons below.

Add Optional Other Attachment | Delete Optional Other Attachment | View Optional Other Attachment

Project Narrative File(s)

*** Mandatory Project Narrative File Filename:** 1239-TEC EPA Air Quality FY23_FINAL.pdf

Add Mandatory Project Narrative File | Delete Mandatory Project Narrative File | View Mandatory Project Narrative File

To add more Project Narrative File attachments, please use the attachment buttons below.

Add Optional Project Narrative File | Delete Optional Project Narrative File | View Optional Project Narrative File

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 02/28/2022

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. Enhanced Air Quality Monitoring for Communities	66.034	$	$	$ 491,171.00	$ 0.00	$ 491,171.00
2.						
3.						
4.						
5. Totals		$	$	$ 491,171.00	$ 0.00	$ 491,171.00

Standard Form 424A (Rev. 7- 97)
Prescribed by OMB (Circular A -102) Page 1

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) Enhanced Air Quality Monitoring for Communities	(2)	(3)	(4)	Total (5)
a. Personnel	$ 24,600.00	$	$	$	$ 24,600.00
b. Fringe Benefits	4,428.00				4,428.00
c. Travel	4,563.00				4,563.00
d. Equipment	61,976.00				61,976.00
e. Supplies	81,480.00				81,480.00
f. Contractual	154,792.00				154,792.00
g. Construction	0.00				0.00
h. Other	129,846.00				129,846.00
i. Total Direct Charges (sum of 6a-6h)	461,685.00				$ 461,685.00
j. Indirect Charges	29,486.00				$ 29,486.00
k. TOTALS (sum of 6i and 6j)	$ 491,171.00	$	$	$	$ 491,171.00
7. Program Income	$	$	$	$	$

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Prescribed by OMB (Circular A -102) Page 1A

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8. Enhanced Air Quality Monitoring for Communities	$ 0.00	$ 0.00	$ 0.00	$ 0.00
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 163,723.00	$ 40,931.00	$ 40,931.00	$ 40,930.00	$ 40,931.00
14. Non-Federal	$				
15. TOTAL (sum of lines 13 and 14)	$ 163,723.00	$ 40,931.00	$ 40,931.00	$ 40,930.00	$ 40,931.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (YEARS)			
	(b)First	(c) Second	(d) Third	(e) Fourth
16. Enhanced Air Quality Monitoring for Communities	$ 163,723.00	$ 163,724.00	$ 163,724.00	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	$ 163,723.00	$ 163,724.00	$ 163,724.00	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:

22. Indirect Charges: Federal de minimus Indirect Cost Rate (10%)

23. Remarks: Indirect cost is determined at: Federal de minimus Indirect Cost Rate (10%), less equipment and applied to the first $25,000 of subaward

OMB Number: 4040-0004
Expiration Date: 12/31/2022

Application for Federal Assistance SF-424

* 1. Type of Submission:	* 2. Type of Application:	* If Revision, select appropriate letter(s):
☐ Preapplication	☒ New	
☒ Application	☐ Continuation	* Other (Specify):
☐ Changed/Corrected Application	☐ Revision	

* 3. Date Received:	4. Applicant Identifier:
03/25/2022	

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: The Enterprise Center Inc.

* b. Employer/Taxpayer Identification Number (EIN/TIN):	* c. Organizational DUNS:
20-0062024	1496496700000

d. Address:

* Street1:	1100 Market Street Suite 500
Street2:	
* City:	Chattanooga
County/Parish:	Hamilton
* State:	TN: Tennessee
Province:	
* Country:	USA: UNITED STATES
* Zip / Postal Code:	37402-2893

e. Organizational Unit:

Department Name:	Division Name:

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

Prefix:		* First Name:	Geoff
Middle Name:			
* Last Name:	Millener		
Suffix:			

Title: Chief Operating Officer

Organizational Affiliation:
The Enterprise Center

* Telephone Number:	4236195008	Fax Number:	

* Email: geoff@theenterprisectr.org

Application for Federal Assistance SF-424

*** 9. Type of Applicant 1: Select Applicant Type:**

M: Nonprofit with 501C3 IRS Status (Other than Institution of Higher Education)

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

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

Environmental Protection Agency

11. Catalog of Federal Domestic Assistance Number:

66.034

CFDA Title:

Surveys, Studies, Research, Investigations, Demonstrations, and Special Purpose Activities Relating to the Clean Air Act

*** 12. Funding Opportunity Number:**

EPA-OAR-OAQPS-22-01

* Title:

Enhanced Air Quality Monitoring for Communities

13. Competition Identification Number:

Title:

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

1234-Area Affected by Project.pdf

Add Attachment | Delete Attachment | View Attachment

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

CLEEAN - Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact

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 TN-003 * b. Program/Project TN-003

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

Add Attachment | Delete Attachment | View Attachment

17. Proposed Project:

* a. Start Date: 11/01/2022 * b. End Date: 10/30/2025

18. Estimated Funding ($):

* a. Federal	491,171.00
* b. Applicant	0.00
* c. State	0.00
* d. Local	0.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	491,171.00

*** 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.

☒ 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 ☒ 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)**

☒ ** 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: Geoff

Middle Name:

* Last Name: Millener

Suffix:

* Title: Chief Operating Officer

* Telephone Number: 4236195008 Fax Number:

* Email: geoff@theenterprisectr.org

* Signature of Authorized Representative: Geoffrey Millener * Date Signed: 03/25/2022

IRS Department of the Treasury
Internal Revenue Service

Cincinnati Service Center
CINCINNATI OH 45999-0038

In reply refer to: 0256439164
June 25, 2019 LTR 4168C 0
20-0062024 000000 00
00012433
BODC: TE

ENTERPRISE CENTER INC
% JOE FERGUSON
1100 MARKET STREET FLOOR 5
CHATTANOOGA TN 37402

031542

Employer ID number: 20-0062024
Form 990 required: Y

Dear Taxpayer:

We're responding to your request dated June 18, 2019, about your tax-exempt status.

We issued you a determination letter in FEB 2005, recognizing you as tax-exempt under Internal Revenue Code (IRC) Section 501(c)(03).

We also show you're not a private foundation as defined under IRC Section 509(a) because you're described in IRC Sections 509(a)(1) and 170(b)(1)(A)(vi).

Donors can deduct contributions they make to you as provided in IRC Section 170. You're also qualified to receive tax deductible bequests, legacies, devises, transfers, or gifts under IRC Sections 2055, 2106, and 2522.

In the heading of this letter, we indicated whether you must file an annual information return. If you're required to file a return, you must file one of the following by the 15th day of the 5th month after the end of your annual accounting period:

- Form 990, Return of Organization Exempt From Income Tax
- Form 990EZ, Short Form Return of Organization Exempt From Income Tax
- Form 990-N, Electronic Notice (e-Postcard) for Tax-Exempt Organizations Not Required to File Form 990 or Form 990-EZ
- Form 990-PF, Return of Private Foundation or Section 4947(a)(1) Trust Treated as Private Foundation

According to IRC Section 6033(j), if you don't file a required annual information return or notice for 3 consecutive years, we'll revoke your tax-exempt status on the due date of the 3rd required return or notice.

You can get IRS forms or publications you need from our website at www.irs.gov/forms-pubs or by calling 800-TAX-FORM (800-829-3676).

If you have questions, call 877-829-5500 between 8 a.m. and 5 p.m.,

0256439164
June 25, 2019 LTR 4168C 0
20-0062024 000000 00
00012434

ENTERPRISE CENTER INC
% JOE FERGUSON
1100 MARKET STREET FLOOR 5
CHATTANOOGA TN 37402

local time, Monday through Friday (Alaska and Hawaii follow Pacific time).

Thank you for your cooperation.

Sincerely yours,

Kim A. Billups, Operations Manager
Accounts Management Operations 1

INTERNAL REVENUE SERVICE
P. O. BOX 2508
CINCINNATI, OH 45201

DEPARTMENT OF THE TREASURY

Date: MAY 02 2008

ENTERPRISE CENTER INC
1250 MARKET ST STE 3020
CHATTANOOGA, TN 37402-4443

Employer Identification Number:
20-0062024
DLN:
17053096849048
Contact Person:
SHAWNDEA KREBS ID# 31072
Contact Telephone Number:
(877) 829-5500
Public Charity Status:
170(b)(1)(A)(vi)

Dear Applicant:

Our letter dated February 2005, stated you would be exempt from Federal income tax under section 501(c)(3) of the Internal Revenue Code, and you would be treated as a public charity, rather than as a private foundation, during an advance ruling period.

Based on the information you submitted, you are classified as a public charity under the Code section listed in the heading of this letter. Since your exempt status was not under consideration, you continue to be classified as an organization exempt from Federal income tax under section 501(c)(3) of the Code.

Publication 557, Tax-Exempt Status for Your Organization, provides detailed information about your rights and responsibilities as an exempt organization. You may request a copy by calling the toll-free number for forms, (800) 829-3676. Information is also available on our Internet Web Site at www.irs.gov.

If you have general questions about exempt organizations, please call our toll-free number shown in the heading.

Please keep this letter in your permanent records.

Sincerely yours,

Robert Choi
Director, Exempt Organizations
Rulings and Agreements

Letter 1050 (DO/CG)

Section 5 – Quality Assurance Statement

1. QA/QC Management

The Enterprise Center (TEC), working in partnership with the Chattanooga/Hamilton County Air Pollution Control Bureau (CHCAPCB) and Chattanooga Smart Community Collaborative (CSCC), will be responsible for quality assurance and control (QA/QC). This collaborative team brings decades of experience, and currently actively operates and monitors Chattanooga and Hamilton County's existing air quality monitoring networks, including both low-cost sensors (LCS) and EPA monitors. Tellus–will focus on validating the low-cost sensor (LCS; AirU+ and PurpleAir [PA]) measurements. Standard operating procedures will be developed to ensure consistency in sensor operation/placement and data collection. The researchers will also consult with TEC, CHCAPCB and CSCC's QA officers, as needed.

2. Project and Quality Objectives

Data and measurement validation are key to achieving our performance objectives. This project leverages three existing particulate matter sensor networks (CHCAPCB, Tellus's AirU+, and PA) to provide neighborhood-scale estimates of $PM_{2.5}$ and PM_{10} concentration. We propose a multilayered approach to validate sensor performance and the PM concentration estimates. This includes laboratory evaluation, correction factors for the non-FEM (PA/AirU+) measurements, outlier and drift detection, map validation, and transparent data processing/access.

3. Measurement validation

TEC, with CHCAPCB and CSCC, will follow Tennessee QA procedures for existing and new high-sensitivity monitors, and Tellus will follow EPA guidance for performance of LCSs[1–3].

3.1 CHCAPCB monitors. Data from existing DAQ monitors are reviewed and validated by DAQ QA officers following strict EPA guidelines, using established measurement and data quality objectives.

3.2 Sensor Pre-deployment. All AirU+ sensors deployed as part of this project will be of the same make and model type and have the same firmware. Prior to field deployments, all AirU sensors will be calibrated with a 5-point calibration curve ($PM_{2.5}$ concentration range 5 - 150 μg/m^3 and PM_{10}: 10 - 300 μg/m^3).[4] The objective is to avoid deploying any sensor that exhibits a coefficient of variation > than 30%.[1]

3.3 Sensor correction factors. Optical particle counters and nephelometers require a correction factor to convert particle counts and light scattering, respectively, to particle mass concentrations. Seasonal and event-specific factors will be developed for AirU+ ($PM_{2.5}$ and PM_{10}) and PA ($PM_{2.5}$). TEC will co-locate three PAs and three AirU+s each at the CHCAPCB's 911 Siskin Drive monitoring station, equipped with a T640 continuous monitor (hourly $PM_{2.5}$ and complete meteorological measurements), as well as a special purpose T640X monitor at a site to-be-determined, for additional network resilience and calibration. The LCSs will have unrestricted air flow and will be placed within 10 m (horizontal) and 1 m (vertical) of FEM inlet, and 1 m away from each other. All co-located LCSs (AirU+ and PA) that meet the data completeness criteria (75%[1]) will be used to develop seasonal calibration factors. For the past four years, Tellus has demonstrated that, after applying seasonal correction factors, AirU and PAs meet EPA's performance targets (Table ES2)[1] when seasonal mean $PM_{2.5}$ concentrations exceed 5 μg/m^3.[5,6]

3.4 Sensor siting. LCSs deployment will follow EPA recommendations[3]. Briefly, they will be placed 6 ft above the ground or rooftop level, away from non-representative emission sources (i.e., dryer vents, grills, etc.), with at least 180°of unobstructed flow, and if placed on a building it will be placed on the upwind side. The team will take detailed notes regarding the site and photographs the installations[3], and place these in our electronic logbooks.

3.5 Screening. LCS readings (AirU+, PA) will be screened using the following automated procedure. (1) All sensors located indoors are excluded (i.e., specified as indoor or exhibiting an indoor temperature profile). (2) Individual measurements exceeding 1,000 μg/m^3 ($PM_{2.5}$) or 5,000 μg/m^3 (PM_{10}) are flagged.

ED_013931A_00000758-00001

(3) Sensors that measure 0 μg/m^3 for the past 24 hours are flagged. (4) If sensor nodes contain more than one sensor, the measurements are averaged when they agree within 15% and the average of the sensors exceed 5 μg/m^3 ($PM_{2.5}$). Otherwise, both sensors are flagged. (5) We compare LCS $PM_{2.5}$ measurements against the median deviation in the same geographic area over 8-minute intervals. Thus, each sensor's median $PM_{2.5}$ concentration over the 8-minute interval, and the median and median deviations are computed for that geographic area. Measurements that differ from the median by more than 10x the median deviation are flagged. In addition, drift is evaluated on a quarterly basis by examining time periods when PM levels are low[7] (FEM/FRM $PM_{2.5}/PM_{10}$ levels below 5 and 10 μg/m^3, respectively, concentrations selected based on LCS performance, precision of FEMs, and at least 20% of FEM measurements during a season meeting the criteria). If a sensors' median $PM_{2.5}$ or PM_{10} concentration during the low concentration periods exceeds 5 or 10 ug/m^3, they are flagged. These flagged measurements are not removed from the database, but they are excluded from the maps. Poorly functioning AirU+ sensors can be replaced.

3.6 Validation of $PM_{2.5}$ and PM_{10} maps. On a quarterly basis, Tellus will validate the maps (presented to the community) by comparing Tellus's Gaussian Process model predictions at one randomly selected CHCAPCB monitoring station that measures $PM_{2.5}$ using a leave-one-out cross-validation strategy. Tellus has demonstrated the accuracy of their estimate maps using this leave-one-out cross validation approach.[5]

4. Data Management

All sensor data (GPS coordinates, temperature, relative humidity, raw Plantower $PM_{2.5}$ concentration) at 2-minute intervals will be stored in Google Cloud (regularly backed up). The correction factors (and applicable dates) will be publicly available. Data can be accessed through a public API. Field logbooks will be maintained with details about sensor siting, nearby sources, and WiFi connectivity[3]. In addition to live, on-demand access to network health and data, local key personnel will receive a weekly network health report that provides key metrics, such as measurement sources (AirU, UDAQ, PA), time series measurements, and any flagged measurements. Corrective measures, i.e., site inspections, sensor replacement, will be taken as needed.

References

[1] Duvall, R. et al. *Performance Testing Protocols, Metrics, and Target Values for Fine Particulate Matter Air Sensors*; 2021.

[2] Duvall, et al. Deliberating Performance Targets: Follow-on workshop discussing PM10, NO2, CO, and SO2 air sensor targets. *Atmos. Environ.* **2021**, *246*, 118099.

[3] US-EPA. A Guide to Siting and Installing Air Sensors (accessed Feb 21, 2022).

[4] Sayahi, et al. Development of a calibration chamber to evaluate the performance of low-cost particulate matter sensors. *Environ. Pollut.* **2019**, *255*, 113131.

[5] Kelly, et al. Community-Based Measurements Reveal Unseen Differences during Air Pollution Episodes. *Environ. Sci. Technol.* **2021**, *55* (1), 120–128.

[6] Sayahi, et al. Long-term field evaluation of the Plantower PMS low-cost particulate matter sensors. *Environ. Pollut.* **2019**, *245*, 932–940.

[7] Tsujita, et al. Gas sensor network for air-pollution monitoring. *Sensors Actuators,Chem.* **2005**, *110*, 304–311.

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Manifest for Grant Application # GRANT13579944

Grant Application XML file (total 1):

1. GrantApplication.xml. (size 26129 bytes)

Forms Included in Zip File(total 6):

1. Form ProjectNarrativeAttachments_1_2-V1.2.pdf (size 16139 bytes)

2. Form SF424_3_0-V3.0.pdf (size 24192 bytes)

3. Form SF424A-V1.0.pdf (size 23085 bytes)

4. Form EPA4700_4_3_0-V3.0.pdf (size 22777 bytes)

5. Form OtherNarrativeAttachments_1_2-V1.2.pdf (size 15920 bytes)

6. Form EPA_KeyContacts_2_0-V2.0.pdf (size 37284 bytes)

Attachments Included in Zip File (total 6):

1. OtherNarrativeAttachments_1_2 OtherNarrativeAttachments_1_2-Attachments-1236-IRS Determination Letter.pdf application/pdf (size 191390 bytes)

2. ProjectNarrativeAttachments_1_2 ProjectNarrativeAttachments_1_2-Attachments-1239-TEC EPA Air Quality FY23_FINAL.pdf application/pdf (size 566128 bytes)

3. OtherNarrativeAttachments_1_2 OtherNarrativeAttachments_1_2-Attachments-1237-Partner Letters.pdf application/pdf (size 1796323 bytes)

4. OtherNarrativeAttachments_1_2 OtherNarrativeAttachments_1_2-Attachments-1238-TEC_Resume Upload for EPA Air Quality_Final.pdf application/pdf (size 881600 bytes)

5. SF424_3_0 SF424_3_0-1234-Area Affected by Project.pdf application/pdf (size 82696 bytes)

6. OtherNarrativeAttachments_1_2 OtherNarrativeAttachments_1_2-Attachments-1235-Section 5_Quality Assurance Statement_FINAL.pdf application/pdf (size 220882 bytes)

Areas Affected by Project

County: Hamilton County, TN

City: Chattanooga, TN

HAMILTON COUNTY SCHOOLS

March 22, 2022

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms. Socia:

This letter confirms that Hamilton County Schools has agreed to serve as a project partner with The Enterprise Center on their funding application for the U.S EPA Enhanced Air Quality Monitoring for Communities, EPA-OAR-OAQPS-22-01 funding opportunity. We agree to partner with both the lead agency and the other partners on the CLEEAN initiative, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact project.

The Hamilton County School District comprises 576-square miles in southeastern Tennessee with a population of 357,738 residents. Our 79 schools consist of Pre-K through grade twelve with nearly 2,800 full-time teachers responsible for educating over 44,500 students. The district has developed a 10-year master plan for facilities and has been a key partner in the initial efforts of the Chattanooga Smart Community Collaborative to expand community air quality monitoring capacity, including locating the sensors at more than 25 of our school and other facilities. We are committed to this partnership to ensure that healthy air quality is enjoyed by all of our students and their families, particularly those attending our Title I schools and those living in low-income and minority households. We are also committed to providing a world-class education and a future without limits for all of our students, and this collaborative offers unique opportunities for integrating live, local and relevant data and technologies into curricula across grade levels and learning communities — as well as a platform for empowering students and families to understand the link between air quality and their health outcomes.

During the grant period we will support the project through the following activities as a part of the grant agreement:

- Offer community and neighborhood locations where sensors can be installed, at school buildings and other HCS facilities as appropriate.
- Collaborate around the development of a library loan program, wherein HCS students could borrow sensors to contribute additional data to the air monitoring network, as well as better understand their own hyper-local data;

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HAMILTON COUNTY SCHOOLS

- Support providing the data collected for reporting, monitoring, and issuing alerts.
- Contribute to the development of, and deliver, standards-aligned K-12 learning modules, projects and curricula.
- Contribute to achieving the outputs, outcomes, milestones and in meeting the performance measures specified in the proposal.

We look forward to participating in this partnership with The Enterprise Center and other community partners.

Sincerely,

Dr. Justin Robertson
Superintendent

Office of the Superintendent • 3074 Hickory Valley Road • Chattanooga, TN 37421
Tel: 423-498-7042 • www.hcde.org

City of Chattanooga

Mayor Tim Kelly

March 23, 2022

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms. Socia:

In response to the U.S EPA Enhanced Air Quality Monitoring for Communities (EPA-OAR-OAQPS-22-01,) this letter confirms that the City of Chattanooga has enthusiastically agreed to serve as a partner as a part of the CLEEAN, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact project.

Since the peak of Chattanooga's industrial era in the late 1960's, local air quality has made tremendous progress. However, with record growth and a steadily increasing number of cars on our roads and surrounding interstate system, it is important for our community to continue to control air pollution and monitor our progress as outlined in our One Chattanooga Strategic Plan. Potential, longer-term project overlap includes the City of Chattanooga's climate goals and resilience planning, which specifically name "Design Chattanooga for inclusive and sustainable growth," "Expand access and connect our parks, trails, and greenways system," "Invest in sustainable and resilient infrastructure" and "Lead in the emerging green economy" as explicit goals in the draft plan. The City of Chattanooga is committed to identifying specific strategies in partnership with community stakeholders to achieve these goals, and participation in the CLEEAN initiative will go a long way to inform those strategies.

During the grant period we will support the project through the following activities as a part of the grant agreement:

- Provide technical assistance to aid in the expansion of the current Smart Cities efforts to install and utilize sensors.
- Utilize data from this expanded network to inform City resilience and climate adaptation planning.
- Offer City-operated Community Centers as deployment locations. In addition, the monitoring program will provide a basis for new afterschool programming at the centers for local residents and children and may support new investments in historically under-resourced neighborhoods.
- Emphasize environmental and health equity as part of the One Chattanooga Strategic Plan.
- Utilize the data collected for reporting, monitoring and issuing alerts, as well as

integrate historical and newly measured data as part of Chattanooga's Open Data Portal.

- Utilize the project to add enhanced network and data resilience. Contribute to achieving the program outputs, outcomes, milestones, and in meeting the performance measures specified in our proposal.

We congratulate you for your robust and inclusive approach taken toward this effort, and look forward to working with The Enterprise Center and our other community partners in the CLEEAN program.

Sincerely

Erik Schmidt
Director of Sustainability
City of Chattanooga

March 18, 2022

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms. Socia:

In response to the U.S. EPA Enhanced Air Quality Monitoring for Communities notice (EPA-OAR-OAQPS-22-01), this letter confirms that Tetrad/Tellus, led by our team at the University of Utah College of Engineering, will continue our air quality monitoring partnership with Chattanooga, begun through US IGnite in 2020, to support the CLEEAN initiative, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact.

Tetrad/Tellus is committed to developing air quality sensor technology that will improve the world's atmosphere and the lives of those battling chronic illness. With the first intended application as a micro-climate sensing network, the platform technology is ultimately designed to be customized to targeted pollutants for a variety of conditions. Tetrad's low cost IoT platform offers the possibility to collect more spatial and temporal data across the world.

During the grant period we will support the project through the following activities as a part of the grant agreement:

- Provide Tetrad/Tellus PM_{10} and $PM_{2.5}$ sensor hardware and technical assistance.
- Assist in the development and execution of the quality assurance and quality control process.
- Share relevant insight, best practices and data from efforts external to Chattanooga and Hamilton County, in order to inform local deployment and utilization.
- Contribute to achieving the outputs, outcomes, milestones and in meeting the performance measures specified in the proposal.

We look forward to participating in this partnership with The Enterprise Center and other partners.

Sincerely,

Kerry Kelly

Kerry E. Kelly
Co-Founder and Cheif Science Officer
Tellus Networked Sensor Solutions, inc.

Carl Luft

Carl Luft
Vice President
Tellus Networked Sensor Solutions, inc.

March 23rd, 2022

Energy, Connectivity & Community

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms. Socia,

EPB of Chattanooga is pleased to write this letter indicating our support and agreement to serve as a partner for The Enterprise Center's CLEEAN initiative, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact project. EPB will collaborate with both The Enterprise Center and other partners on their funding application for the U.S. EPB Enhanced Air Quality Monitoring for Communities, EPA-OAR-OAQPS-22-01 funding opportunity.

In 2009, EPB deployed an ultra-high speed gigabit per second passive fiber-optic data network and Smart Grid to serve the greater Chattanooga area by providing energy and connectivity solutions as a means of promoting economic development and enhancing quality of life for our community. Our next generation electric and communications system is capable of minimizing outages, incident response times and theft, optimizing operations, increasing system state intelligence, and helping customers and students become more connected. EPB has remained an integral partner in the Chattanooga Smart Community Collaborative initiative, working with partners to develop and deploy projects and technologies that examine and test everything from traffic flow to air quality and safety issues.

EPB is committed to support the CLEEAN initiative project throughout the grant period with the following activities to satisfy the grant agreement:

- Provide backhaul and resiliency for the sensor network through EPB's Smart Grid
- Provide technical assistance to aid in the expansion of the current Smart City cities efforts to install and utilize sensors
- Contribute to the city's resiliency and environmental response plan based on the data and research from the project
- Contribute to achieving the outputs, outcomes, milestones and in meeting the performance measures specified in our proposal

EPB looks forward to participating and continuing its partnership with The Enterprise Center and other community partners.

Sincerely,

James Ingraham
Vice President Strategic Research

PO Box 182255
Chattanooga, Tennessee
37422-7255

green|spaces

Sustainability Made Simple

63 East Main Street

Chattanooga, TN 37408

March 18, 2022

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms.Socia:

This letter confirms that green|spaces, has agreed to serve as a project partner with The Enterprise Center on their funding application for the U.S EPA Enhanced Air Quality Monitoring for Communities, EPA-OAR-OAQPS-22-01 funding opportunity. We agree to partner with both the lead agency and the others on the CLEEAN initiative, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact project.

Since 2007, through our advocacy and incentive campaigns, education and training classes, design competitions, and other programs, green|spaces, a Chattanooga based non-profit organization, has advanced the sustainability of living, working, and building in Chattanooga. We continue to develop new programming that advances our shared mission of meeting our responsibility to be stewards of the environment and raising the quality of life for residents and visitors. green|spaces maintains a keen focus on equity, including through work as part of the the Orchard Knob Collaborative, a targeted area for this project; through a recent TVA grant, we are working to the impact of housing and the built environment on community health, and we anticipate the expanded network will both produce relevant data and, as an asset, have implications for future work and resources We are also part of a separate research project with Three Cubed for which we will install a series of Awair Omni indoor air quality sensors in homes to monitor the air quality before and after a series of interventions intended to improve the indoor air quality and reduce the severity of asthma for residents.

During the grant period we will support the project through the following activities as a part of the grant agreement:

- Provide indoor/outdoor design changes and offer best practices due to expertise in sustainability and environmental planning, as author of the Integrated Community Sustainability Plan.
- Provide technical assistance to aid in the expansion of the current Smart City's efforts to install and utilize sensors, with a particular emphasis on Orchard Knob and other historically underresourced communities.
- Contribute to the city's resiliency and environmental response plan based on the data and research from the project.
- Contribute to achieving the outputs, outcomes, milestones and in meeting the performance measures specified in our proposal.

We look forward to participating in this partnership with The Enterprise Center and other community partners.

Sincerely,

Michael Walton AIA, NCARB, LEED AP

Executive Director
green|spaces
63 E Main Street
Chattanooga, TN 37408
423.648.0963

Chattanooga-Hamilton County Air Pollution Control Bureau

March 21, 2022

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms. Socia:

This letter confirms that the Chattanooga-Hamilton County Air Pollution Control Bureau has agreed to serve as a project partner with The Enterprise Center on their funding application for the U.S. EPA Enhanced Air Quality Monitoring for Communities, EPA-OAR-OAQPS-22-01 funding opportunity. We agree to partner with both the lead agency and the other partners on the CLEEAN, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact project.

The Air Pollution Control Bureau, founded in 1969, strives to administer local air pollution control laws that are intended to achieve and maintain such levels of air quality as will protect human health and safety and to the greatest degree practicable, prevent injury to plant and animal life and property, and foster the comfort and convenience of the people. We are joining this partnership to ensure that healthy air quality is enjoyed by all residents and that underrepresented communities, specifically those of color and low-income households, are empowered to understand how air quality affects their health outcomes and the role they can play in helping inform decisions about air quality control in their respective neighborhoods.

During the grant period we will support the project through the following activities as a part of the grant agreement:

- Provide technical assistance to aid in the expansion of the current Smart Cities efforts to install and utilize sensors;
- Provide calibration data and quality assurance for those continuous monitors maintained by the Chattanooga-Hamilton County Air Pollution Control Bureau;
- Utilize the data collected for reporting, monitoring, and issuing alerts;
- Utilize the project to add additional resiliency to our current monitoring network;
- Contribute to achieving the outputs, outcomes, milestones and in meeting the performance measures specified in the proposal.

We look forward to participating in this partnership with The Enterprise Center and other community partners.

Sincerely,

Kathy Jones

Kathy Jones
Air Monitoring Manager
Chattanooga-Hamilton County Air Pollution Control Bureau

THE UNIVERSITY OF TENNESSEE
CHATTANOOGA

CUIP Center for Urban Informatics & Progress

701 East M.L. King Boulevard
Chattanooga, TN 37403
Phone: (423) 425-5511
Fax: (423) 425-5517
utc.edu/CUIP

March 18, 2022

Deb Socia
The Enterprise Center
1100 Market Street, Suite 500
Chattanooga, TN 37402

Dear Ms. Socia:

In response to the U.S. EPA Enhanced Air Quality Monitoring for Communities notice (EPA-OAR-OAQPS-22-01), this letter confirms that the University of Tennessee at Chattanooga has agreed to serve as a project partner of CLEEAN, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact project.

Since its founding as Chattanooga University in 1886, the University of Tennessee at Chattanooga has focused its resources on excellence in education and research. The Center for Urban Informatics and Progress (CUIP) is a smart city and urbanization research center at the University of Tennessee at Chattanooga. As the City of Chattanooga emerges as a pioneer in urban renewal and sustainable development, CUIP leverages the power of big data, artificial intelligence, statistical modeling, machine learning, and more to engage communities and study how cities can adapt to our generation's challenges to ensure that our future is safer, smarter, and healthier for all. Our applied research efforts pioneer ways to improve traffic flows, reduce vehicle and pedestrian accidents, reduce carbon emissions, optimize healthcare patient outcomes, and more .CUIP also operates Chattanooga's Smart City Testbed, a 1.2 mile, real-world sandbox with a wide array of sensors, computing resources, and experimental wireless networks facilitating cutting edge research across the Smart City ecosystem, including already-deployed PurpleAir sensors which will contribute to the overall goals of CLEEAN. UTC and CUIP are also founding partners of the Chattanooga Smart City Collaborative, with a keen interest in public health outcomes.

Having worked alongside The Enterprise Center, US Ignite and Tetrad on the initial expansion of $PM_{2.5}$ monitoring capacity across Hamilton County, we are excited to support this continued growth. During the grant period we will support the project through the following activities as a part of the grant agreement:

- Provide technical assistance to aid in the expansion of the current Smart City's efforts to install and utilize sensors.
- Contribute to community resiliency and environmental response plans through data and research.
- Provide data and research for this project to inform investments in historically under-resourced neighborhoods, including relevant GIS, demographic and health mapping through UTC's ITG Lab.
- Emphasize environmental and health equity as part of the University Strategic Plan.
- Contribute to achieving the outputs, outcomes, milestones and in meeting the performance measures specified in the proposal.
- CLEEAN monitoring capacity through the development of an Air Quality Monitoring Fellowship housed at UTC/CUIP.

We look forward to participating in this partnership with The Enterprise Center and other community partners.

Sincerely,

Dr. Mina Sartipi
Guerry Professor, Computer Science and Engineering Department and
Founding Director for the Center for Urban Informatics and Progress
University of Tennessee at Chattanooga

The Enterprise Center EPA Air Quality Proposal – Part I. Cover Page

Title: CLEEAN - Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact

Applicant Organization: The Enterprise Center
Address: 1100 Market Street, Suite 500; Chattanooga, TN 37402
Primary Contact: Geoff Millener, 423-661-3300, geoff@theenterprisectr.org
DUNS Number: 149649670

Set-Aside: No set-aside

Applicant Organization Description: The Enterprise Center (TEC) is a non-profit economic development partner to the City of Chattanooga and the Hamilton County region whose mission is to unite people, organizations, and technology to build an advanced and inclusive future for all citizens. With a focus on equity, collaboration, economic mobility, and Smart City innovation, TEC accomplishes its mission through four core initiatives: Community Connectivity and Digital Equity, including HCS EdConnect and Tech Goes Home; Smart Community Technology, Research, and Application Development; the Innovation Ecosystem, including small business and entrepreneur support; and Workforce Development.

Project Partners: Chattanooga/Hamilton County Air Pollution Control Bureau (Kathy Jones), City of Chattanooga (Erik Schmidt), EPB (James Ingraham), Hamilton County Schools (Justin Robertson), green|spaces (Michael Walton), Tetrad/Tellus (Dr. Kerry Kelly), and University of Tennessee at Chattanooga - UTC (Dr. Mina Sartipi)

Project Location: Chattanooga/Hamilton County, TN (South Chattanooga; East Chattanooga; Downtown; Brainerd), includes zip codes of 37401, 37402, 37403, 37404, 37406, 37407, 37408, 37409, 37410, 37411, 37412, 37414.

Air Pollutant Scope – Particle Pollution: $PM_{2.5}$ and PM_{10}

EPA Funding Requested	Total Project Cost
$491,171.00	$491,171.00

Project Period - November 1, 2022 – October 30, 2025

Short Project Description: In addition to ongoing research into the correlation between COVID-19 and air quality, developing data and a more granular understanding of air quality across Hamilton County communities that routinely rank at the bottom statewide for asthma, chronic illnesses, and hospitalization is a high priority for the Chattanooga Smart Community Collaborative (CSCC) and is the focus of this proposal. CSCC partners have already deployed more than 30 air quality sensors at locations across Hamilton County, which stream live data accessible to the public. Funds awarded will support 130 additional fixed, low-cost sensors in the study area, provide 50 sensors for resident use via a library loan program, and add resiliency via one additional FRM/FEM monitor. Live data visualization, health information, and educational resources will be hosted publicly for residents, and sensor data will be imported into repositories, including the City of Chattanooga's OpenData Portal, ensuring practitioners and researchers have access to the network and increasing their ability to advance other research, inform public health advisories, and enhance citizen self-efficacy.

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Part II. Workplan

Section 1 – Project Summary and Approach

A. Overall Project

Sensor, Network, Data Assimilation, Screening, Uncertainty, and Validation. CLEEAN, or Chattanooga Leveling Environmental Equity Across Neighborhoods: Collaborative Smart Community Air Quality Monitoring for Systemic Impact will generate accurate, near real-time estimates of $PM_{2.5}$ and PM_{10} concentrations throughout the Chattanooga and Hamilton County, TN, area. CLEEAN will integrate measurements from the state, Tellus' AirU, and PurpleAir (PA) with rigorous quality assurance (QA), data-fusion algorithms, and engaging visualizations. This infrastructure was originally developed under a National Science Foundation grant, and the back-end services, automated QA, and visualizations have been transitioned to Tellus, Inc. These visualizations, in the form of maps, are available through a public-facing website (**Figure 1**). Tellus' team has *demonstrated the performance of the PM sensors, the infrastructure, and the accuracy of the $PM_{2.5}$ estimate maps in several peer-reviewed publications*. For example, comparing $PM_{2.5}$ concentrations estimated from our infrastructure to FEM measurements during a 2019 pollution event in Salt Lake City revealed RMSE of 4.9–5.7 μg/m^3 and nRMSE of 20.2–21.3% (leave one out cross validation at two different DAQ sites, nRMSE: normalized root mean square error). **Figure *2*** illustrates the infrastructure. The following sections detail the sensing nodes, the infrastructure, the QA and data-fusion, and the visualizations.

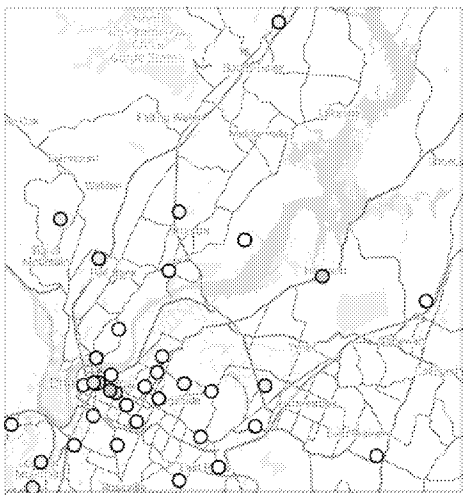

Figure 1. $PM_{2.5}$ concentrations in Chattanooga, 12/1/2021, 10:30 am EDT.

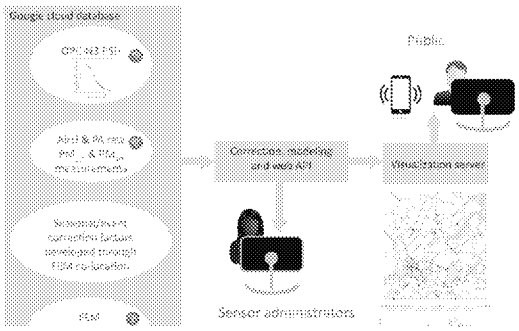

Figure 2 SEQ Figure * ARABIC 2. Overview of measurement through mapping infrastructure.

Sensor nodes. The PM measurements include three types of low-cost sensors (LCS; AirU, AirU$^+$ and PurpleAir, or PA, II), as well as UDAQ FEM/FRMs.

$PM_{2.5}$ measurements. The *AirU node* measures $PM_{2.5}$ concentration with the Plantower PMS3003. It is designed around an Espressif ESP32 microcontroller with WIFI (2.4GHz) and BLE4.0 capabilities. Each node has auxiliary sensors, including Texas Instruments HDC1080 digital temperature and humidity, SGX SensorTech MiCS-4514 Dual-MOS oxidizing and reducing sensors, Quectel L70 GPS Module, and micro-SD card for offline storage of data and log messages. Nodes communicate wirelessly to a Google Cloud Platform (GCP) database. The primary form of communication is via secure MQTT messaging with GCP IoT Core. Devices update their credentials every 6 hours and use private RSA certificates to encrypt messages. Over-The-Air firmware updates are pushed as needed. Currently, there are approximately 30 AirU sensors in the study area. If funded, we anticipate 130 additional fixed AirU and AirU+ sensors in the located across community centers; public schools; City and County government and school district properties; and other community partner locations within distressed communities with high rates of health disparities, minority and low-income households, or households at greater risk for adverse health outcomes (older adults and those with chronic health conditions). An additional 50 sensors will be available to individuals through a library loan program, providing additional live data points.

The *PA II* node measures $PM_{2.5}$ concentration with two PMS 5003 sensors mounted in one housing. It contains a BME280 pressure, temperature and humidity sensor, and an ESP8266 chip to

communicate with the PMS sensor and over WiFi to their cloud. Their measurements are available through a public API. There are approximately 10 PA II sensors in the study area.

PM_{10} measurements. 30 of the 130 additional fixed sensors will be AirU$^+$ models; the AirU$^+$ will measure $PM_{2.5}$ with the PMS 3003 and PM_{10} with the OPC-N3. The AirU+ utilizes the AirU's board's SPI connection port and communication infrastructure. Alphasense provides the libraries necessary to integrate the sensor measurements into an IoT platform, such as the AirU. In addition to using the direct measurements of PM_{10} from the DAQ FEMs and the AirU+ nodes, we will estimate PM_{10} concentrations using the particle size distribution from the OPC-N3s and the co-located AirU and PAII to develop an appropriate AirU or PAII PM_{10} to $PM_{2.5}$ ratio, using the method described by Sugiomoto 2016.

LCS Sensor Performance. Low-cost optical sensors, like those in this proposal, require a correction factor (CF) to convert light scattering to particle mass concentration. We will continue to develop and apply seasonal and event-specific factors for the AirU, AirU$^+$, and PA to provide accurate estimates of $PM_{2.5}$ and PM_{10} by co-locating three sensors of each type with FEMs (detailed in the QA plan). These CFs will be applied seasonally (i.e., winter, spring, summer, fall). An AirU has been in close proximity to The Chattanooga/Hamilton County Air Pollution Control Board's primary Teledyne T640 FEM (Riverside/Siskin Dr. monitoring station) since November of 2021. This has *demonstrated* that, after applying seasonal correction factors (see QA plan), AirUs *meet EPA's performance targets* for $PM_{2.5}$ concentrations. For example, the AirU correlates with the FEM (R^2 0.91) and exhibits a RMSE ranging from 1 $\mu g/m^3$. During this study, the team will deploy a total of three AirU$^+$s at the Riverside monitoring station and will also deploy three PAs at this same station, as well as three more of each model alongside an additional special purpose T640X monitor at a site to-be-determined, for added network resilience and to support calibration and the accuracy of correction factors. The team has also demonstrated performance of the AirUs and PAs in previous peer-reviewed studies.

Data screening and fusion. We will employ rigorous automated data screening to remove outliers and sensors that have experienced drift (see QA plan). The screened and corrected $PM_{2.5}$ sensor measurements are incorporated into a Gaussian Process (GP) model, which includes customized kernel functions that incorporate distance, time, and elevation to obtain continuous-valued spatio-temporal estimates of $PM_{2.5}$ concentration throughout the study region, complete with a confidence value describing the accuracy of the measurement. This GP model allows the construction of dense $PM_{2.5}$ colormaps. The visualizations of $PM_{2.5}$ concentration use the EPA AQI color scheme, which we selected because of its familiarity to the public, although we recognize that this health-based color scheme is based on 24-hour pollutant concentrations.

Data access and storage. The public will have access to real-time and a week of historical visualizations, and individual sensor PM measurements through a public website. More extensive data will be available to the Project Manager, key personnel, and partners through a Google data studio dashboard, and to the public in general through an API, which exposes several routes to access data by sensor ID, location (with radius), aggregation type, and datetime period, and through a phone app. The data includes raw, unfiltered LCS measurements, LCS measurements with CFs applied, CFs (and their time periods), PM gridded estimates used to generate the maps, and PM estimates at any location and time. The data are stored in a private and secure Google Cloud Platform (GCP)-hosted SQL database optimized for time-series storage transactions (Google BigQuery).

Library sensors. 50 AirU sensors will be publicly available through a loan procedure with local public and school libraries so users can monitor pollution levels in and around their homes in real time while actively contributing to community monitoring via a 'citizen science' approach. A secure web portal will be provided to support the checkout procedure. Users will be given instructions on how to access their data during their loan period; users will also be able to opt-in to sharing sensor data, but locations will be removed from public mapping to protect PII. At the end of the loan period the user will be able to access

the data through a secure web portal and/or the Tellus phone app. Users can utilize bandwidth via home WiFi or a concurrently loaned 4G LTE hotspot.

B. Project Significance

Community History. In 1969, Walter Cronkite famously said Chattanooga is the "dirtiest city in America," but the city has made environmental improvement a cornerstone of its 30-year renaissance, with air quality a key concern. From dirtiest city to a model Smart City, it's through partnerships like the CSCC, and US Ignite and NSF, that Chattanooga has been able to leverage emerging technologies and data to improve quality of life, and, with a focus on equity, has already launched a 30 low-cost sensor network. There is, however, more work to be done and additional capacity needed, as many of our urban neighborhoods are near polluting industry, ongoing development, and increased traffic.

Needs. Communities such as Downtown, East and South Chattanooga, and Brainerd, are home to 87,199 people (48% of the city's population). These neighborhoods, which many people of color call home (61% versus 42% citywide), are also some of the lowest income areas (54% vs. 39% citywide). Worse, many of these homes, while historical, remain a constant reminder of Chattanooga's industrial past, as many of the area's largest industrial manufacturers remain in operation inside or adjacent to these communities. These neighborhoods routinely rank at the bottom for asthma (10-12% vs. 8.4% nationally) and other chronic illnesses (non-skin cancer average rate of 6%). Due to industry being critical to the economy of the city, the city's prominence as a logistics and trucking hub, and significant and ongoing residential, commercial, and brownfield development, developing data and a more granular understanding of air quality across these communities is a top priority for CLEEAN.

Our team, utilizing GIS mapping to consider demographic, socioeconomic, and health data, has identified over 200 possible neighborhood locations for air quality sensors, utilizing existing public assets like City Community Centers, Hamilton County Schools, public WiFi locations, and the MLK Smart City TestBed. Additionally, sensors will be co-located at Chattanooga/Hamilton County Air Pollution Control Bureau monitoring stations.

Public Benefit. To ensure that air quality is being monitored in the most polluted and potentially polluted areas, as well as in historically underserved communities with reduced health outcomes, the CLEEAN partnership will identify deployment locations for air quality sensors at the neighborhood level. This allows residents and researchers both to understand and explore air quality at the hyper-local level; the use of low-cost sensors also adds resiliency to the existing monitoring efforts. Chattanooga's municipal fiber infrastructure also ensures that fixed sensors can be cost-effectively deployed, powered, and connected. All collected data will be streamed to a public portal, included in Smart City repositories (including the UTC's Center for Urban Informatics and Progress (CUIP)) and made open source via the City of Chattanooga's OpenData Portal, with the intention of public and private use for policy change, activism, and education. The CLEEAN partnership will further utilize data to create relevant K-12 educational activities, both in the classroom and through city-run afterschool programming. Educational staff will be trained in age-appropriate curriculum and lessons will be framed from the perspective of Chattanooga, its potential pollution, and the impact on health. The library loan program further supports residents, and particularly students, to take an active part in these monitoring efforts.

The CLEEAN partnership's focus on breadth of deployment using LCSs, particularly in underserved communities, specifically addresses inequity in access to relevant air quality, as well as provides information to community leaders for mitigation and policy change.

Section 2 – Community Involvement

A. Community Partnerships

Chattanooga has a robust history of creating and sustaining partnerships to help establish, nurture, and scale projects. One example is the Chattanooga Smart Community Collaborative (CSCC), leading to

Chattanooga being one of two U.S. cities selected for the G20 Global Smart City Alliance policy roadmap Pioneer Programme. TEC is the convener of CSCC, which includes subgroups focused on health equity; sustainable energy; smart logistics; and infrastructure resiliency. In addition to convening the collaborative, TEC lends a perspective on equity, ensuring community voices have agency. Several CSCC members have partnered with TEC on CLEEAN, along with additional community stakeholders (**Table I**).

Table I. Community Partnerships

Project Partners	Contacts	Roles
The Enterprise Center	Deb Socia, President/CEO Geoff Millener, COO	Fiscal agent, convener, project management and oversight, curriculum development, community engagement, reporting
Chattanooga /Hamilton Co. Air Pollution Control Bureau	Kathy Jones, Air Monitoring Manager	Technical assistance; calibration data and QA for monitors they maintain, use of data in core air quality monitoring
The City of Chattanooga	Erik Schmidt, Director of Sustainability	Technical assistance; data integration within Open Data Portal; sensor placement at City Community Centers; and implementation sites for afterschool curriculum
EPB (Electric Power Board for Chattanooga)	James Ingraham, Vice President Strategic Research	Technical assistance; Backhaul and resiliency for the sensor network through EPB's Smart Grid
University of Tennessee at Chattanooga	Dr. Mina Sartipi, Guerry Professor, Computer Science and Engineering, and Founding Director of the Center for Urban Informatics and Progress	Host and support AQM Fellow; Technical assistance; data and research to inform investments in historically under-resourced communities, including GIS, demographic, and health mapping through UTC's ITG lab
Tellus, Inc.	Dr. Kerry Kelly, Associate Professor, Chemical Engineering, Univ. of Utah and Associate Director, Program for Air Quality, Health and Society	Tetrad/Tellus PM_{10} and $PM_{2.5}$ sensor hardware and technical assistance; development and execution of QA/QC process; insight, best practices, and data from efforts external to Hamilton Co. to inform local deployment and utilization
Hamilton County Schools	Justin Robertson, Superintendent	Site locations; library sensor loan program collaboration; development and delivery of standards-aligned curricula
green|spaces	Michael Walton, Executive Director	Design changes; technical assistance; use of data in ongoing research; integration of data within sustainability planning

Expertise. In addition to the expertise offered from TEC, our partners include the city's leader in air pollution control, key government leaders, the operators of our nationally recognized electric power board and smart grid, two academic partners including a major university and the county school district, a grassroots environmental and equity organization, and the designers of the low-cost sensors proposed for use in this project. Through the addition of a dedicated project Fellow, to be hosted by UTC, we will add additional capacity and expertise to the ongoing work.

Partner Benefits. CLEEAN benefits include the increased access to near real-time and localized data from which to base decisions on health alerts, inform community education and outreach efforts, enhance existing and future resiliency efforts, and inform public policy. Additionally, a more informed citizenry regarding air quality and its impact on health and long-term environmental impact leads to a more engaged population where citizens take part in the conversations and design process regarding environmental solutions for their communities and creates future generations of ecological advocates.

Sustainability. The Tellus low-cost sensors selected for this project have a low failure rate, even over time, and are inexpensive to replace, once installed, making upkeep manageable. The volume of sensors deployed creates network resiliency, and our deployment strategy will account for redundancy to ensure CLEEAN's replacement protocol for aging or malfunctioning sensors will have minimal downtime regarding data collection. We are confident that achieving the projected outcomes will enable us to leverage additional dollars to continue CLEEAN well past the funding period; proposal goals further align directly with the core mission work of project partners, adding additional institutional sustainability.

B. Community Engagement

TEC is the primary driver of a significant number of signature technology and innovation programs in the region. Given TEC's specific focus on equity and involvement in several major initiatives within the

county's most vulnerable populations, CLEEAN will be able to make program design and project education roundtables accessible to multiple target populations, including minority, immigrant, low-income, older adults, and those with chronic health conditions and/or disabilities. Specifically, the communities of Downtown, Brainerd, East Chattanooga, and South Chattanooga will be engaged in the design process.

TEC will ensure these populations have input into the design of CLEEAN through offering community surveys, roundtables, and education/outreach events. To engage the affected communities TEC will (1) leverage our involvement convening the multi-stakeholder TVA Connected Communities pilot serving residents in Orchard Knob, one of the most impoverished and aging communities in Chattanooga; (2) engage low-income residents who participate in both our digital equity programming focused workforce development and on telehealth technologies and disease management; (3) convene community input sessions at City Community Centers and Title I schools, both located in an under-served communities and service high low-income and minority populations; and (4) partner with local immigrant-serving organizations to reach the county's largest community of non-English speakers by hosting workshops in Spanish.

Data Usage. Data from this project will be offered publicly, as an accessible and live visualization of neighborhood-level air quality across the city, as well as uploaded to Chattanooga's Open Data Portal for use by all. User workshops will be held in the same target communities that participated in project design to ensure that residents understand how to access, synthesize, and utilize data to make personal health decisions. Included in these workshops will be neighborhood associations, faith-based groups, and health providers who will help sustain the conversation regarding the correlation between air quality and health outcomes and how citizens can engage with local governments to help affect policy change. Additionally, CLEEAN partners and other stakeholders have pledged to utilize data from their project to inform resiliency and environmental response planning, as well as to support related Smart City research.

Section 3 – Environmental Justice/Underserved Communities

The proposed project will cover the breadth of Chattanooga and Hamilton County's diverse communities while seeking to particularly benefit historically underserved communities within the Chattanooga city limits, with a focus on Brainerd, Downtown, East Chattanooga, and South Chattanooga. These communities, which are represented by 27 census tracts, are home to 87,199 people, or 48% of the city's total population. This combined area is representative of Chattanooga's highest density of people of color (61% versus 42% citywide) and low-income families (54% versus 39% citywide)—more specifically, EJSCREEN data reports this area has an average Demographic Index of 57%, while the city's 41%, EPA Region's 34%, and United States' 36%, are all significantly lower (**Table II**).

Table II. Demographic Data

Area	Demographic Index	Unemployment Rate	Linguistically Isolated	Less than HS Education
Downtown	46%	7%	1%	16%
East Chattanooga	68%	10%	2%	20%
Brainerd	45%	3%	1%	10%
South Chattanooga	67%	15%	8%	30%
Total/Average	***57%***	***8%***	***3%***	***18%***
Chattanooga	41%	6%	2%	12%
Hamilton County	30%	5%	2%	11%
TN Avg.	31%	5%	2%	13%
EPA Region (4) Avg.	34%	6%	3%	13%
US Avg.	36%	5%	5%	12%

Chattanooga's continued growth (10.60% since 2010, or .48% annually) and limited housing stock has resulted in significant development, particularly in historic neighborhoods. In just the first half of 2021, single-family home build permits were up 44% in the county, with a total of 1,450 new homes constructed in the area. Construction, which seem innocuous, contributes to 25%-40% of the world's carbon emission,

while also producing harmful particulate pollution and requiring the burning of fossil fuels–increasing greenhouse gas emissions.

Education and mitigation factors are needed to improve health outcomes, especially as moving is rarely an option for those with lower incomes. Complicating prevention and health education in these neighborhoods is a higher-than-average concentration of individuals unable to complete a high school education or its equivalent. Moreover, in South Chattanooga specifically, there is a significant number of individuals considered linguistically isolated (8%). Such language barriers further highlight the need for an intentional approach to inclusion and education that considers culture, education level, and access.

Table III. Air Pollutant Data			
Area	**Particulate Matter 2.5 (µg/m3)**	**Diesel Particulate Matter (µg/m3)**	**Air Toxics Respiratory Hazard Index**
Downtown	8.84	0.461	0.5
East Chattanooga	8.9	0.454	0.51
Brainerd	8.945	0.4495	0.5
South Chattanooga	8.93	0.382	0.5
Total/Average	***8.90***	***0.44***	***0.50***
Chattanooga	8.84	0.367	0.48
Hamilton County	8.73	0.299	0.45
TN Avg.	8.2	0.231	0.4
EPA Region (4) Avg.	8.18	0.261	0.4
US Avg.	8.74	0.295	0.36

On average, these individuals, representing nearly half of Chattanooga's population, are living with Particulate Matter 2.5 and Diesel Particulate Matter values at 8.9 and 0.44 µg/m3, respectively, and an Air Toxics Respiratory Hazard Index of .50. This data shows that a large group of people in the city of Chattanooga are at a greater risk of pollution-related disease, such as asthma and cancer, than those within the state or even nationally—a concern that is backed by recent CDC data. These four focus communities suffer from Asthma rates ranging from 10% to 12%, with South and East Chattanooga showing the worst rates—the US average is only 8.4%. Moreover, the cancer (non-skin) rate for these communities averages 6%.

Table IV. Air Pollutant Percentile Data						
EJ Index Percentile	**Downtown**	**E. Chattanooga**	**Brainerd**	**S. Chattanooga**	**Chattanooga**	**Hamilton Co.**
State						
Particulate Matter 2.5	84	90	78	93	76	54
Diesel Particulates	88	94	82	95	81	62
Air Toxics Respiratory HI	85	91	79	93	77	54
EPA Region						
Particulate Matter 2.5	75	83	65	86	62	40
Diesel Particulates	80	87	72	88	71	47
Air Toxics Respiratory HI	77	85	67	88	64	40
USA						
Particulate Matter 2.5	76	83	67	86	65	43
Diesel Particulates	80	88	72	89	71	50
Air Toxics Respiratory HI	80	87	69	90	67	40

Through the installation of additional air quality monitoring sensors across, with an intentional focus within low-income, minority, and linguistically isolated communities, the proposed project intends to utilize data to provide quicker and more informative community alerts, focused outreach and education, and increased self-efficacy among these under-resourced communities. We will work closely with the City of Chattanooga, community organizations, such as the Urban League of Greater Chattanooga and La Paz, and the local school system to provide workshops and afterschool education to a range of cohorts on topics such as *What is Air Pollution*; *Air Quality Awareness*; and *Mitigation Activities*. Education and

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outreach will be offered in both Spanish and English, and there will be a concerted canvassing effort to ensure all families are aware of education opportunities and how to receive air quality reports.

We will form an **Air Quality Community Advisory Council** consisting of 12 or more community members from across the City of Chattanooga, in addition to CLEEAN partners. The council members will reflect the diversity of the hardest hit communities and possess diverse skill sets and a range of relevant knowledge and technical experience. The Advisory Council will meet quarterly to review air quality reports, hear from health experts, support environmental justice activities; and inform policies, research interests and other grant activities. One of the first key responsibilities of this council will be to assist with the planning and implementation of this proposed project.

Section 4 – Environmental Results—Outcomes, Outputs and Performance Measure

A. Expected Project Outputs and Outcomes

The CLEEAN partnership has designed outputs and outcomes to demonstrate how increased monitoring capacity, data granularity and immediacy, and community engagement can support long-term impact on reducing harmful airborne particulates in underrepresented neighborhoods and those with heavy industry and/or development, as well as reduce the negative health impacts for vulnerable populations, including minorities, low-income, older adults, and those with chronic health conditions. **Table V** outlines our short-term outcomes, which we see as the first step in achieving longer term goals such as data-informed local air quality and brownfield development policies, enhanced resiliency planning and 0-carbon and climate change adaptation, reduction in $PM_{2.5}$ and PM_{10}, and measurable health improvements, such as the reduction of asthma emergencies.

Table V. Outputs and Outcomes

Category	Output/Activities	Outcome/Measures
Improve Monitoring Capacity, Accuracy and Resiliency	Modeling, site selection, community engagement	Deploy 130 fixed monitors and assess data collected by these sensors
Increase Community Engagement	Convene Air Quality monitoring committee; host 4 quarterly community meetings, annually; develop a public portal for live data and a library loan system	100 individuals will checkout sensors through the library loan program and we will measure number of visitors to the public portal annually
Increase Stakeholder Engagement	Conduct 12 annual CLEEAN stakeholder meetings	Increased funding for air quality projects and 10% growth in number of datasets accessed in the city's OpenData Portal year over year
Expand High School Education Models	Create health, policy, and environmental science projects, lessons, and curricula	90% of students will demonstrate an increase in knowledge of air quality and how it relates to health and the overall ecosystem via surveying; we will measure number of classes and students annually
Improve Understanding of the Relation between Air Quality and Health	Create air quality, health, and policy modules; conduct community meetings and trainings in collaboration with health provider; integrate health resources within online portal	80% of participants in training will show an increase in knowledge of air quality and how it relates to health outcomes; we will measure number of participants annually
Identify Neighborhoods of Environmental Concern	Create an index and ranking system and distribute to and educate policymakers and other stakeholders	Use community baseline particulate readings and measures neighborhood levels against baseline annually

B. Performance Measures and Plan

CLEEAN Project Manager will oversee all contractors and project partners, and the Advisory Council will meet quarterly to review air quality reports, produce community-facing communications, support environmental justice activities, and craft policy change petitions for local and state governments. This council, led by the Project Manager, will be responsible for ensuring that the project progresses in accordance with the plan, is on target to achieve milestones, and adheres to reporting guidelines and the report submission timeline. Additionally, TEC will be responsible for tracking and reporting all expenditures and purchases to ensure they are in alignment with grant award documents, as well as

subawards. Lastly, the project will be evaluated by the CLEEAN partnership, with TEC leading the effort in consultation with Tellus, Inc., who will be over QA/QC.

C. Timeline and Milestones

Table VI. Timeline	
Timeframe	**Milestones**
Y1 Q1 Nov-Dec, 2022	• Conduct community outreach, best-fit data analysis, and site selection for network expansion. • Develop public facing mapping and resource pages. • Procure equipment approved in grant award. • Integrate live data into databases.* • Develop school and public library lending programs. • Develop relevant curricular resources for K-12 integration. • Convene partners through monthly CSCC meetings. • Identify Advisory Council members and meet quarterly through grant lifecycle. • Host community engagement workshops to inform project execution. • Track all project progress outputs, expenditures and submit quarterly reports as an ongoing activity through Y3, Q4.
Y1 Q2 Jan – March, 2023	• Oversee installation activities. • Further develop public facing mapping and resource page. • Receive, inventory, and tag purchased equipment. • Further develop school and public library lending programs. • Deploy $PM_{2.5}$ and PM_{10} sensors. • Publish continuous, live $PM_{2.5}$ and PM_{10} data via public portal and integrated within existing databases as ar ongoing activity throughout the lifecycle of the grant. • Plan for and submit quarterly grant reports – ongoing each quarter.
Y1 Q3 & Q4 April-Sept, 2023	• Further deployment of $PM_{2.5}$ and PM_{10} sensors. • Implement school and public library lending programs. • Conduct community engagement and education events – ongoing each quarter. • Monitor data (continuous/ongoing) via live data streams and integration within existing databases, offering regular reporting to community stakeholders.
Y2 Q1 Oct – Dec, 2023	• Create assets through ongoing educational resources and curriculum development. • Integrate data within related research or policy activities.
Y2 Q2-Q4; Y3 Q4 Jan 2024 – Oct 2025	• Continuation of ongoing, aforementioned activities
Y3 Q4 July – Oct, 2025	• Final report developed and discriminated to community and stakeholders.

Section 5 – Quality Assurance Statement - See Optional Attachment Form

Section 6 – Programmatic Capability and Past Performance

A. Past Performance

Table VII lists TEC's top five grants over the past three years. Each grant award was managed in accordance with its funder-mandated compliance requirements, and through a combination of internal leadership and staff, community partners, and outsourced project management, when applicable, TEC was able to complete each grant period successfully.

Table VII. Past Performance				
Award Year	**Funder**	**Type**	**Purpose**	**Amount**
2019	City of Chattanooga	Local Govt	Operations, Innovation District, Digital Equity, Smart Cities	$2,227,500
2020	CARES Act	State/Federal	Internet access, digital literacy	$1,663,460
2020	City of Chattanooga	Local Govt	Operations, Innovation District, Digital Equity, Smart Cities	$1,423,500
2020	TN Department of Human Services/Signal Centers, Inc.	State Subaward	Workforce Development, Early Childhood Education, Digital Lit.	$1,272,155
2021	City of Chattanooga	Local Govt	Operations, Innovation District, Digital Equity, Smart Cities	$1,418,500

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B. Reporting Requirements

TEC has a long history of meeting funders' reporting requirements on time and achieving the outcomes of those agreements. In the rare case that the scope of the project has shifted, or an unforeseen complication arises, as in the case of the COVID-19 pandemic, TEC has conducted timely and appropriate communication with funders to scale project scope according to circumstance. TEC has a history of submitting acceptable final technical reports under our grant agreements and has enjoyed repeat funding by local, state, and federal entities. Lastly, TEC undergoes a federal single audit annually, and has never had any negative findings.

C. Staff Expertise

Applicant Organization. TEC's involvement in advancing Smart City research and application development activities helps further cement Chattanooga as a national leader and model community. TEC leads specific Smart City initiatives, like the newly installed 40-sensor air quality monitoring network and the TVA-funded, public health-focused Connected Community pilot in Orchard Knob, as well as educational applications, like the 4K microscope housed at the STEM School. TEC also convenes the Chattanooga Smart Community Collaborative, a growing group of our region's major institutions who work together to identify challenges in our community and create innovative solutions.

Staff Strengths. Chief Operating Officer at TEC, **Geoff Millener**, will serve as Project Manager for CLEEAN. Geoff has served as project manager and program director for an evolving portfolio of Smart City, education, and technology initiatives. A graduate of Amherst College, he works collaboratively with local, state, and national partners in the public, private, and non-profit sectors. Related to CLEEAN, he is the project lead for a 40+ continuous $PM_{2.5}$ sensor network across Hamilton County, working in collaboration with community anchor institutions and partner cities, including Salt Lake City, Cleveland, and Kansas City. Additionally, Geoff leads the TVA-funded Orchard Knob Collaborative Smart City pilot that focuses on the social determinants of health in a historically underrepresented neighborhood.

Additional staff support by CLEEAN partners includes: (1) **Erik Schmidt:** As Director of Sustainability for the City of Chattanooga, Erik provides coordination and planning for the Mayor's Office to achieve greater presence and adoption of sustainable business and resilience practices, including the *Clean Energy for Low Income Communities Accelerator*, and engages with stakeholder groups for regional resilience planning. (2) **Kathy Jones:** Kathy has 26 years of experience with the Chattanooga-Hamilton monitoring sites for ozone and particulate matter. She oversees the regulatory data that are compared against the National Ambient Air Quality Standards (NAAQS) and submission of the data to EPA's national database. Kathy has expertise in criteria pollutants; hazardous materials; indoor pollution; radon; radon in schools; asbestos air sampling, analysis, supervision, and inspection; odors; visible emissions; and pollen and mold. (3) **Dr. Mina Sartipi:** Dr. Sartipi is the Founding Director of the Centers for Urban Informatics and Progress (CUIP) at the University of Tennessee at Chattanooga (UTC), where she is also a Guerry Professor in the ComputerScience and Engineering Department. She will direct the Air Quality Monitoring Fellow for CLEEAN. (4) **Dr. Kerry Kelly:** Dr. Kelly is an Associate Professor of Chemical Engineering at the University of Utah. She has a PhD in Environmental Engineering and a BS in Chemical Engineering. She served eight years on Utah's Air Quality Board and currently serves on the state's Air Quality Policy Advisory Board. Her research focuses on three areas: linking combustion particle physicochemical properties to toxicological endpoints; understanding the connections between energy, air quality, and health; and using low-cost air-quality sensing to understand local-scale, air quality differences, engage students, and understand and improve sensor performance. (5) **Michael Walton:** Michael is the Executive Director for green|spaces, has 15 years of experience in sustainable development, and most recently spearheaded the creation of the Chattanooga Integrated Community Sustainability Plan, which outlines a series of

collective goals, values, strategies, and tactics to advance Chattanooga's environmental, social, and economic sustainability.

Section 7 – Budget

A. Budget Detail

Line Item & Itemized Cost	EPA Funding
Personnel	
(1) Project Manager (TEC COO at 10%)	$24,600.00
TOTAL PERSONNEL	$24,600.00
Fringe Benefits	
Project Manager @ 18%	$4,428.00
TOTAL FRINGE BENEFITS	$4,248.00
Travel	
Project Staff Local Travel @ 50 miles/week (.585/mi)	$4,563.00
TOTAL TRAVEL	$4,563.00
Equipment	
1 Teledyne T640x Continuous PM2.5 + PM10 Monitor with Auxiliary Flow System and Shelter	$49,166.00
1 Agilaire 8872 Logger Housing and Display Monitor	$12,810.00
TOTAL EQUIPMENT	$61,976.00
Supplies	
100 AirU Continuous PM2.5 Monitors ($250/unit)	$25,000.00
10 Annual Replacement AirU PM2.5 Monitors (Year 2 & 3)	$5,000.00
30 AirU+ Continuous PM2.5/PM10 Monitors ($805/unit)	$24,150.00
3 Annual Replacement AirU+ PM2.5/PM10 Monitors (Year 2 & 3)	$4,830.00
50 AirU Continuous PM2.5 Monitors - Library Kit ($250/unit)	$12,500.00
5 Annual Replacement AirU PM2.5 Monitors for Library (Year 2 & 3)	$2,500.00
Marketing and Outreach Materials	$7,500.00
TOTAL SUPPLIES	$81,480.00
Contractual	
130 AirU Monitor Installation ($500/unit)	$65,000.00
AirU Support (Equipment Calibration, QA, Data Administration and Visualization)	$39,729.00
Community and Air Quality Consulting	$30,000.00
Teledyne T640x Monitor Installation	$20,000.00
TOTAL CONTRACTUAL	$154,792.00
Other	
Subaward: University of Tennessee at Chattanooga CUIP (Air Quality Monitoring Fellow)	$129,846.00
TOTAL OTHER	$129,846.00
Indirect Charges	
Project Cost x Federal de minimus Indirect Cost Rate (10%), less equipment and applied to the first $25,000 of subaward	$29,141.00

TOTAL INDIRECT	$29,486.00
TOTAL FUNDING	**$491,171.00**
TOTAL PROJECT COST	**$491,171.00**

B. Reasonableness of Costs

Personnel ($24,600): One Program Director (10% time), employed by TEC, who will oversee the project's execution and prepare required reporting

Fringe Benefits ($4,248): The budgeted fringe benefits are calculated at 18% of salary and include employee insurance, retirement, and unemployment.

Travel ($4,563): Staff travel is calculated at $0.585/mile for 50 miles a week over three years (156 weeks). The budgeted travel covers the cost of local, in-state travel for presentations or workshops.

Equipment ($61,976): Budgeted equipment includes 1 Teledyne T640x Continuous PM2.5 + PM10 Monitor with Auxiliary Flow System and Shelter ($49,166); and 1 Agilaire 8872 Logger Housing and Display Monitor ($12,810).

Supplies ($81,480): Due to the sub-$5,000/unit cost of air monitors, these devices are classified as Supplies: 100 AirU Continuous PM2.5 Monitors ($250/unit - $25,000) plus an additional 20 as replacements in years 2and 3 ($5,000); 30 AirU+ Continuous PM2.5/PM10 Monitors ($805/unit - $39,150) plus an additional 3 as replacements in years 2 and 3 ($4,830); and 50 AirU Continuous PM2.5 Monitors - Library Kit ($250/unit - $12,500) plus an additional 5 as replacements in years 2 and 3 ($2,500). We have also included $7,500 for materials related to outreach and marketing to ensure that individuals are aware of the project, how to attend workshops or classes, and how to access air quality reports–this cost also includes Spanish translation for all written materials.

Contractual ($154,792): We will contract with expert organizations to provide four services. Low cost sensor installation ($65,000), estimated at $500/device based on prior experience in installation; installation of the T640X ($20,000), with an estimate provided by CHCAPCB based on prior experience; and necessary community engagement and air quality consulting services ($30,000) will be provided by a to-be hired contractor(s). Support, specific to AirU devices, ($39,729) will be provided by Tellus.

Other ($129,846): Through a subaward, the University of Tennessee at Chattanooga Center for Urban Informatics and Progress will create a position and bring on an Air Quality Monitoring Fellow to support the work of CLEEAN, monitor network health, develop reporting materials, upload and share data, conduct community outreach and otherwise support partner organizations and grant goals.

Indirect Charges ($29,486): We are using the Federal de minimus Indirect Cost Rate (10% of Direct Costs, excluding equipment and applied to only the first $25,000 of a subaward).

C. Expenditure of Awarded Funds

Primary financial oversight will be provided by TEC's President and CEO and the board's executive committee, as well as through our contracted staff accountant. All TEC financial practices are in accordance with U.S. Generally Accepted Accounting Principles (GAAP) and in compliance with Financial Accounting Standards Board (FASB) guidelines. TEC has successfully received and managed federal grants from the EPA, the Department of Transportation totaling $1.62M, and the CARES Act totaling over $1.6M. Additionally, TEC receives a federal single audit annually, performed by an independent auditor, and all past audits have been clean with no material deficiencies or weaknesses identified.

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Geoffrey C. Millener

Ex. 6 Personal Privacy (PP)

Work Experience

Chief Operating Officer (September 2021 – Present) The Enterprise Center: *Chattanooga, Tennessee*
Senior Program and Operations Officer (April 2020 – August 2021), **Digital Equity Officer** (August 2017 – April 2020)

- Manage internal and external processes across the organization's teams and brands
- Provide strategy, project management and execution for an evolving portfolio of economic development, broadband, digital access, Smart City, workforce, entrepreneurship and emerging technology initiatives
- Project lead for a 40+ continuous $PM_{2.5}$ sensor network across Hamilton County, working in collaboration with community anchor institutions and partner cities, including Salt Lake City, Cleveland and Kansas City.
- Project lead for the TVA-funded Orchard Knob Collaborative Smart City pilot, investing in the built-environment and connective infrastructure, with a focus on the social determinants of health in an historic neighborhood
- Support strategic growth and development, fostering community, philanthropic and corporate partnerships
- Work collaboratively with local, state and national partners in the public, private and non-profit sectors
- Build sustainability into new and emerging work as lead grant writer, resulting in more than $18M in organizational funding and for multistakeholder community initiatives
- Lead community operations team for HCS EdConnect, securing a 10 year, $15M commitment to provide home connectivity for low-income students while conducting tracking, data analysis, communications and outreach
- Coordinate research and evaluation efforts with university partners, Fellows and summer scholars
- Translate innovative, highly technical projects into compelling narratives, with bylines for Brookings, TechDirt and other publications; regular podcast, television and other media experience
- Invited speaker at local, national and international convenings on Smart Cities, digital equity and technology
- Named the national Charles Benton Digital Equity Champion: Emerging Leader by NDIA in 2021

Innovation & Technology Programs Manager (June 2015 – August 2017) PEF: *Chattanooga, Tennessee*

- Responsible for program development and management, grant writing, marketing, communications and budgeting for signature social entrepreneurship, technology and public policy initiatives
- Led Teacherpreneur, a startup incubator and accelerator for educators, serving as project manager for a portfolio of 70 early-stage startups; facilitating the application cycle, judging and award allocation
- Built and directed a 16-month advocacy and public policy fellowship for educators, convening a network of policymakers, elected officials, journalists and nonprofit and civic leaders
- Named to Mozilla's inaugural Network50, an international group 'who made the Internet a better place,' in 2017

Project Coordinator (June 2014 – June 2015). Mozilla: *Mountain View, California* and *Chattanooga, Tennessee*

- Provided project management for eight gigabit startups in Chattanooga, accelerating community, national and international connections for teams as part of the multi-city, NSF-supported Mozilla Gigabit Community Fund
- Crafted narrative around Fund projects and activities, translating local success to an international audience
- Created systems and processes around grant selection and project management for a multi-city network

Education

Amherst College (August 2007 – May 2011) *Amherst, Massachusetts*

- Bachelor of Arts with Distinction conferred in May 2011; double major in English and Spanish

La Universidad de Salamanca (August 2009 – January 2010) *Salamanca, Spain*

Additional Experience and Activities

Chair, Regional Broadband Alliance (Jan. 2019 –) Thrive Regional Partnership: *Alabama, Georgia and Tennessee*
Community Advisory Board, Assistive Technology (Oct. 2019 –) Signal Centers, Inc.: *Chattanooga, Tennessee*
Community Advocate Various Organizations: *Chattanooga, Tennessee*

- Leadership Tennessee NEXT – Class IV (2022); Trustee, UNFoundation (2021 –); Chattanooga Times Free Press '20 under 40' (2020); Chair, St. Paul's Outreach Grants Committee (2019 –); Leadership Chattanooga (2018/19); Signal Centers Accessibility Summit Committee (2019 –); Chair, Community Digital Equity Committee (2016 –)

Kerry E. Kelly, P.E., Ph.D.
University of Utah

A. PROFESSIONAL PREPARATION

Purdue University, West Lafayette, IN	Chemical Engineering	B.S., 1988
University of North Carolina Chapel Hill, Chapel Hill, NC	Environmental Engineering	M.S. 1991
University of Utah	Environmental Engineering	PhD 2015

B. APPOINTMENTS

2015-present, Assistant Professor, Chemical Engineering, University of Utah

2013-present, Associate Director, Program for Air Quality, Health and Society

2010-2015, Research Associate and Assistant Director, Utah Clean Coal Program, Department of Chemical Engineering and Institute for Clean & Secure Energy, University of Utah

2002-2010, Associate Director, Institute for Combustion & Energy Studies, University of Utah

2000-2010, Research Engineer, Institute for Combustion & Energy Studies, University of Utah

1996-2000, Research Engineer, University of Tennessee

1994-1996, Scientist, Fraunhofer Institute for Atmospheric Environmental Research (Germany)

1992-1993, Process Engineer, Radian Corp.

C. PRODUCTS

i) Directly Related to Project

T. Sayahi, A. Butterfield, **K.E. Kelly** (2019) Long-term field evaluation of the Plantower PMS low-cost particulate matter sensors, Environmental *Pollution,* 245, 932-940.

K. Le, K. Tingey, T. Becnel, P. Giallardon, T. Butterfield, **K.E. Kelly** (2018) Building air quality sensors & inspiring citizen scientists, *Chemical Engineering Education*, 52, 3, 193-201. http://journals.fcla.edu/cee/article/view/106570/102014

K.E. Kelly, J. Whitaker, A. Petty, C. Widmer, A. Dybwad, D. Sleeth, R. Martin, A. Butterfield (2017) Ambient and laboratory evaluation of a low-cost particulate matter sensor, *Environmental Research*. 221, 491-500. http://dx.doi.org/10.1016/j.envpol.2016.12.039

K.E. Kelly, R. Altizer, J. Husle, B. Mohanty, J. Ferraro, C. Haltiner, L. Banks (2015) BadAirDay.org This video game allows players, as mayor, to see the effects of policy and personal decisions on Utah's air quality. It is based on the state's air emissions inventory and was developed in partnership with the Utah Division of Air Quality, the Utah Health Department, Breathe Utah, and the Utah Education Network.

K.E. Kelly, R. Kotchenruther, R. Kuprov, G.D. Silcox (2013) Receptor model source attributions for Utah's Salt Lake City airshed and the impacts of wintertime secondary ammonium nitrate and ammonium chloride aerosol, *Journal of the Air & Waste Management Association*, 63:5, 575-590.

ii) Additional Significant Publications

G.D. Silcox, **K.E. Kelly**, E.T. Crosman, C.D. Whiteman, B.L. Allen (2012) Wintertime $PM_{2.5}$ concentrations during persistent, multi-day cold-air pools in a mountain valley, *Atmospheric Environment,* 46 17-24.

K. Le, T. Butterfield, **K.E. Kelly**, Citizen Scientists Engagement in Air Quality Monitoring, *Proc. ASEE Annual Meeting,* June 23 – 27, Salt Lake City, UT.

M. Baasandorj, S.W. Hoch, R. Bares, J.C. Lin, S.S. Brown, D.B. Millet, R. Martin, **K.E. Kelly**, C. Jaramillo, K.J. Zarzana, W.P. Dube, G. Tonnesen, C.D. Whiteman, J. Sohl (2017) Contribution of early morning and nighttime chemistry to wintertime $PM_{2.5}$ pollution episodes in Salt Lake Valley, Utah. *Environmental Science & Technology.* 51(11):5941-5950. doi: 10.1021/acs.est.6b06603.

J. Wilkey, **K.E. Kelly**, I.C. Jaramillo, J.P. Spinti, T. Ring, M. Hogue (2016) Predicting emissions from oil and gas operations in the Uinta Basin, *Journal of the Air & Waste Management Association.* 66(5):528-45. doi: 10.1080/10962247.2016.1153529.

K.E. Kelly, Z. Luo, Tao Wang, E.G. Eddings (2015) Joint NSF-NSFC workshop on combustion related to sustainable energy, *Combustion Science & Technology,* http://www.tandfonline.com/doi/full/10.1080/00102202.2015.1089239

D. SYNERGYSTIC ACTIVITIES

- State policy leadership: Utah State Air Quality/Air Quality Policy Board (2009 – present).
- Co-founded the University of Utah's Program for Air Quality, Health and Society.
- Leads HiGear, a camp for high-school women to introduce engineering concepts through hands-on activities.
- Local policy Leadership: Salt Lake City Mayor's Air Quality Advisory Committee
- Professional Leadership: AIChE Environmental Division Area Chair

Mina Sartipi, Ph.D.

Founding Director - Center for Urban Informatics and Progress
Guerry Professor - University of Tennessee (UT) Chattanooga
Data Science and Engineering Faculty - Bredesen Interdisciplinary Research Center, UT
E-mail: mina-sartipi@utc.edu Home Page: http://www.utc.edu/CUIP

EDUCATION

Young American Leaders Program (YALP)	Harvard Business School	2019
UT Leadership Institute	University of Tennessee	2017
Ph.D in Electrical and Computer Engineering	Georgia Institute of Technology	2003 - 2006
M.S. in Electrical and Computer Engineering	Georgia Institute of Technology	2001 - 2003
B.S. in Electrical Engineering	Sharif University of Technology	1996 - 2000

RESEARCH AREAS

- Smart Cities (Mobility, Energy, and Health)
- Urban Informatics
- Cyber-Physical Systems (CPS)

EXPERIENCE

Founding Director for the Center of Urban Informatics and Progress (CUIP) **Chattanooga, TN** **2018 - present**

- Participated in over $10M funded grants, over $4M of which was led by CUIP
  - Department of Energy, National Science Foundation, Industry, State, and foundations
- Lead a team of 25 people
  - Consisting of research faculty, postdoctoral fellows, students from interdisciplinary background, and marketing
- Developed MLK Smart Corridor - an urban testbed for testing smart mobility solutions in the real-world settings
  - Engaging industry and academic institutions to utilize the testbed
  - Secured funding from federal resources, industry, and foundations to expand,
- Coordinating Smart City research and the strategic vision for Urban Science

UC Foundation Professor, **Chattanooga, TN** **2015 - present**
Department of Computer Science and Engineering
University of Tennessee at Chattanooga

PROFESSIONAL ACTIVITIES

- Member of the board of directors - EPB (2021 - present), Chattanooga Design Studio (2021 - present), The Enterprise Center in Chattanooga, TN (2017-present), Variable Inc (2012-present)
- Member of the board of Trustees at the Thrive Regional Partnership, January 2018-present

PUBLICATIONS - (SAMPLE FROM 2021)

1. T. V. Tran, T. -N. Doan and M. Sartipi, "TSLib: A Unified Traffic Signal Control Framework Using Deep Reinforcement Learning and Benchmarking," 2021 IEEE International Conference on Big Data (Big Data), 2021

2. J. Cho, K. Place, R. Salstrand, M. Rahmat, M. Mansouri, N. Fell, M. Sartipi, "Developing a Predictive Tool for Hospital Discharge Disposition of Patients Poststroke with 30-Day Readmission Validation", Stroke Research and Treatment, vol. 2021, Article ID 5546766, 9 pages, August 2021.

3. C. Del-Real, C. Ward, M. Sartipi, "What do people want in a smart city? Exploring the stakeholders' opinions, priorities and perceived barriers in a medium-sized city in the United States," International Journal of Urban Sciences, August 2021.

4. J. Roland, P. D. Way, C. Firat, T. -N. Doan, M. Sartipi, "Modeling and predicting vehicle accident occurrence in Chattanooga, Tennessee," Elsevier Journal of Accident Analysis & Prevention, Volume 149, 2021, 105860, ISSN 0001-4575.

5. Peter D. Way, Jeremiah Roland, Osama Osman, Mina Sartipi, "Spatio-Temporal Accident Prediction: Effects of Negative Sampling on Understanding Network-Level Accident Occurrence," Journal of Transportation Research Record, 2021.

6. Y. Patel, C. Firat, T. Childers and M. Sartipi, "Ridership Prediction of New Bus Routes At Stop Level By Modeling Socio-economic Data Using Supervised Machine Learning Methods", Transportation Research Board, Jan. 2021.

AWARDS - (2020 - PRESENT)

- UTC College of Engineering and Computer Science, Best Researcher Award, 2021
- Guerry Professor, 2020, Distinguished service to education, research and scholarship
- G20 Smart Cities Alliance, Chattanooga, TN was chosen as one of the two US cities to implement G20's Smart City Alliance policy roadmap
- 2021 International Data Corporation (IDC) Smart Cities North America Award Winner – Police and Law Enforcement Category
- 2021 Smart 50 Awards, Chattanooga Regional Crash Prediction (CDOT Smart City Division and Hamilton County)
  2021 Smart 50 Awards, Pedestrian Analysis Along The East M.L. King Boulevard Smart Corridor (Smart City Division, Seoul Robotics, and Ouster)
- 2020 Smart 50 Awards, Digital Transformation, at the Smart Cities Connect Conference (MLK Smart Corridor)
- 2020 Smoky Mountain Computational Science and Engineering Conference, Runner-up for best paper, "Data Analysis and Visualization of Traffic in Chicago with Size and Landuse-aware Vehicle to Buildings Assignment", A. Alharin, Y. Patel, T. -Nam Doan and M. Sartipi

Résumé Summary for Kathy Jones

Kathy Jones has worked a total of twenty-six (26) years for the Chattanooga-Hamilton County Air Pollution Control Bureau as Air Monitoring Manager. She supervises the regulatory monitoring sites for ozone and particulate for Chattanooga-Hamilton County and supervises two technicians who operate the sites. She is in charge of the regulatory data that are compared against the National Ambient Air Quality Standards (NAAQS) and submission of the data to EPA's national database. Her responsibilities include establishing or discontinuing monitoring sites, writing grants, grant reporting, Standard Operating Procedures (SOPs), monitoring network reviews, quality assurance documents, data evaluation, and special monitoring projects. She holds a BA in Biology from Carson Newman University and 60 post-baccalaureate hours from Chattanooga State and the University of Tennessee at Chattanooga in biology, chemistry, math, and engineering. She recently completed the math and engineering prerequisites for a master's degree in engineering. She has publications but not as first author.

She has expertise in criteria pollutants; hazardous materials; indoor pollution; radon; radon in schools; asbestos air sampling, analysis, supervision, and inspection; odors; visible emissions; and pollen and mold. She has been a microscopist for thirty-five years. She is a guest speaker about air monitoring or air pollution for numerous college classes, organizations, and conferences.

Ms. Jones spent ten (10) years employed in four different local industrial plants before working in management at Air Pollution. She has worked as a laboratory supervisor of three laboratories (including a process lab) in a cement plant, a microencapsulator in product development, a microbiologist, and a chemist.

Erik Schmidt, Director of Sustainability

101 E. 11th St., City Hall, Suite 300, Chattanooga, TN 37402
(423) 643-7822
eschmidt@chattanooga.gov

Education

B.A. Biology; minor, Environmental Studies, Baylor University, 1998

Empolyment History and Project Experience

Director of Sustainability, August 2014 – Current: ***City of Chattanooga, Office of Mayor Mayor Tim Kelly; formerly Andy Berke***

As Director of Sustainability for the City of Chattanooga, Erik provides coordination and planning for the Mayor's Office, municipal department administrators, and operations staff to achieve greater presence and adoption of sustainable business and resilience practices; assessment of existing and proposed municipal facilities for the identification, planning and funding of major capital projects such as major LED retrofits, PV solar arrays, microgrids and fleet and transportation modernization efforts; planning, promotion and engagement with internal and external stakeholders for sustainability initiatives (including but not limited to the U.S. Department of Energy's (USDOE) *Better Buildings Challenge* (2018-20 achievers) and *Clean Energy for Low Income Communities Accelerator*, and the USDOE *SolSmart* initiative (Gold status); representing the City through various organizations such as the Southeast Sustainability Directors Network (SSDN), U.S. Green Build Council (USGBC) and formerly USDOE Urban Dynamics Institute (UDI) Cities Advisory Panel at Oak Ridge National Laboratory (ORNL); assist with application and management of various grant funding opportunities; and engagement with stakeholder groups for regional resilience planning including local, state, and federal agencies, utilities (Tennessee Valley Authority (TVA); Chattanooga Electric Power Board (EPB), etc.), healthcare providers, higher education institutions, local nonprofits, etc.

Project Scientist / Lead Ecologist, October 2004 – July 2014: ***ARCADIS, U.S., Inc.***

As Lead Ecologist for the Chattanooga ARCADIS office, Erik provided successful navigation and coordination with all levels of regulatory compliance agencies, allowing for creative execution of projects for a wide range of clients including the Tennessee Department of Transportation (TDOT); the U.S. Department of the Army; the Tennessee Valley Authority (TVA); various cities and counties; CSX and Norfolk Southern Railroads; and various private sector clients such as the United Parcel Service (UPS), Volkswagen Group of America, Life Care Centers of America, and Nuclear Fuel Services, Inc. Additional responsibilities included task management for over $10M in project revenue, budget and scope development, assistance with marketing and proposal efforts and client relationship development.

Environmental Scientist, February 2004 - September 2004: ***Travis Pruitt & Associates***

As Project Scientist, Erik managed land disturbance and water quality permit applications, scheduling and performance of NPDES compliance inspections, habitat assessments and assistance with jurisdictional determinations for waters of the State and U.S. for various residential and commercial developments in the greater Atlanta area.

Environmental Compliance Ecologist, March 2002 - February 2004
Georgia Department of Transportation, Environmental Compliance Bureau

In accordance with consent decree mandate, Erik conducted periodic assessments of state and federal highway construction projects to ensure compliance with the NPDES permit, federal and state water quality laws, and GDOT specifications relating to erosion prevention and sediment control. Additional responsibilities included coordination with GDOT project personnel, management, and contractor representatives to provide guidance for proper installation of erosion control devices, inspections, and recordkeeping under the NPDES permit, as well as facilitation of enforcement action for non-compliant construction sites.

Michael Walton AIA, NCARB, LEED AP

Executive Director

Since 2014, Michael has focused the programming at green|spaces on facilitating sustainable development that improves economic, social, and environmental resilience throughout the Chattanooga region, with a focus on empowering the most vulnerable communities. He helped design and launch the Empower, green|light, green|leader, Build it Green, Green Prix, and the NextGen Homes programs with the green|spaces team, partners and program stakeholders.

Michael has 15 years of experience in sustainable development and practiced architecture in Knoxville and Washington DC focusing on sustainable design for commercial, residential and urban design projects for environmental and social nonprofits and tech companies before returning to Tennessee to lead green|spaces.

Michael grew up in Greeneville, TN, studied at the ETH-Zurich as a guest student, received his professional Architecture degree from the University of Tennessee College of Architecture and Design and attended Harvard Business School's Young American Leaders Program.

He serves as the President of the American Institute of Architects of Chattanooga, on Tennessee American Water's Community Advisory Board, on the board of the ACE Mentor Program, Creative Discovery Museum, and on advisory boards for the Interior Design, Master of Public Health, Engineering Management and Technology, and Interdisciplinary Geospatial Technology Lab programs at the University of Tennessee at Chattanooga.

Education

Bachelor of Architecture,
summa cum laude
University of Tennessee

Department of Architecture
Guest Student
ETH-Zurich

Young American Leaders Program
Harvard Business School

Registrations

Registered Architect
Tennessee

Accreditations

LEED AP
U.S. Green Building Council

National Council of Architectural Registration Boards

Project Experience

Facilitated Equity and Resilience Workshop at US Green Building Council's 2019 Greenbuild Conference

Panelist at 2019 Department of Energy Better Building Summit Resilience Applications for Low Income Communities

Panelist at Oak Ridge National Lab Nexus of Resilience and Energy Efficiency in Buildings Workshop

Developed and launched the Integrated Community Sustainability Plan to set long term goals and develop actionable strategies to achieve those goals

Designed, developed, and launched Empower Chattanooga, education and outreach program

Launched green|light, Chattanooga's Green Business Certification

Coordinated Low-Impact Development Design Competition, Green Sparks Design Competition and NextGen Homes Design Competition

Managed integrated design, development, and construction of NextGen Homes (Net Zero Energy)

Provides consulting and training for high performance building and sustainability projects

Chattanooga/Hamilton County Air Quality Monitoring Fellow at The University of Tennessee at Chattanooga and Center for Urban Informatics and Progress

Working with Salt Lake City, Cleveland, and Kansas City, and supported by US Ignite, Chattanooga partners have been working over the past year to deploy a low-cost sensor network to measure $PM_{2.5}$ concentrations at a hyper-local level to support ongoing research, environmental mitigation, and community health initiatives. Developing data and a more granular understanding of air quality across particularly underserved communities was a high priority for Chattanooga Smart Community Collaborative (CSCC) stakeholders, including the University of Tennessee at Chattanooga's Center for Urban Informatics and Progress (CUIP).

CUIP is a smart city and urbanization research center at the University of Tennessee at Chattanooga. Using the power of big data, artificial intelligence, statistical modeling, machine learning, and more, they are studying how cities can adapt to our generation's challenges to ensure that our future is safer, smarter, and healthier for all. Our applied research efforts pioneer ways to improve traffic flows, reduce vehicle and pedestrian accidents, reduce carbon emissions, optimize healthcare patient outcomes, and more.

Role

Housed at CUIP, the Air Quality Monitoring Fellow will support Smart Community Collaborative efforts to deploy low-cost sensors across Hamilton County; monitor particulate matter concentrations in neighborhoods; integrate data sets into new and existing publicly accessible repositories; support community engagement activities through research and data; and develop reporting for community stakeholders.

Other responsibilities may include:

- Monitoring network health, addressing potential issues and overseeing planned replacement activities;
- Communicating with CSCC partners and external stakeholders;
- Participating in community meetings;
- Supporting grant applications and other project sustainability efforts; and
- Conducting relevant and related research.

Desired Experience:

- MS or PhD in computer science or related field with knowledge of data science;
- Air quality monitoring expertise and understanding of PM 2.5 health impacts;
- Ability to analyze the cause of air pollution and work with the experts on the team to propose solutions to mitigate them; and
- Understand U.S. policy for air pollution control and monitoring.