OMB Number: 4040-0001
Expiration Date: 06/30/2011

APPLICATION FOR FEDERAL ASSISTANCE
SF 424 (R&R)

3. DATE RECEIVED BY STATE: | **State Application Identifier:**

1. * TYPE OF SUBMISSION
☐ Pre-application ☒ Application ☐ Changed/Corrected Application

4. a. Federal Identifier: HL103970

b. Agency Routing Identifier:

2. DATE SUBMITTED: | **Applicant Identifier:**

5. APPLICANT INFORMATION

*** Organizational DUNS:** 806345617

* Legal Name: Arizona Board of Regents, University of Arizona

Department: | Division:

* Street1: P.O. Box 3308

Street2:

* City: Tucson | County / Parish: Pima

* State: AZ: Arizona | Province:

* Country: USA: UNITED STATES | * ZIP / Postal Code: 85722-3308

Person to be contacted on matters involving this application

Prefix: Ms. | * First Name: Sherry | Middle Name: L.

* Last Name: Esham | Suffix:

* Phone Number: 520-626-6000 | Fax Number: 520-626-4137

Email: sponsor@email.arizona.edu

6. * EMPLOYER IDENTIFICATION *(EIN) or (TIN):* 1742652689A1

7. * TYPE OF APPLICANT: H: Public/State Controlled Institution of Higher Education

Other (Specify):

Small Business Organization Type ☐ Women Owned ☐ Socially and Economically Disadvantaged

8. * TYPE OF APPLICATION:
☐ New ☒ Resubmission
☐ Renewal ☐ Continuation ☐ Revision

If Revision, mark appropriate box(es).
☐ A. Increase Award ☐ B. Decrease Award ☐ C. Increase Duration ☐ D. Decrease Duration
☐ E. Other (specify):

* Is this application being submitted to other agencies? Yes ☐ No ☒ What other Agencies?

9. * NAME OF FEDERAL AGENCY: National Institutes of Health

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:

TITLE:

11. * DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:
Relating Diesel Exhaust Exposure to Respiratory and Immune Outcomes in Early Life

12. PROPOSED PROJECT:
* Start Date: 07/01/2011 | * Ending Date: 06/30/2016

*** 13. CONGRESSIONAL DISTRICT OF APPLICANT:** AZ-007

14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix: Dr. | * First Name: Paloma | Middle Name:

* Last Name: Beamer | Suffix:

Position/Title: Assistant Professor, College of Public Health

* Organization Name: Arizona Board of Regents, University of Arizona

Department: Community, Environ. & Policy | Division: College of Public Health

* Street1: 1295 N. Martin Ave.

Street2: P.O. Box 245210

* City: Tucson | County / Parish: Pima

* State: AZ: Arizona | Province:

* Country: USA: UNITED STATES | * ZIP / Postal Code: 85724-5210

* Phone Number: 520-626-0006 | Fax Number: 520-626-8009

* Email: pbeamer@email.arizona.edu

15. ESTIMATED PROJECT FUNDING

a. Total Federal Funds Requested	670,326.00
b. Total Non-Federal Funds	0.00
c. Total Federal & Non-Federal Funds	670,326.00
d. Estimated Program Income	0.00

16. * IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES ☐ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE:

b. NO ☒ PROGRAM IS NOT COVERED BY E.O. 12372; OR

☐ PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. 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 18, 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.***

18. SFLLL or other Explanatory Documentation

Add Attachment | Delete Attachment | View Attachment

19. Authorized Representative

Prefix: * First Name: Leslie Middle Name: P.

* Last Name: Tolbert Suffix: Ph.D.

* Position/Title: Vice-President for Research

* Organization: Arizona Board of Regents, University of Arizona

Department: Division:

* Street1: P.O. Box 3308

Street2:

* City: Tucson County / Parish: Pima

* State: AZ: Arizona Province:

* Country: USA: UNITED STATES * ZIP / Postal Code: 85722-3308

* Phone Number: 520-626-6000 Fax Number: 520-626-4137

* Email: sponsor@email.arizona.edu

*** Signature of Authorized Representative**: Sean Armstrong

*** Date Signed**: 11/09/2010

20. Pre-application Add Attachment | Delete Attachment | View Attachment

424 R&R and PHS-398 Specific
Table Of Contents

OMB Number: 4040-0010
Expiration Date: 08/31/2011

Project/Performance Site Location(s)

Project/Performance Site Primary Location ☐ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name: ABOR, University of Arizona

DUNS Number: 8063456170000

* Street1: 1295 N. Martin Ave.

Street2: P.O. 245210

* City: Tucson County: Pima

* State: AZ: Arizona

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: 85724-5210 * Project/ Performance Site Congressional District: AZ-007

Project/Performance Site Location 1 ☐ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

* Street1:

Street2:

* City: County:

* State:

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: * Project/ Performance Site Congressional District:

Additional Location(s) Add Attachment Delete Attachment View Attachment

RESEARCH & RELATED Other Project Information

1. * Are Human Subjects Involved? ☒ Yes ☐ No

1.a If YES to Human Subjects

Is the Project Exempt from Federal regulations? ☐ Yes ☒ No

If yes, check appropriate exemption number. ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

If no, is the IRB review Pending? ☒ Yes ☐ No

IRB Approval Date:

Human Subject Assurance Number:

2. * Are Vertebrate Animals Used? ☐ Yes ☒ No

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending? ☐ Yes ☐ No

IACUC Approval Date:

Animal Welfare Assurance Number

3. * Is proprietary/privileged information included in the application? ☐ Yes ☒ No

4.a. * Does this project have an actual or potential impact on the environment? ☐ Yes ☒ No

4.b. If yes, please explain:

4.c. If this project has an actual or potential impact on the environment, has an exemption been authorized or an environmental assessment (EA) or environmental impact statement (EIS) been performed? ☐ Yes ☐ No

4.d. If yes, please explain:

5. * Is the research performance site designated, or eligible to be designated, as a historic place? ☐ Yes ☒ No

5.a. If yes, please explain:

6. * Does this project involve activities outside of the United States or partnerships with international collaborators? ☐ Yes ☒ No

6.a. If yes, identify countries:

6.b. Optional Explanation:

7. * Project Summary/Abstract 1243-Abstract_v5.pdf Add Attachment Delete Attachment View Attachment

8. * Project Narrative 1244-Narrative.pdf Add Attachment Delete Attachment View Attachment

9. Bibliography & References Cited 1245-References.pdf Add Attachment Delete Attachment View Attachment

10. Facilities & Other Resources 1246-FACILITIES.pdf Add Attachment Delete Attachment View Attachment

11. Equipment 1247-Equipment.pdf Add Attachment Delete Attachment View Attachment

12. Other Attachments Add Attachments Delete Attachments View Attachments ☒

Relating Diesel Exhaust Exposure to Respiratory and Immune Outcomes in Early Life

The goal of this career development plan is to help Dr. Paloma Beamer, an environmental engineer, launch an independent biomedical research program. Asthma is a heterogeneous disease and the natural history, risk factors and clinical expression of the disease differ between asthma and wheezing phenotypes. Common to all forms of asthma is intermittent or persistent airway inflammation during critical time periods of development as a result of altered immune responses to viral infection, allergic sensitization, or environmental irritants. Vehicle exhaust is the primary source of air pollution in urban environments, where asthma prevalence rates are highest. Exposure to diesel exhaust has been associated with respiratory outcomes including asthma and decreased lung function in epidemiological studies and has also been linked with airway inflammation via *in vivo* human laboratory studies. The main objective of the research plan is to assess longitudinally the role of diesel-related pollutant exposure during infancy in developmental alterations of the immune and respiratory systems that lead to transient early life wheezing or asthma. The proposed project will use data collected from two on-going prospective birth cohort studies that provide extensive longitudinal data for 1730 children on IgE, cytokines, lung function and respiratory symptoms. To complete the aims, Dr. Beamer will use GIS techniques to model diesel-related pollution exposure based on birth and childhood addresses. She will then assess if diesel-related pollutant exposure in early life is associated with: (1) increased incidence of asthma-related respiratory symptoms; (2) decreased lung function; (3) increased bronchial responsiveness; (4) predominance of Th2 versus Th1 cytokine production and (5) increased allergic sensitization as measured by total and allergen-specific IgE and skin prick tests. Findings from these analyses will aid Dr. Beamer in designing age-appropriate interventions that she can evaluate in future community-based trials aimed at the primary prevention of asthma. This research plan forms the basis of a 5-year career development plan for Dr. Beamer under the mentorship of Dr. Fernando Martinez (respiratory diseases, epidemiology), Dr. Lynn Gerald (asthma, community-based research), Dr. Duane Sherrill (biostatistics), and Dr. Eric Betterton (atmospheric chemistry and physics). Additional collaborators include Dr. Anne Wright (asthma epidemiology) and Dr. Andrew Comrie (urban air pollution, spatial analysis). This interdisciplinary group has designed a career development program that includes (1) formal training in biostatistics, epidemiology, immunotoxicology, spatial analysis, intervention development and evaluation, (2) regular meetings with mentors and collaborators, (3) participation in seminars, (4) presenting results at scientific meetings, (5) publishing in peer-reviewed journals, and (6) submitting an R01. Completion of this career development plan will establish Dr. Beamer as a researcher at the interface of environmental engineering and epidemiology, and position her to design and evaluate novel interventions aimed at reducing the burden of respiratory disease from environmental exposures.

Relating Diesel Exhaust Exposure to Respiratory and Immune Outcomes in Early Life

The goal of this career development plan is to help Dr. Paloma Beamer, an environmental engineer, launch an independent research career focused on assessing how exposures to environmental pollutants may lead to development of respiratory disease, particularly in vulnerable and underserved populations. Completing the research project component of this proposal will help us understand if exposure to diesel-related pollutants as an infant results in alterations of the immune and respiratory systems that could result in early childhood wheezing or development of asthma. Dr. Beamer will use the findings from this proposal to engineer intervention strategies that can then be tested in community settings and hopefully help reduce the burden of wheezing in childhood.

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FACILITIES & OTHER RESCOURSES

Laboratory

Dr. Paloma Beamer has been provided with 860 square feet of wet laboratory space in the Medical Research Building. This includes 2 fume hoods, a filter weighing room, an environmental sample preparation room, a walk-in cold room and a large area for field sampling preparation and break down. Dr. Beamer's laboratory is fully equipped for collection and analysis of multi-media samples for environmental contaminants. Equipment includes a high-capacity microwave oven for acid digestion and solvent extractions, a sieve shaker, high-performance liquid chromatograph with an auto-sampler and a UV detector, and an analytical ultra-microbalance. Additional equipment at includes a refrigerator, ultra-temperature freezers, centrifuges, a furnace, a drying oven, a PC computer to operate laboratory equipment and several SKC air pumps. Dr. Beamer also has access to a ventilated plexi-glass chamber and real-time instruments to measure particulate and gaseous pollutants that can be used to assess air pollution control technologies for the intervention development. Although it will not be clear which hazardous air pollutants will be most important to develop interventions for in future studies, the flexibility of this laboratory space and equipment will provide Dr. Beamer with the necessary resources to evaluate any of the hazardous air pollutants proposed.

Office

Dr. Beamer has 118 square feet of personal office space in Drachman Hall, which houses the Mel and Enid Zuckerman College of Public Health. This provides Dr. Beamer with access to administrative staff and shared office resources such as the laser printer and photocopier. Dr. Beamer has also been provided with an additional 113 square feet of cubicle administrative space in the Medical Research Building, directly outside the door of her laboratory. The administrative space will be used by the data manger and laboratory technician for the proposed project. The Medical Research Building is immediately adjacent to Drachman Hall.

All of the mentors and collaborators for this proposal have their primary offices within close proximity of Dr. Beamer, which will facilitate their availability and mentorship. Dr. Lynn Gerald and Dr. Duane Sherrill, co-mentors, also have primary offices located in Drachman Hall. Dr. Fernando Martinez, mentor, and Dr. Anne Wright, collaborator, have their primary offices located in the College of Medicine which is adjacent to Drachman Hall. Dr. Eric Betterton, co-mentor, and Dr. Andrew Comrie, collaborator, have their offices on the main University of Arizona Campus located across the street from the Arizona Health Sciences Center.

Computer

Dr. Beamer has a Dell Precision T3400 workstation and a MacBook in her office, to facilitate intensive computer modeling and analysis, as well as writing manuscripts, preparing presentations and completing course assignments for the proposed training portion. These computers are equipped with a wide variety of software, including Microsoft Office, ArcGIS, S-PLUS, STATA, and MATLAB. The computers are connected to a Local Area Network, which provides access to back-up servers and a laser printer. Dr. Beamer also has large-format color ink jet printer for printing out maps generated from this project.

Other Resources

Dr. Beamer will continue to be supported by the administrative staff for the Division of Community, Environment and Policy, which include an administrative associate and an accountant. Dr. Beamer will also have access to the information technology staff for MEZCOPH to aid with this computer intensive modeling project.

Dr. Beamer will have access to research support staff at the Arizona Respiratory Center (ARC) under the direction of her sponsor, Dr. Fernando Martinez. The ARC research support staff has been involved in the collection of the data to be utilized by Dr. Beamer and the have extensive experience in their use for data analyses. The ARC Data Manager will provide Dr. Beamer with access to the data as well as directed instruction in how to create and manipulate the files. Regular contact with the ARC research staff will provide Dr. Beamer with the opportunity to learn appropriate data management techniques for her future cohort studies. Dr. Beamer will also have access to the computers at the ARC and available software including: SPSS, SAGE, MapMarkers, Linkage, Xplot for graphics, FORTRAN, C, AWK, ICON, and LISP programming languages and the Island Productivity Services for word processing, graphics, and presentations.

The University of Arizona is committed to developing their junior faculty. In addition to research support already outlined, there are also several seminars and workshops on career and research program development that Dr. Beamer will have access too. This includes New Investigator workshops in the College of Medicine that focus on the NIH Peer Review Process and Grant Writing and Research Integrity Education seminars. As part of the NSF-funded University of Arizona ADVANCE program there is a monthly career development discussion series aimed at providing mentoring and strategies for success in academia. Furthermore the Mel and Enid Zuckerman College of Public Health has a monthly junior faculty luncheon to discuss issues specific to the College and to ensure that the junior faculty are progressing successfully.

The Arizona Laboratory for Emerging Contaminants (ALEC), located at the University of Arizona, is available to assist faculty, student and staff researchers to detect, quantify and speciate organic and inorganic micro-pollutants in complex environmental matrices. They utilize state-of-the-art mass spectrometry and associated analytical techniques to study a variety of samples. Dr. Beamer has collaborated with ALEC on of some of her research projects, and will work with ALEC to ensure that she is using the appropriate techniques to measure the hazardous air pollutants.

EQUIPMENT

This is primarily a computer-modeling project that will use existing data sets. Dr. Beamer has a Dell Precision T3400 workstation and a MacBook in her office, to facilitate intensive computer modeling and analysis, as well as writing manuscripts, preparing presentations and completing course assignments for the proposed training portion. An additional computer has been requested with the capacity to handle large data sets and the ArcGIS software for use by the data manager assisting Dr. Beamer. A large-format color ink jet printer for printing out maps generated from this project, is located in Dr. Beamer's administrative space in the Medical Research Building.

Dr. Beamer's laboratory is equipped to handle measurement and analysis of air pollutants. Equipment necessary to develop and evaluate the intervention will depend on which pollutants are identified as most critical from the proposed research. The equipment in Dr. Beamer's laboratory is appropriate for analyzing both particulate, volatile organic compounds and gaseous pollutants and includes: a high-capacity microwave oven for acid digestion and solvent extractions, a sieve shaker, high-performance liquid chromatograph with an auto-sampler and a UV detector, and an analytical ultra-microbalance. Additional equipment at includes a refrigerator, ultra-temperature freezers, centrifuges, a furnace, a drying oven, a PC computer to operate laboratory equipment and several SKC air pumps. Dr. Beamer also has access to a ventilated plexi-glass chamber and real-time instruments to measure particulate and gaseous pollutants

Through the Arizona Laboratory for Emerging Contaminants, Dr. Beamer also has access to a gas chromatograph tandem mass spectrometer, liquid chromatograph tandem mass spectrometer and an inductively coupled plasma mass spectrometer. These analytical equipment allow for analysis of metal and organic contaminants at very low detection limits.

List of Referees

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OMB Number: 4040-0001
Expiration Date: 06/30/2011

RESEARCH & RELATED Senior/Key Person Profile (Expanded)

PROFILE - Project Director/Principal Investigator

Prefix: Dr. * First Name: Paloma Middle Name:
* Last Name: Beamer Suffix:
Position/Title: Assistant Professor, College of Public Health Department: Community, Environ. & Policy
Organization Name: Arizona Board of Regents, University of Arizona Division: College of Public Health
* Street1: 1295 N. Martin Ave.
Street2: P.O. Box 245210
* City: Tucson County/ Parish: Pima
* State: AZ: Arizona Province:
* Country: USA: UNITED STATES * Zip / Postal Code: 85724-5210
* Phone Number: 520-626-0006 Fax Number: 520-626-8009
* E-Mail: pbeamer@email.arizona.edu

Credential, e.g., agency login: pbeamer

*** Project Role:** PD/PI **Other Project Role Category:**

Degree Type: Ph.D.
Degree Year: 2007

***Attach Biographical Sketch** 1234-PBbiosketch(v2).pdf [Add Attachment] [Delete Attachment] [View Attachment]
Attach Current & Pending Support [Add Attachment] [Delete Attachment] [View Attachment]

PROFILE - Senior/Key Person 1

Prefix: Dr. * First Name: Fernando Middle Name:
* Last Name: Martinez Suffix:
Position/Title: Regents Professor Department: Pediatrics
Organization Name: Arizona Board of Regents, University of Arizona Division: College of Medicine
* Street1: 1501 N. Campbell Ave.
Street2:
* City: Tucson County/ Parish: Pima
* State: AZ: Arizona Province:
* Country: USA: UNITED STATES * Zip / Postal Code: 85724-5030
* Phone Number: 520-626-6387 Fax Number:
* E-Mail: fernando@arc.arizona.edu

Credential, e.g., agency login:

*** Project Role:** Other Professional **Other Project Role Category:** Mentor

Degree Type:
Degree Year:

***Attach Biographical Sketch** 1235-20101108_Biosketch_FM_Be [Add Attachment] [Delete Attachment] [View Attachment]
Attach Current & Pending Support 1236-FDM Other Support 2010 1 [Add Attachment] [Delete Attachment] [View Attachment]

RESEARCH & RELATED Senior/Key Person Profile (Expanded)

PROFILE - Senior/Key Person 2

Prefix: Dr. * First Name: Duane Middle Name:

* Last Name: Sherrill Suffix:

Position/Title: Professor, College of Public Health Department: Epidemiology & Biostatistics

Organization Name: Arizona Board of Regents, University of Arizona Division: College of Public Health

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Street2:

* City: Tucson County/ Parish: Pima

* State: AZ: Arizona Province:

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* Phone Number: 520-626-7513 Fax Number: 520-626-6093

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Credential, e.g., agency login:

*** Project Role:** Other Professional **Other Project Role Category:** Co-Mentor

Degree Type:

Degree Year:

***Attach Biographical Sketch**	1237-DL Sherrill biosketch -	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	1238-Duane Sherrill - Active	Add Attachment	Delete Attachment	View Attachment

PROFILE - Senior/Key Person 3

Prefix: Dr. * First Name: Lynn Middle Name:

* Last Name: Gerald Suffix:

Position/Title: Professor, College of Public Health Department: Health Promotion Sciences

Organization Name: Arizona Board of Regents Division: College of Public Health

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Street2:

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* State: AZ: Arizona Province:

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Credential, e.g., agency login:

*** Project Role:** Other Professional **Other Project Role Category:** Co-Mentor

Degree Type:

Degree Year:

***Attach Biographical Sketch**	1239-LBG biosketch.pdf	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	1240-Ongoing Research Support	Add Attachment	Delete Attachment	View Attachment

RESEARCH & RELATED Senior/Key Person Profile (Expanded)

PROFILE - Senior/Key Person 4

Prefix: Dr. * First Name: Eric Middle Name:

* Last Name: Betterton Suffix:

Position/Title: Professor, College of Science Department: Atmospheric Sciences

Organization Name: Arizona Board of Regents, University of Arizona Division: College of Science

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Credential, e.g., agency login:

*** Project Role:** Other Professional **Other Project Role Category:** Co-Mentor

Degree Type:

Degree Year:

***Attach Biographical Sketch**	1241-Biosketch Betterton K 20	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	1242-CPBetterton.pdf	Add Attachment	Delete Attachment	View Attachment

Tracking Number:GRANT10738842 Funding Opportunity Number:PA-10-062 Received Date:2010-11-09T16:37:33-04:00

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Paloma Beamer	POSITION TITLE Assistant Professor
eRA COMMONS USER NAME pbeamer	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
UC Berkeley	B.S.	2000	Civil and Environmental Engineering
Stanford University	M.S.	2002	Civil and Environmental Engineering
Stanford University	Ph.D.	2007	Civil and Environmental Engineering

A. Personal Statement

Dr. Beamer is an expert in exposure assessment and modeling. This K25 Mentored Quantitative Research Development Award will allow Dr. Beamer to contribute her expertise by assessing environmental exposures for two on-going birth cohort studies, while obtaining additional competencies in the biomedical sciences. Specifically she will receive training in biostatistics, epidemiology, immunotoxicology, spatial analysis, intervention development and evaluation. This training will provide Dr. Beamer with additional expertise to complete the research plan aimed at assessing longitudinally the role of diesel-related pollutant exposure during infancy in developmental alterations of the immune and respiratory systems that lead to transient early life wheezing or asthma. At completion of this K25, Dr. Beamer will have a rare skill set that combines her environmental engineering background in assessing exposures and designing interventions with new competencies to evaluate the role of these exposures in development of respiratory diseases and the effectiveness of the interventions in reducing these diseases. Ultimately this unique interdisciplinary training will enable her to establish her independence as a biomedical researcher.

B. Positions and Honors

Employment

2001-2003 Instructor, Coordinator, Mentor, NASA Research in Science and Engineering Program, Stanford University, *Associate Dean Noe Lozano, Ph.D.*

2001-2004 Teaching Assistant, Civil and Environmental Engineering, Stanford University, *Professor James Leckie, Ph.D. and Associate Professor Alexandria Boehm Ph.D.*

2003 Research Intern, Transdermal Technology, ALZA Corporation, Menlo Park, CA *Jay Audett, Ph.D.*

2005 Lecturer, Department of Civil and Environmental Engineering, Stanford University *Professor Richard Luthy, Ph.D.*

2000-2007 Research Assistant, Exposure Research Group, Stanford University *Professor James Leckie, Ph.D.*

2007 – Present Assistant Professor, Division of Community, Environment and Policy, Mel and Enid Zuckerman College of Public Health, University of Arizona *Tenure-eligible, Division Director Jeff Burgess, M.D., MPH, MS Dean Iman Hakim, M.D., Ph.D., MPH*

2009 – Present Assistant Professor, by courtesy, Department of Chemical and Environmental Engineering, University of Arizona *Non-tenure eligible, Department Chair Jim Fields, Ph.D.*

Honors

1995 Regent Scholar, University of California, Berkeley

1996 Outstanding Freshman, Hispanic Engineers and Scientists (SHPE), UC Berkeley

2000 Lifetime Achievement Award, Hispanic Engineers and Scientists (SHPE), UC Berkeley

2000 Kennedy Interdisciplinary Award, Latin American Studies, UC Berkeley

2000 Engineer-In-Training Certification, San Mateo, CA
2000 Dean's Doctoral Diversity Fellowship, Stanford University
2002 Fellow, National Institute of Health Training Grant in Biotechnology, Stanford University
2004 Student Research Poster Competition, 1st Place, International Society of Exposure Analysis Conference, Philadelphia, PA
2005 Graduate Student of the Year Award, Stanford Society of Chicano/Latino Engineers and Scientists (SHPE)
2006 Selected as one of 55 attendees from a group of over 730 applicants to attend the NSF ADVANCE Workshop on Negotiating the Ideal Faculty Position at Rice University
2007 Associate Investigator, Arizona Cancer Center
2008 Water Sustainability Program, Recruitment and Research Initiative Proposal, Infrastructure Investment Grant.
2008 Superfund Basic Research Program, Pilot Project Grant
2009 Associate Member, Southwest Center for Environmental Health Sciences
2009 Southwest Center for Environmental Health Sciences, Pilot Project Grant
2009 Arizona Cancer Center, American Cancer Society Institutional Research Grant, Pilot Project
2010 Yuma Friends of Arizona Health Sciences Center, Young Investigator Award

Professional Societies

1997-Present Society of Hispanic Professional Engineers (SHPE)
2006-Present Society for the Advancement of Chicanos and Native Americans in Science (SACNAS)
2006-Present International Society of Exposure Science (ISES)
2008-Present Association of Women Faculty, University of Arizona
2009-Present American Chemical Society (ACS)
2010-Present International Society of Children's Health in the Environment (ISCHE)

Other Professional Activities

2005-2007 Graduate Student Council, Diversity Committee, Stanford University
2005-Present Reviewer. *Journal of Exposure Science and Environmental Epidemiology*
2007-Present Reviewer. *Environmental Research*
2007-Present Advisory Board, Latino/a Association of Graduate Students in Engineering and Science, University of Arizona
2008-Present Institutional Chemical Safety Committee, University of Arizona
2008-Present Academic Councilor, Board Member, International Society of Exposure Science
2009-Present Reviewer. *American Journal of Industrial Medicine*
2009-Present Reviewer. *Risk Analysis*
2009-Present Reviewer, *Building and Environment*
2010 Peer Reviewer, US Environmental Protection Agency, *Exposure Factors Handbook*

B. Publications

Peer-reviewed Papers

Beamer, P., Castaño, A., and J.O. Leckie. (2002). "Vertical Profile Particulate Matter Measurements in a California Day Care." Proceedings of the Indoor Air Conference, Monterey, CA.

AuYeung, W., Canales, R.A., Beamer, P., Ferguson, A.C., and J.O. Leckie. (2004). "Young Children's Mouthing Behavior: An Observational Study via Videotaping in a Primarily Outdoor Residential Setting." J Children's Health, 2 (3-4), pg. 271-295.

Ferguson, A.C., Canales, R.A., Beamer, P., AuYeung, W., Key, M., Munninghoff, A., Lee, K.T., Robertson, A., and J.O. Leckie. (2005). "Video methods in the quantification of children's exposures." J Exp Anal Environ Epidemiol, 16: 287-298.

AuYeung, W., Canales, R.A., Beamer, P., Ferguson, A.C., and J.O. Leckie. (2006). "Young children's hand contact activities: An observational study via videotaping in primarily outdoor residential settings." J Exp Sci Environ Epidemiol, 16: 434-446.

Xue, J., Zartarian, V., Moya, J., Freeman, N. and P. Beamer. (2007). "A Meta-Analysis of Children's Hand-to-Mouth Frequency Data for Estimating Non-Dietary Ingestion Exposure." Risk Analysis, 27(2): 411-420.

Beamer, P., Key, M.E., Ferguson, A.C., Canales, R.A., AuYeung, W., and J.O. Leckie. (2008). "Quantified Activity Pattern Data from 6-to-27-Month-Old Farmworker Children for Use in Exposure Assessment." Environ Res, 108: 239-246.

Beamer, P., Canales, R.A., and J.O. Leckie. (2009). “Developing Probability Distributions for Transfer Efficiencies for Dermal Exposure.” J Exp Sci Environ Epidemiol, 19: 274-283.
Beamer, P. Canales, R. A., Bradman, A., and J. O. Leckie. (2009). “Estimates of Residential Non-Dietary Exposure for Farmworkers’ Children Using Micro-Level Activity Time-Series.” Environ International, 35: 1202-1209.
Layton, D.W., and P. Beamer. (2009). “Migration of Contaminated Soil and Airborne Particulates to Indoor Dust.” Environmental Science & Technology, 43(21): 8199-8205. PMID: 19924944.
Xue, J., Zartarian, V., Tulve, N., Moya, J., Freeman, N., AuYeung, W., and Beamer, P. (2010). “A Meta-Analysis of Children’s Object-to-Mouth Frequency Data for Estimating Non-Dietary Ingestion Exposure.” J Exp Sci Environ Epidemiol, 20: 536-545. PMID: 19773815

Selected Peer-Reviewed Abstracts

Key, M., Beamer, P., Ferguson, A.C., Canales, R.A., AuYeung, W., and J.O. Leckie. (2004). “Time Activity Assessment: Demographics of the Study Population.” Presented at ISEA conference, Philadelphia, PA.
Beamer, P., Ferguson, A., Canales, R., AuYeung, W., Key, M. and J. Leckie. (2004). “Analysis of Children’s Mobility on Their Micro-Level Activity Patterns.” Presented at ISEA conference, Philadelphia, PA.
Beamer, P., Ferro, A., Canales, R., Ferguson, A., and J. Leckie. (2005). “Introduction to Human Exposure Analysis: a Stanford graduate engineering level course.” Presented at ISEA conference, Tucson, AZ.
Beamer, P., and J.O. Leckie. (2005). “Systematic verification of micro-level activity time series data to reduce uncertainty.” Presented at ISEA conference, Tucson, AZ.
Shi, H., Ferguson, A.C., Beamer, P., and J.O. Leckie. (2005). “Validation of a dermal absorption model by linkage to a PBPK model for TCE.” Presented at ISEA conference, Tucson, AZ.
Beamer, P., Shi, H., Ferguson, A.C., and J.O. Leckie. (2006). “Development of a Cumulative Dermal Absorption Model by Linkage to a PBPK Model for Chlorpyrifos and Diazinon.” Presented at ISEA/ISEE conference, Paris, France.
Shi, H., Beamer, P., Ferguson, A.C., and J.O. Leckie. (2006). “A Dermal Absorption Model Validation By Linkage to A PBPK Model for Chloroform.” Presented at ISEA/ISEE conference, Paris, France.
Beamer, P., Canales, R.A., Bradman, A., Leckie, J., and B. Eskenazi. (2007). “Correlations Between Micro-Level Activity Statistics and Non-Dietary Exposure Estimates of Young Farm-Worker Children.” Presented at ISEA conference, Durham, NC.
Beamer, P., Leckie, J., and A. Bradman. (2007). “Estimates of Dietary Exposure for Young Mexican American Children Using Demographic Information and Publicly-Available Databases.” Presented at ISEA conference, Durham, NC.
Beamer, P., Canales, R.A., Ferguson, A.C., Eskenazi, B., Leckie, J.O., Bradman, A. (2008) “Organophosphate Pesticide and Exposure Route Contribution to Aggregate and Cumulative Dose for Young Farmworker Children.” Presented at ISEA/ISEE conference, Pasadena, CA.
Beamer, P., Leckie, J.O. (2008) “Estimation of Age-Specific Physiological and Pharmacokinetic Parameters for PBPK Modeling of Children.” Presented at ISEA/ISEE conference, Pasadena, CA.
Beamer, P., Luik, C.E., Leckie, J.O. (2009). “Quantified Outdoor Micro-activity Data for Children Aged 7-12 Years Old.” Presented at ISES conference, Minneapolis, MN.
Ascher, R.M., Rosen, J.C., Odegaard, N., Beamer, P.I. (2009). “Potential Incidental Heavy Metal Ingestion While Using Art Pastels.” Presented at ISES conference, Minneapolis, MN.
Beamer, P., Ascher, R., Stern, D.A., Sherrill, D., Wright, A.L., Martinez, F.D. (2010). “Spatial Relation of Traffic-Related Pollutants and Early Childhood Respiratory Illnesses and Wheezing in Tucson Arizona.” Presented at ATS conference, New Orleans, LA.

C. Research Support

Spatial Analysis of Traffic-Related Exposures and Respiratory Outcomes.
*Southwest Environmental Health Science Center Pilot Project Program (*04/01/09-03/31/10)
The objective of this grant is to assess incidence of lower respiratory illnesses and childhood wheezing related to traffic pollutant exposure. GIS modeling is used to estimate exposure via traffic volumes and hazardous air pollutants for each census tract. Dr. Beamer oversaw and coordinated the entire project. She has developed methods for geocoding cases and estimating exposure. She is responsible for data analyses. This grant has allowed Dr. Beamer to develop research protocols and obtain preliminary data for the proposed research. Results from this project were presented at the American Thoracic Society in May 2010.
Role: Principal Investigator

Migration of Soil Particles to the Indoor Environment: Implications for Risk Assessment.
TRIF-WESP Superfund Pilot Project Program (02/01/08-05/31/09)
The objective of this project is to characterize the migration of soil contaminants to the indoor environment from: (1) tracking on footwear and (2) aeolian resuspension followed by airborne penetration of the building shell through field measurements and model simulations. Dr. Beamer oversaw and coordinated the entire project. She was responsible for questionnaire and field sampling methods development and all of the environmental modeling. The first manuscript from this work, outlining the modeling framework, has been published in *Environmental Science & Technology*. Dr. Beamer has been interviewed by several media sources including National Public Radio and Time regarding this work.
Role: Principal Investigator

Characterization of Infant's Exposure to Trichloroethylene: Implications for Cancer Risk Assessment
American Cancer Society Institutional Research Grant Committee. (7/01/09-6/30/10)
The objectives of this grant are to quantify TCE in breastmilk and assess cancer risk to infants via breastmilk and drinking water via a PBPK model. Dr. Beamer oversaw and coordinated the project. She is responsible for questionnaire and analytical method development, as well as the PBPK modeling.
Role: Principal Investigator

Development of Cumulative Aggregate Exposure and Dose Model
Funded by EPA-STAR Grant, United Parcel Service, Center for Children's Environmental Health, UC Berkeley, and the Mel and Enid Zuckerman College of Public Health, University of Arizona
The objective of this work was to develop a model to estimate exposure and dose via multiple exposure routes to multiple pesticides incurred by farmworkers' children in their home environments. Dr. Beamer created modules to estimate dietary ingestion, gastrointestinal and lung absorption and a PBPK model that can account for a growing child. She performed validation of each module, and completed all model simulations. Model results indicate that farmworkers' children may be at risk from pesticide exposure. While this project was part of Dr. Beamer's graduate work at Stanford University, since beginning her position at UA she has updated model components, incorporated new methods, and completed additional simulations. One manuscript was published in *Environment International*, one manuscript is in revision, and another manuscript is in preparation.
Role: Principal Investigator

Analysis of Outdoor Activity Patterns of Older Children
Funded by Vice Provost for Research, University of Arizona, 07/01/08-06/30/10
The purpose of this project is to quantify micro-level activity patterns of older children (aged 7-12 years) while they are playing outdoors. There are very few values available for older children (> 6 years) for use in exposure models and risk assessment required for pesticide registration. Results indicate that older children have frequent mouth contacts with hands and objects in their environment that are not significantly different from younger children. Current US EPA recommendations for risk assessment may not be protective enough for this age group. Dr. Beamer has worked with a graduate student in all aspects of this project. This has included quantifying the activity patterns and performing the statistical analyses. A manuscript has been submitted to *Journal of Exposure Science and Environmental Epidemiology*.
Role: Principal Investigator

Outdoor Pesticide Sampling in Yuma: Implications for Interventions to Reduce Farmworker Families' Exposures
Yuma Friends of Arizona Health Sciences Center, Young Investigator Award (Project Period TBD)
The objective of this recently-funded proposal is to obtain pesticide samples in Yuma to estimate the relative contributions of pesticides that enter the homes via the air from nearby fields with those that enter the homes on people's shoes and clothes. Another objective is to calculate pesticide residence time in homes. This would allow for development of more targeted community-based interventions in the future. Dr. Beamer will assist in developing sampling protocols and model simulations.
Role: Principal Investigator

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Fernando D. Martinez, MD	Regents' Professor Director, Arizona Respiratory Center Director, BIO5 Institute & CTSI Swift-McNear Professor of Pediatrics
eRA COMMONS USER NAME (credential, e.g., agency login) fmartinez	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Chile, Santiago	MD	1971	Medicine
University of Chile, Santiago	Residency	1972-1973	Medicine
University of Rome, Italy	MD	1973-1975	Medicine
University of Rome, Italy	Fellowship	1976-1981	Pediatrics
University of Rome, Italy	Specialization	1976-1981	Pediatric Pulmonology

PERSONAL STATEMENT: I have worked on risk factors and natural history of asthma for the last 25 years. I have been at the Arizona Respiratory Center since 1987 and Director of the Center for the last 13 years. The center has made very important contributions to our understanding of the etiology and pathogenesis of asthma and COPD, and has pioneered work on the complex gene by environment interactions that determine the development of the disease. During my career, I have mentored tens of trainees in epidemiology and genetics of asthma. Many of these trainees are now leaders in the field of pediatric asthma in Europe, South America, and in the United States. For example, Erika von Mutius, MD, who trained in our Center, is a leader of pediatric asthma research in Europe, as is Renato Stein, MD, in Brazil. I recently was awarded, one of nine Asthma Network (AsthmaNet) Centers in the United States, in collaboration with Duke University. This will allow us to participate in collaborative research trials for the prevention and treatment of asthma for the next 7 years and to further train experts in this area of research. I am also the Principal Investigator for the National Children's Study, Arizona Center. I believe that the above considerations make me qualified to serve as a mentor to Dr. Beamer.

A. POSITIONS AND HONORS:

Clinical Appointments:

Attending at the Pediatric Pulmonary Ward University of Rome Pulmonary Section Department of Pediatrics	1981-1982
Pediatrician in charge of Outpatient Clinic	1983-1984
University of Rome Children's Respiratory Clinic	1985-1987
General Pediatric Practitioner, Viterbo, Italy	1981-1987
Attending Physician, Department of Pediatrics, University of Arizona	1991-present
Consulting Physician, Whiteriver Hospital, Whiteriver, Arizona	1992-present

Academic Appointments:

University of Chile Research Associate

Department of Epidemiology & Social Medicine Area Oriente: School of Medicine, Santiago, Chile	1969-1971

University of Rome

Lecturer at the Department of Pediatrics	1981-1986

University of Arizona

Visiting Research Associate	1984-1985
Research Scientist (Pediatrics)	1987-1990
Research Scientist (Respiratory Sciences Center)	1987-1996
Research Assistant Professor	1990-1991
Assistant Professor	1991-1994

Associate Professor	1994-1997
Director, Arizona Respiratory Center	1996-present
Swift-McNear Professor of Pediatrics	1997-present
Co-Director, Institute for Biomedical Science and Biotechnology	2002-2005
Faculty Member, BIO5 Institute	2005-present
Director, BIO5 Institute	2009-present
Regents' Professor	2009-present

Honors and Awards (Last 5 Years)

2005

- 2004 Pfizer Visiting Professorship in Allergic Disease and Asthma, St. Louis, MO (received 2005)
- Scientific Accomplishment Award (1 of 4 awarded annually), 2005 American Thoracic Society Meeting
- Honorary Fellowship, Allergy Society of South Africa, Durbin, South Africa

2006

- 2005 Pfizer Visiting Professorship in Allergic Disease and Asthma, Vanderbilt University (received 2006)

2007

- 2006 Pfizer Visiting Professorship in Pulmonary Medicine, Stanford University (received 2007)

2008

- The J. Burns Amberson Lectureship, American Thoracic Society (ATS) Annual Meeting (*Unopposed)* ***A* once-yearly lecture awarded to only one (out of over 20,000) ATS member for "lifetime accomplishment" in the field of respiratory medicine and science.**

2009

- The Donald K. Buffmire Visting Lectureship in Medicine, University of Arizona

Service

National

Member, Expert Panel charged with writing the NIH Guidelines for the Treatment of Asthma, National Asthma Education and Prevention Program (NAEPP)	1995-present
Member, Board of Extramural Advisors, NHLBI	1999-2006
Co-Chair, Asthma Subcommittee, National Children's Study, NIH	2002-2005
Parker B. Francis Fellowship Program Council of Scientific Advisors	2003-2005
Member, Pulmonary-Allergy Drugs Advisory Committee, FDA	2003-2007

University Of Arizona

Interviewer for Pediatric Pulmonary Fellowship Training Program	1988-present
Space and Facilities Committee; Steele Memorial Children's Research Center	1992-present
Professional Evaluation Committee	1992-present
Director, Arizona Respiratory Center	1996-present
Co-Director, Institute for Biomedical Science & Biotechnology	2002-2005
Member, Search Committee for Vice President for health Sciences	2000
Chair of Search Committee for Dean of College of Medicine	2003
Member, Search Committee for Vice Dean College of Medicine, Phoenix Campus	2006
Chair of Clinical and Translational Science Executive Board, UofA	2006-present
Chair of Clinical Scholars Circle	2007-present
Co-Chair of the Integrated Health Sciences Facility Core of the NIEHS-funded Southwest Environmental Health Sciences Center (SWEHSC)	2007-present

B. SELECTED PEER-REVIEW PUBLICATIONS (Selected out of 183):

1. Karakoc F, Remes ST, **Martinez FD**, Wright AL. The association between persistent eosinophilia and asthma in childhood is independent of atopic status. Clin Exp Allergy. 2002 Jul-Aug;2(4):261-7. *PMID 12002737*
2. Oddy WH, Halonen M, **Martinez FD**, Lohman IC, Stern DA, Kurzius-Spencer M, Guerra S, Wright AL. TGF-beta in human milk is associated with wheeze in infancy. J Allergy Clin Immunol. 2003 Oct;112(4):723-8. *PMID 14564350*
3. Crestani E, Guerra S, Wright AL, Halonen M, **Martinez FD**. Parental asthma as a risk factor for the development of early skin test sensitization in children. J Allergy Clin Immunol. 2004 Feb;113(2):284-90. *PMID 14767443*

4. Kabesch M, Hasemann K, Schickinger V, Tzotcheva I, Bohnert A, Carr D, Baldini M, Hackstein H, Leupold W, Weiland SK, **Martinez FD**, von Mutius E, Bein G. A promoter polymorphism in the CD14 gene is associated with elevated levels of soluble CD14 but not with IgE or atopic diseases. Allergy. 2004 May;59(5):520-5. *PMID 15080833*
5. Graves PE, Siroux V, Guerra S, Klimecki WT, Martinez FD. Association of atopy and eczema with polymorphisms in T-cell immunoglobulin domain and mucin domain-IL-2-inducible T-cell kinase gene cluster in chromosome 5 q 33. J Allergy Clin Immunol. 2005 Sep;116(3):650-6. *PMID 16159638*
6. Bieli C, Eder W, Frei R, Braun-Fahrlander C, Klimecki W, Waser M, Riedler J, von Mutius E, Scheynius A, Perhagen G, Doekes G, Lauener R, **Martinez FD**; PARSIFAL study group. A polymorphism in CD14 modified the effect of farm milk consumption on allergic diseases and CD14 gene expression. J Allergy Clin Immunol. 2007 Dec;120(6):1308-15. *PMID 17919709* Stern DA, Morgan WJ, Wright AL, Guerra S, **Martinez FD**. Poor airway function in early infancy and lung function by age 22 years: a non-selective longitudinal cohort study. Lancet. 2007 Sep 1;370(9589):758-64. *PMID 17765525*
7. Stern DA, Guerra S, Halonen M, Wright AL, **Martinez FD**. Low IFN-gamma production in the first year of life as a predictor of wheeze during childhood. J Allergy Clin Immunol. 2007 Oct;120(4):835-41. Epub 2007 Aug 8. *PMID 17689598*
8. Guerra S, Sherrill DL, Kurzius-Spencer M, Venker C, Halonen M, Quan SF, **Martinez FD**. The course of persistent airflow limitation in subjects with and without asthma. Respir Med. 2008; 102(10):1473-82. *PMID 18684603*
9. Castro M, Ramirez MI, Gern JE, Cutting G, Redding G, Hagood JS, Whitsett J, Abman S, Raj JU, Barst R, Kato GJ, Gozal D, Haddad GG, Prabhakar NR, Gauda E, **Martinez FD**, Tepper R, Wood RE, Accurso F, Teague WG, Venegas J, Cole FS, Wright RJ. Strategic Plan for Pediatric Respiratory Diseases Research: An NHLBI Working Group Report. Proc Am Thorac Soc. 2009 Jan;6(1):1-10. *PMID 19131525*
10. Guerra S, **Martinez FD.** Epidemiology of the origins of airflow limitation in asthma. Proc Am Throac Soc. 2009 Dec;6(8):707-11. *PMID 20008881*
11. **Martinez FD**, Fabbri LM. Genetics, ethics, and the use of long-acting beta-adrenergics to treat asthma. Am J Respir Crit Care Med. 2010 Apr1; 181(7):647-8. *PMID 20335379*
12. Bosco A, Ehteshami S, Stern DA, **Martinez FD**. Decreased activation of inflammatory networks during acute asthma exacerbations is associated with chronic airflow obstruction. Mucosal Immunol. 2010 Jul; 3(4):399-409. Epub 2010 Mar 24. *PMID 20336062*
13. Garcia-Marcos L, **Martinez FD**. Multi trigger versus episodic wheeze in toddlers: new phenotypes or severity markers? J Allergy Clin Immunol. 2010 Sep; 126(3): 489-90. *PMID 20816185*
14. Stein RT, **Martinez, FD**. Respiratory syncytial virus and asthma: still no final answer. Thorax. 2010 Oct 26 {Epub ahead of print]. *PMID 20978023*

C. RESEARCH SUPPORT:

Active Support

- **U10 HL64307 (Martinez, PI)** 09/01/04 – 12/31/10 (No Cost Extension)

NIH/NHLBI
CARE – Tucson Clinical Center
The CARE network has established a successful infrastructure to conduct clinical research in pediatric asthma.
Role: PI

- **R01 HL56177 (Martinez, PI)** 08/01/07 – 07/31/11

NIH/NHLBI
Natural History of Asthma from Birth to Early Adult Life
The major goals of this program are to assess longitudinally the roles of lower respiratory tract illnesses (LRIs) during the first three years of life, early and late allergic sensitization, persistent respiratory symptoms during childhood, and persistent bronchial responsiveness (BHR) in relation to onset, persistence, remission, and relapse of asthma and asthma-like symptoms during childhood and into adolescence.
Role: PI

- **P30 ES006694 (Lau, PI)** 07/01/06-06/31/11

NIH/NIEHS

Southwest Environmental Health Sciences Center
Role: Investigator

- **HHSN275200800034C (Martinez)** 09/26/08-09/25/13

NIH/NICHD (National Institute for Children's Health and Development)
Arizona National Children's Study
To identify preventable environmental risk factors along the causal pathways for a number of adverse health outcomes, providing strategies that will reduce prevalence and improve health.
Role: PI

- **U10 HL098112 (Martinez)** 09/30/09 – 09/29/16

NIH
Arizona/Duke Clinical Center for AsthmaNet
This is a double-armed clinical Management trial covering adult asthma management at Duke University and pediatric asthma management at the University of Arizona. The proposal also includes a clinical research skills development core which will provide training opportunities for pulmonary and allergy fellows and other trainees in the design and implementation of clinical trials in a network setting.
Role: PI

- **RC2 HL101543 (Raby)** 10/01/09 – 09/30/11

Harvard University subcontract (NIH RC2 application)
The Asthma BioRepository for Integrative Genomics Research
The purpose of this proposal is to perform and coordinate the participation of the Childhood Asthma Research and Education (CARE) Network in the Grand Opportunity application "The Asthma BioRepository for Integrative Genomics Research".
Role: sub-PI

- **RC2 HL101651 (Ober)** 10/01/09 – 09/30/11

University of Chicago subcontract (NIH RC2 application)
The EVE Asthma Genetics Consortium: Building upon GWAS
The purpose of this proposal is to perform and provide analyses of the SHARP data (CARE and ACRN) in the Grand Opportunity application "*The EVE Asthma Genetics Consortium: Building upon GWAS*".
Role: sub-PI

Completed Support

- **R01 HL80083 (Martinez, PI)** 06/01/05-05/31/09

NIH/NHLBI
IL8- and GATA3-mediated Pathways in Asthma Exacerbations
This project studied two pathways involved in triggering AE: one centered on IL-8 and neutrophils, the other mediated by GATA3 and eosinophils. The novel mechanisms used allowed us to define the role played by these pathways and may lead to the identification of new therapeutic targets for the prevention and treatment of AEs.
Role: PI

Principal Investigator/Program Director (Last, First, Middle): Sherrill, Duane L.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Duane L. Sherrill	Professor Associate Dean for Research Mel-Enid Zuckerman College of Public Health, University of AZ Director, Arizona Clinical Research Training Program
eRA COMMONS USER NAME DSHERRILL	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Metropolitan State College, Denver, Colorado	B.S.	1976	Math/Elec. Engineering
University of Colorado Health Sciences Center	M.S.	1982	Biometry
University of Colorado Health Sciences Center	Ph.D.	1987	Biometry

A. Personal Statement

The main objective of this career training grant is to examine the role of diesel-related pollutant exposure during infancy in developmental alterations of the immune and respiratory systems that may ultimately result in transient early life wheezing or asthma. This project will use prospective data collected from two on-going birth cohort studies that provide extensive longitudinal data. This project is very statistically intensive and although Paloma has a strong math and engineering background she needs additional training and mentoring in this area. My role as a Biostatistician will be will be overseeing and assisting in the training and application of the statistical methodology.

B. Positions and Honors

Positions and Employment

1988-1999 Director of Epidemiology-Biostatistics SCOR Unit, Respiratory Sciences Center, (Presently known as “Arizona Respiratory Center”), College of Medicine, University of Arizona, Tucson
1988-1989 Research Assistant Professor, Pulmonary and Critical Care Medicine Section, Department of Medicine, College of Medicine, University of Arizona, Tucson
1989-1996 Research Associate Professor, Pulmonary and Critical Care Medicine Section, Department of Medicine, College of Medicine, University of Arizona, Tucson
1992-2001 Faculty, Epidemiology Interdisciplinary Graduate Program, College of Medicine, (Graduate College), University of Arizona, Tucson
1993-2001 Epidemiology Concentration Director, Graduate Program in Public Health, College of Medicine, (Presently known as the “Mel & Enid Zuckerman College of Public Health”) University of Arizona
1996-2003 Associate Professor, College of Public Health, (Presently known as the “Mel and Enid Zuckerman College of Public Health”), University of Arizona, Tucson
1997-2000 Unit Director, Biostatistics Unit, Arizona Prevention Center, University of Arizona
2000-2005 Biostatistics Concentration Director, Arizona Graduate Program in Public Health, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson
2000-Present Director, Arizona Clinical Research Training Program, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson
2002-2006 Co-Director of Biostatistics Core, University of Arizona General Clinical Research Center (GCRC)
2003-Present Professor, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson
2006-Present Associate Dean for Research, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson

Honors

1973-1974	Vice-President's Honor Role, Metropolitan State College
1974-1976	Colorado Scholars Award, Metropolitan State College
1982	Murice Davis Award, American Statistical Society
2003	Nominated member Alpha Nu Chapter of Delta Omega, National Public Health Honorary Society

C. Selected peer-reviewed publications (in chronological order). (Note: selected from 121 total publications.)

1. Chen Z, Wang Z, Lohman T, Heymsfield SB, Outwater E, Nicholas JS, Bassford T, LaCroix A, **Sherrill DL**, Punyanitya M, Wu G, Going S. Dual-energy X-ray absorptiometry is a valid tool for assessing skeletal muscle mass in older women. *J. Nutr.* 137(12):2775-2780, 2007.
2. Kurzius-Spencer M, Foster K, Littau S, Richey KJ, Clark BM, **Sherrill DL**, Goodman RB, Boitano S, Burgess JL. Tracheobronchial markers of lung injury in smoke inhalation victims. *J Burn Care Res.* 29: 311-318, 2008.
3. Silva GE, Guerra S, Keim S, Barbee RA, **Sherrill DL**. Longitudinal decline of diffusing capacity of the lung for carbon monoxide in community subjects with the PiMZ α1-Antitrypsin Phenotype. *Chest.* 133:1095-1100, 2008.
4. Wang MT, Malone DC, Skrepnec GH, Armstrong E, **Sherrill DL**, Harris RB, Tsai CL. Use of Salmeterol with and without concurrent use of inhaled corticosteroids and the risk of asthma-related hospitalization among patients with asthma. *Cur. Med. Res.* (24):1-9, 2008.
5. Tebow G, **Sherrill DL**, Lohman IC, Stern DA, Wright AL, Martinez FD, Halonen M, Guerra S. Effects of parental smoking on interferon-γ production in children. *Pediatrics*. 121(6), 2008.
6. Zhao Q, **Sherrill DL**, Goodwin JL, Quan SF. Association between sleep disordered breathing and behavior in school-aged children: the Tucson Children's Assessment of Sleep Apnea Study (TuCASA). *Open Epidemiol J.* 1:1-9, 2008.
7. Guerra S, **Sherrill DL**, Kurzius-Spencer M, Venker C, Halonen M, Quan SF, Martinez FD. The course of persistent airflow limitation in subjects with and without asthma. Respir Med. 102(10):1473-82, 2008.
8. Chen Z, Beck TJ, Cauley JA, Lewis CE, LaCroix A, Bassford T, Wu G, **Sherrill DL**, Going S. Hormone therapy improves femur geometry among ethnically diverse postmenopausal participants in the Women's Health Initiative hormone intervention trials. J Bone Miner Res. 23(12):1935-45, 2008.
9. Maio S, Baldacci S, Carrozzi L, Polverino E, Angino A, Pistelli F, Di Pede F, Simoni M, **Sherrill, DL**, Viegi G. Urban residence is associated with bronchial hyper-responsiveness in Italian general population samples. Chest. 135(2):434-41, 2009
10. Sorino C, **Sherrill DL**. Frequent exacerbators in COPD: who are they? Am J Respir Crit Care Med. 180(3):283-4, 2009.
11. Marcus FI, Zareba W, Calkins HG, Towbin JA, Basso C, Bluemke DA, Estes M, Picard MH, Sanborn DY, Thiene G, Wichter T, Cannom D, Wilber D, Scheinman M, Duff H, Daubert J, Talajic M, Krahn A,Sweeney M, Garan H, Sakaguchi S, Lerman B, Kerr C, Kron J, Steinberg J, **Sherrill DL**, Gear K, Brown M, Severski P, Polonsky S, McNittS. Arrhythmogenic right ventricular cardiomyopathy/ dysplasia, clinical presentation and diagnostic evaluation: results from the North American Multidisciplinary Study. Heart Rhythm 6(7):984-92. PMID #19560088
12. Kurzius-Spencer M, Foster K, Littau S, Richey K, Clark B, **Sherrill DL**, Boitano S, Caruso DM, Burgess J. Tracheobronchial protease inhibitors, body surface area burns and mortality in smoke inhalation. J Burn Care Res. 30(5):824-31. PMID# 19692916
13. Thorn ST, Brown MA, Yanes J, **Sherrill DL**, Pugmire J, Anderson KA, Klotz SA. Pulmonary nocardiosis in cystic fibrosis. J Cyst Fibros. 8(5):316-20. PMID# 19683479
14. Guerra S, **Sherrill DL**, Venker C, Ceccato CM, Jalonen M, Martinez FD. Chronic bronchitis before age 50 years predicts incident airflow limitation and mortality risk. Thorax. 64(10):894-900. PMID #19581277
15. Marcus FI, Mc Kenna WJ, **Sherrill DL**, Basso C, Bauce B, Bluemke DE, Calkins H, Corrado DA, Cox MG, Daubert J, Fontaine G, Gear K, Hauer RN, Nava A, Picard MH, Protonotarios N, Saffitz JE, Yoerger Sanborn DM, Steinberg JS, Harikrishna MT, Thiene G, Towbin JA, Tsatsopoulou A, Wichter T, Zareba W.

Diagnosis of Arrhythmogenic right ventricular cardiomyopathy/dysplasia (ARVC/D); Proposed modification of the task force criteria. Circulation. Vol.121 (#13)/(840827) and European Heart Journal. Vol.31 (#7)

D. Research Support

Ongoing Research Support:

Martinez PI / Duane Sherrill, Co-Investigator; 08/10/05-07/31/10; NIH/NHLBI; HL56177. ***Longitudinal Study of Asthma from Birth to Adulthood.*** The major goals of this program are to assess longitudinally the roles of lower respiratory tract illnesses (LRIs) during the first three years of life, early and late allergic sensitization, persistent respiratory symptoms during childhood, and persistent bronchial responsiveness (BHR) in relation to onset, persistence, remission, and relapse of asthma and asthma-like symptoms during childhood and into adolescence. This program aims to study the relation between physiologic landmarks occurring during adolescence (such as age at first signs of puberty and age of peak growth velocity) and changes in the prevalence of BHR and asthma-like symptoms in males and females with reference to pre-pubertal values.

Chen PI / Duane Sherrill, Co-Investigator; 10/01/07-9/30/12; NIH; 1 R01 AG027373-01A2. ***Biomarkers and Genetic Factors Related to Sarcopenia in Women.*** This application seeks support to identify blood biomarkers associated with sarcopenia, and interactions between genetic variations and environmental factors related with level and rate of sarcopenia in women.

Woosley PI / Duane Sherrill, Co-Investigator; 9/30/02-9/29/12; AHRQ; 2 U18 HS10385-04. ***Center for Education and Research in Therapeutics (CERT);Project: Drug-Drug Outcomes Core.*** The major goals of this project are to examine factors affecting the incidence of serious drug-drug interactions in the community and Veterans Affairs medical centers.

Guerra PI/ Duane Sherrill, Co-Investigator;12/01/08–11/30/13;NIH/NHLBI; R01 HL095021-01. ***Serum Biomarkers of COPD: a Population-based Prospective Study.*** The major goal of this project is to use a multi-analyte approach to identify a panel of biomarkers that predict development/ progression of COPD phenotypes and COPD-related mortality risk.

Completed Research Support: (completed during the last three years)

Quan PI / Duane Sherrill, Co-Investigator; 1/1/05 - 11/30/08; NIH/NHLIB; 2 RO1 HL062373-05A2. ***Impact of Childhood Sleep Disordered Breathing (TuCASA).*** This is a prospect study of adolescents to investigate the prevalence and risk factors for sleep disordered breathing and sleep apnea and to assess ethnic differences.

Chen PI / Duane Sherrill, Co-Investigator; 07/01/03- 06/30/08; NIH/NIAMS; 1RO1 AR049411. ***Longitudinal Changes in Hip Geometry.*** The major goal of this program is to look at Longitudinal changes in hip geometry and to study effects of interventions and aging on skeletal microstructure and muscle mass among multiethnic postmenopausal women in the U.S.

Albani PI / Duane Sherrill, Co-Investigator; 10/01/09–09/30/14; NIH/NIAID; 1 R01 AR056273-01A1. ***Mechanisms of Immune Modulation in JIA.*** This project aims to explore and identify mechanisms of tolerance induction from the TREAT trial in JIA.

Albani PI / Duane Sherrill, Co-Investigator; 10/01/09–09/30/11; NIH/NIAID (ARRA Funding); 1 R01 AI084551-01. ***Immune tolerance in the therapy of rheumatoid arthritis.*** The major goals of this project are to demonstrate the mechanisms of action of the immuno-therapy and characterize the molecular responses.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Lynn B. Gerald, PhD, MSPH	Canyon Ranch Endowed Chair for Lifestyle and Behavioral Science/Professor
eRA COMMONS USER NAME (credential, e.g., agency login) geraldl	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Alabama at Birmingham	BS	1990	Psychology/Gerontology
University of South Alabama	MA	1992	Sociology/Gerontology
University of Alabama at Birmingham	MSPH	1997	Epidemiology
University of Alabama at Birmingham	PhD	1997	Medical Sociology

A. Personal Statement

I have extensive experience and expertise in the development and implementation of community based clinical trials in children with asthma. My previous funding from NIH/NHLBI has included three R01s which focused on school based asthma interventions and I also served as a Co-Investigator on the original NHLBI funded contracts to examine the effectiveness of asthma self-management programs in the schools. I have also served as PI on an NHLBI funded community based trial related tuberculosis as well as PI of an ALA Asthma Clinical Research Center. These Centers have conducted numerous NIH and industry sponsored clinical trials. My specific role in this project is to serve as a co-mentor for Dr. Beamer. I have extensive experience in mentoring at the post-doctoral level and with both clinician scientists and PhDs. During the past 5 years I have mentored 3 post-doctoral fellows, and 6 junior faculty. In my role as the Director of the Lung Health Center at the University of Alabama at Birmingham (UAB), I was tasked with serving as the Research Advisor for the Pulmonary Fellowship Program and I currently serve as Co-PI of a HRSA/MCH training grant program in the College of Public Health. I have also mentored medical students in summer research projects, served as advisors for the NIH minority mentor program at UAB, assisted a post-doctoral fellow in obtaining an NIH minority supplement, served on numerous thesis and dissertation committees, and served as a mentor in the UAB Department of Medicine faculty mentoring program. In summary, I have a demonstrated record of successful and productive research projects in the area of investigation and have the mentoring expertise necessary to assist Dr. Beamer in her career goals.

B. Positions and Honors

Positions

1992-1994	Instructor, Department of Sociology, University of South Alabama, Mobile, AL
1996-1997	Instructor, Department of Sociology, University of Alabama at Birmingham, Birmingham, AL
1997-2002	Assistant Professor, Department of Critical and Diagnostic Care, School of Health Related Professions, University of Alabama at Birmingham, Birmingham, AL
1997-2008	Scientist, Lung Health Center, University of Alabama at Birmingham, Birmingham, AL
1999-2004	Assistant Professor, Division of Pulmonary, Allergy & Critical Care Medicine, School of Medicine, University of Alabama at Birmingham, Birmingham, AL
1999-2007	Assistant Director, Lung Health Center, University of Alabama at Birmingham, Birmingham, AL
2000-2004	Associate Scientist, Center for Health Promotion, University of Alabama at Birmingham, Birmingham, AL
2001-2004	Assistant Professor, UAB Graduate School, University of Alabama at Birmingham, Birmingham, AL
2004-2007	Associate Professor, Division of Pulmonary, Allergy & Critical Care Medicine, University of Alabama at Birmingham, Birmingham, AL
2007-2008	Director, Lung Health Center, University of Alabama at Birmingham, Birmingham, AL
2007-2008	Professor, Division of Pulmonary, Allergy & Critical Care Medicine, University of Alabama at Birmingham, Birmingham, AL

2009-Present Canyon Ranch Endowed Chair for Lifestyle and Behavioral Health, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ
2009-Present Professor, Health Promotion Sciences, Mel and Enid Zuckerman, College of Public Health, University of Arizona, Tucson, AZ
2009-Present Scientist, Arizona Respiratory Center, University of Arizona.

Honors

2007 Nominated (1 of 6 women) for the **American Thoracic Society's Elizabeth A. Rich Award** for outstanding scientific achievement among female scientists in pulmonary disease.
2007 Jefferson County American Federation of Teachers, **JCAFT Partners in Health Award.**
2006 **Max Cooper Award for Research Excellence**. University of Alabama at Birmingham, School of Medicine.
2005 Nominated (1 of 15 candidates) for the CHEST Foundation's **Alfred Soffer Research Award**.
2004 Featured as a "**Lung Disease Champion**" in the American Lung Association's *How We Help Today Annual Report 2004.*
2003 American Thoracic Society Behavioral Science Assembly **Junior Scholar Award**. *(Given to the individual who has made the most outstanding scientific contributions relevant to behavioral science and lung diseases early in his or her career.)*

C. Selected Peer-reviewed publications (in chronological order)

1. **Gerald, LB**, Redden D, Turner-Henson A, Feinstein R, Hemstreet MP, Hains C, Brooks CM, Erwin S, & Bailey WC. (2002). "A multi-stage asthma screening procedure for elementary school children." Journal of Asthma 39(1):29-36. PMID: 11883737
2. **Gerald LB**, Turner-Henson A, Hains C, Tang S, Feinstein R, Wille K, Erwin S & Grad R. (2004). "Validation of a multi-stage asthma case detection procedure for elementary school children." Pediatrics,114(4):e459-e468. PMID: 15466072
3. Mangan J & **Gerald LB**. (2006). "Asthma Agents: monitoring asthma in school." Journal of School Health, 76(6): 300-302. PMID: 16918859
4. **Gerald LB**, Redden D, Wittich A, Hains C, Turner-Henson A, Hemstreet MP, Feinstein R, Erwin S & Bailey WC. (2006). "Outcomes for a comprehensive school based asthma management program." Journal of School Health, 76(6): 291-296. PMID: 16918857
5. Wheeler, Lani S., Sarah L. Merkle, **Lynn B. Gerald**, & Virginia S. Taggart. (2006). "Managing asthma in schools: lessons learned and recommendations." Journal of School Health. 76(6):340-344. PMID: 16918868
6. Merkle, Sarah L., Lani S. Wheeler, **Lynn B. Gerald,** Virginia S. Taggart. (2006). "Introduction: Learning From Each Other About Managing Asthma in Schools." Journal of School Health. 76(6):202-204. PMID: 16918838
7. **Lynn B. Gerald,** Marianna M. Sockrider, Roni Grad, Bruce G. Bender, Leslie P. Boss, Stanley P. Galant, Jorrit Gerritsen, Christine L. M. Joseph, Robert M. Kaplan, Julie A. Madden, Joan M. Mangan, Greg J. Redding, Diana K. Schmidt, Christina D. Schwindt, Virginia S. Taggart, Lani S. Wheeler, Kristin N. Van Hook, Paul V. Williams, Barbara P. Yawn, and Bulend Yuksel, on behalf of the ATS Ad Hoc Committee on Issues in Screening for Asthma in Children. (2007). "An Official ATS Workshop Report: Issues in Screening for Asthma in Children." Proceedings of the American Thoracic Society 4:133-141. PMID: 17494724
8. Joan M. Mangan, Angelina Wittich, & **Lynn B**. **Gerald**. (2007). "The potential for reducing asthma disparities through improved family and social function and modified health behaviors." CHEST 132:789-801. PMID: 17998343
9. McClure, Leslie A., Kathy F. Harrington, Holli Graham, & **Lynn B. Gerald.** (2008). "Internet-based monitoring of asthma symptoms, peak flow meter readings, and absence data in a school-based clinical trial". Controlled Clinical Trials. 5:31-37. PMID: 18283077
10. **Gerald, Lynn B.,** Leslie McClure, Kathy Harrington, Joan M. Mangan, Linda Gibson, Jody Atchison, & Roni Grad. (2008) "Design of the supervised asthma therapy study: implementing an adherence intervention in urban elementary schools." Contemporary Clinical Trials. 29(2):304-310.
11. **Gerald, Lynn B.**, Joan M. Mangan, Leslie McClure, Linda Gibson, Jody Atchison, & Roni Grad. (2009). "Increasing adherence to inhaled steroid therapy among schoolchildren: randomized controlled trial of school based supervised asthma therapy." Pediatrics.*123:466-474.* PMID: 19171611

12. **Gerald, Lynn B.**, Joe K. Gerald, Linda Gibson, Karna Patel, Sijian Zhang, & Leslie A. McClure. (2009). "Changes in ETS exposure and asthma morbidity among urban school children." CHEST; 135:911-916. PMID: 19017893
13. Grad, Roni, Leslie McClure, Sijian Zhang, Joan M. Mangan, Linda Gibson, & **Lynn B. Gerald.** (2009). "Peak flow measurements in children with asthma: what happens at school?" Journal of Asthma; 46:535-540.
14. Gerald, Joe K., Yanhui Sun, Roni Grad, & **Lynn B. Gerald.** (2009). "Asthma morbidity among children evaluated by asthma case detection." Pediatrics. 124(5):927-933. PMID: 19841121
15. Gerald, Joe K., Roni Grad, William C. Bailey, & **Lynn B. Gerald**. "Cost-Effectiveness of School-Based Asthma Screening in an Urban Setting". (2009). Journal of Asthma and Clinical Immunology. 125:643-650. A*ccompanying Editorial by Sean McElligott and Daniel Polsky 651-652.* PMID: 20226298
16. Wheeler, L., Rebecca Buckley, **Lynn B. Gerald**, Sarah Merkle, & Teresa Morrison. "Working with Schools to Improve Pediatric Asthma Management." (2010). Pediatric Asthma, Allergy, and Immunology. 22(4):197-207.

D. Research Support

Ongoing Research Support

T76MC04925

HRSA/MCH Garcia/Gerald (PI) (6/01/10 – 5/31/15) Maternal and Child Health Public Health Training Program. The over arching goal for the training program is to increase the number and quality of culturally competent MCH professionals who will provide the next generation of MCH public health leadership for the development of evidence-based policies, programs, and program evaluation to address the health and wellness women, children and families throughout the Southwest and Rocky Mountain region, and nationally.

1R01HLHL086972

NHLBI Gerald (PI) (08/01/07 – 12/30/08) Bailey (PI) (1/01/09 – Present) 08/01/07 -- 05/31/12
Effect of a School Based Hand Sanitizer Program on Asthma. This project will test the effect of a school based hand sanitizer program on asthma exacerbations in elementary school children.

American Lung Association Gerald (PI) 01/01/10—06/30/10
Asthma Clinical Research Center. The American Lung Association's Asthma Clinical Research Centers consists of 19 clinical centers and a data and coordinating center who have the mission of improving asthma care through clinical research in diverse populations. The ALA-ACRC conducts various clinical studies related to asthma.

Completed Research Support (in past three years selected)

1R40MC08728

HRSA/MCH Gerald (PI) (9/01/07- 12/30/08) Harrington (PI) (1/01/09-Present) 09/01/07 – 08/31/2010
The Impact of Caregiver's (Parent) Health Literacy on Pediatric Asthma Outcomes. This project will examine the effect of a caregiver's health literacy on their child's asthma outcomes.

American Lung Association Gerald (PI) 07/01/04 – 12/30/08
Asthma Clinical Research Center. The American Lung Association's Asthma Clinical Research Centers consists of 19 clinical centers and a data and coordinating center who have the mission of improving asthma care through clinical research in diverse populations. The ALA-ACRC conducts various clinical studies related to asthma.

1R01HL072817-01 NHLBI Gerald (PI) 04/15/04 – 04/15/09
Effectiveness of the TB Contact Priority Model. This project will use a behaviorally focused intervention to implement and test the effectiveness of the TB contact priority model in field implementation.

1R01HL075043-01 NHLBI Gerald (PI) 04/15/04 – 03/31/07
Effectiveness of School Based Supervised Asthma Therapy. This project tested the effectiveness of a school based supervised asthma therapy program in children from urban schools.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Eric A. Betterton	Professor and Head, Department of Atmospheric Sciences
eRA COMMONS USER NAME (credential, e.g., agency login) BETTERTON	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Natal, Durban, South Africa	B.Sc.	1974	Chemistry/Applied Chem
University of Natal, Durban, South Africa	B. Sc. Honors	1975	Chemistry
University of the Witwatersrand, Johannesburg	Ph.D.	1983	Chemistry
California Institute of Technology, Pasadena, CA.	Res. Fellow	1985-8	Environmental Engineering Science

A. Personal Statement

The goal of Dr. Beamer's proposed research is to investigate the potential effects of diesel emissions, including particulate matter, on the respiratory health of young children in Tucson.

I am the PI on an NIEHS Superfund Basic Research Program study of the physical and chemical properties of dust at two EPA Superfund sites in Arizona. We study arsenic- and lead-containing dust arising from smelters and mine tailings.

I have studied atmospheric aerosols for the past two decades ranging from mountain-top studies of PM2.5 to the metal content of PM10 in Tucson, and most recently the chemical and physical characterization of particulate matter arising from mining and smelting operations in Arizona. I teach a graduate level class "Atmospheric Aerosols" and a I have a range of expensive aerosol sampling equipment available, including two instrumented,10-m, dust flux towers currently being installed at Dewey-Humboldt, Arizona.

I developed a broad interest in the environment during my time as a post-doctoral fellow at Caltech and I have pursued those interests in both the gas and aqueous phases. I hold a courtesy appointment in the Department of Chemical and Environmental Engineering, and also have one in the College of Public Health, Dr. Beamer's home college. This K award provides a golden opportunity for Dr. Beamer to bridge the gap between atmospheric sciences and public health professionals. The synergy and timing could hardly be better.

Positions and Employment

2007-present	Head/Director, Department of Atmospheric Sciences/Institute of Atmospheric Physics, University of Arizona.
2000-present	Professor, Department of Atmospheric Sciences and Institute of Atmospheric Physics, University of Arizona.
1994-2000	Associate Professor, Department of Atmospheric Sciences and Institute of Atmospheric Physics, University of Arizona.
1995-2002	Associate Department Head, Department of Atmospheric Sciences and Institute of Atmospheric Physics, University of Arizona.
1988-1994	Assistant Professor, Department of Atmospheric Sciences and Institute of Atmospheric Physics, University of Arizona.
1987-1988	Assistant Professor, Department of Chemistry, California State University, Northridge.
1984-1985	Assistant to Works Manager (), Anglo-Alpha Cement Ltd., Ulco, South Africa.
1982-1984	Operations Engineer (), Anglo-Alpha Technical Services, Johannesburg, South Africa.

1976-1979 Acting Chief Chemist, Impala Platinum Limited, Springs, South Africa.

Honors, Committee Chairs, Other Experience and Professional Memberships

1997 Karen Morehouse Best Paper Award, Great Plains/Rocky Mountain Hazardous Substance Research Center.

1996 College of Science Distinguished Teaching Award.

1992 Quentin Mees Research Award, Arizona Water & Pollution Control Association, (R. G. Arnold, E. A. Betterton, T. Caudill, R. Kuhler, G. Santo).

2002-2003 Chair, University Corporation for Atmospheric Research (UCAR) University Relations Committee.

2003-2009 Chair, NAS, National Research Council, Research Associateship Program Review Panels.

2008-2010 Chair, American Geophysical Union (AGU) Committee on Public Affairs

B. Selected publications (in chronological order).

1. .Kommineni, S.; Ela, W. P.; Arnold, R. G.; Huling, S. G.; Hester, B. J.; Betterton, E. A., NDMA treatment by sequential GAC adsorption and Fenton-driven destruction. *Environmental Engineering Science* **2003,** 20, (4), 361-373.

2. He, J. H.; Arnold, R. G.; Saez, A. E.; Betterton, E. A.; Ela, W. P., Removal of aqueous phase trichloroethylene using membrane air stripping contactors. *Journal Of Environmental Engineering-Asce* **2004,** 130, (11), 1232-1241. http://www.pubs.asce.org/journals/environmental/

3. He, J. H.; Ela, W. P.; Betterton, E. A.; Arnold, R. G.; Saez, A. E., Reductive dehalogenation of aqueous-phase chlorinated hydrocarbons in an electrochemical reactor. *Industrial & Engineering Chemistry Research* **2004,** 43, (25), 7965-7974. http://pubs.acs.org/journal/iecred

4. Ju, X. M.; Saez, A. E.; Ela, W. P.; Arnold, R. G.; Betterton, E. A.; Wallen, M.; Candillo, K.; Barbaris, B.; Orbay, O., Reductive and oxidative destruction of chlorinated hydrocarbons in gas-phase catalytic reactors: Packed-beds and modified fuel cells. *Abstracts Of Papers Of The American Chemical Society* **2004,** 228, 135-ENVR.

5. Li, H.; Arnold, R. G.; Betterton, E. A.; Ela, W. P.; Barbaris, B., Comment on "the mechanisms of rate enhancing and quenching of trichloroethene photodecay in the presence of sensitizer and hydrogen sources". *Water Research* **2004,** 38, (11), 2791-2792. PMID: 15207610

6. He, J. H.; Saez, A. E.; Ela, W. P.; Betterton, E. A.; Arnold, R. G., Destruction of aqueous-phase carbon tetrachloride in an electrochemical reactor with a porous cathode. *Industrial & Engineering Chemistry Research* **2004,** 43, (4), 913-923. http://pubs.acs.org/journal/iecred

7. Orlando, J. J.; Tyndall, G. S.; Betterton, E. A.; Lowry, J.; Lowry, J., Atmospheric chemistry of hydrazoic acid (HN3): UV absorption spectrum, HO center dot reaction rate, and reactions of the center dot N-3 radical. *Environmental Science & Technology* **2005,** 39, (6), 1632-1640. PMID: 15819219

8. Li, H.; Betterton, E. A.; Arnold, R. G.; Ela, W. P.; Barbaris, B.; Grachane, C., Convenient new chemical actinometer based on aqueous acetone, 2-propanol, and carbon tetrachloride. *Environmental Science & Technology* **2005,** 39, (7), 2262-2266. PMID: 15871262

9. Ju, X. M.; Hecht, M.; Galhotra, R. A.; Ela, W. P.; Betterton, E. A.; Arnold, R. G.; Saez, A. E., Destruction of gas-phase trichloroethylene in a modified fuel cell. *Environmental Science & Technology* **2006,** 40, (2), 612-617. PMID: 16468410

10. Matichuk, R.; Barbaris, B.; Betterton, E. A.; Hori, M.; Murao, N.; Ohta, S.; Ward, D., A decade of aerosol and gas precursor chemical characterization at Mt. Lemmon, Arizona (1992 to 2002). *Journal Of The Meteorological Society Of Japan* **2006,** 84, (4), 653-670. http://www.jstage.jst.go.jp/browse/jmsj

11. Orbay, O.; Gao, S.; Barbaris, B.; Rupp, E.; Saez, E.; Arnold, R. G.; Betterton, E. A., Catalytic dechlorination of gas-phase perchloroethylene under mixed redox conditions. *Applied Catalysis B-Environmental* **2008,** 79, (1-2), 43-52. PMID: 19234593

12. Gao, S.; Rupp, E.; Bell, S.; Willinger, M.; Foley, T.; Barbaris, B.; Saez, A. E.; Arnold, R. G.; Betterton, E., Mixed Redox Catalytic Destruction of Chlorinated Solvents in Soils and Groundwater. In *Environmental Challenges In The Pacific Basin*, **2008**; Vol. 1140, pp 435-445. PMID: 18991945

13. Betterton EA, Barbaris B, Conant W, Csavina J, Gao S, Lund L, Rheinheimer P, Sáez E, Wonaschutz A. Physicochemical Characterization of Aeolian Mine Tailings Dust in the Southwest USA. Proceedings American Geophysical Union Fall Meeting, San Francisco, CA, December **2008**.

14. Willinger M, Rupp E, Barbaris B, Gao S, Arnold R, Betterton E, Sáez AE, Thermocatalytic destruction of gas-phase perchloroethylene using propane as a hydrogen source, J Hazard Mater. **2009** Jan 23. PMID: 19217713

15. Eric A. Betterton, Joe Lowry, Robin Ingamells, Brad Venner, "Kinetics and mechanism of the reaction of sodium azide with hypochlorite in aqueous solution", J. Hazardous Materials, in press, July **2010**.

16. Janae Csavina, Andrea Landázuri, Anna Wonaschütz, Kyle Rine, Paul Rheinheimer, Brian Barbaris, William Conant, A. Eduardo Sáez, Eric A. Betterton, Metal and Metalloid Contaminants in Atmospheric Aerosols from Mining Operations, submitted J. Water, Air and Soil Pollution, Sept. **2010**.

17. Theresa Foley, Eric A. Betterton, Ann Marie A. Wolf, PM10 and Metal Concentrations in the Sunnyside Unified School District of Tucson, Arizona, submitted to J. Arizona Nevada Academy of Science, Sept. **2010**

C. Research Support. List selected ongoing or completed (during the last three years) research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and your role (e.g. PI, Co-Investigator, Consultant) in the research project. Do not list award amounts or percent effort in projects.

P42 ES04940-6 NIEHS/SBRP (PI – Betterton) 04/1/05-03/31/10

New Technologies for the Remediation of Halogenated Organics

The major goal of this project is to treat contaminated soil vapor and ground water containing halogenated organics, with an emphasis on destruction of the target pollutant, rather than capture and disposal.

Science Foundation Arizona SRG 0375-08 (PI – Betterton) 01/01/09- 12/31/09

Solar Photovoltaic Cavity Converter and Power Conversion Unit for High Efficiency 2-Meter Solar Collecting Dish

The goal of this project is to construct and test a 2-meter mirror to collect solar energy and convert it into electrical energy.

EPA Pollution Prevention (P2) Grant NP96913801 (PI - Betterton) 01/10/08- 9/30/11

Pollution prevention through community participation.

The major goal of this project is to reduce the amount of hazardous substances, including metal-containing aerosols, entering the environment in parts of Tucson, AZ.

Arizona TRIF (PI – Betterton) 2007

Brine Minimization/Salt Management Using VSEP® Technology to Maximize Water Recovery

The major goal of this project was to test a new reverse osmosis system on high brine waters.

Program Director/Principal Investigator (Last, First, Middle): Martinez, Fernando D.

OTHER SUPPORT

MARTINEZ, FERNANDO D.

ACTIVE:

R01 HL056177 (Martinez/Wright) 08/01/07-07/31/11 1.8 calendar months
NIH/NHLBI $723,928
Natural History of Asthma from Birth to Early Adult Life

This project is designed to continue into early adult life our prospective investigation of risk factors for the development and persistence of asthma, and to study longitudinally assessed mechanisms associated specifically with asthma, in a multiethnic population.

U10 HL064307 (Martinez) 09/30/99-05/31/11 1.8 calendar months
NIH/NHLBI $1,512,135
CARE – Tucson Clinical Center

The CARE network has established a successful infrastructure to conduct clinical research in pediatric asthma.

P30 ES006694 (Lau) 04/01/11-06/31/16 .6 calendar months
NIH/NIEHS $5,500,000
Southwest Environmental Health Sciences Center

The major goals of the NIEHS Center grant are to support research infrastructure, interdisciplinary collaboration, and community outreach and education related to research in the effects of environmental agents on human health

N01 HD80034 (Martinez) 09/26/08-09/25/13 1.8 calendar months
NIH/NICHD ~$2,000,000
National Children's Study – Arizona Center Cost reimbursable contract

To identify preventable environmental risk factors along the causal pathways for a number of adverse health outcomes, providing strategies that will reduce prevalence and improve health.

U10 HL098112 (Martinez/Kraft) 09/30/09-06/30/16 1.8 calendar months
NIH/NHLBI $438,252
Arizona/Duke Clinical Center for AsthmaNet

This is a double-armed clinical Management trial covering adult asthma management at Duke University and pediatric asthma management at the University of Arizona. The proposal also includes a clinical research skills development core which will provide training opportunities for pulmonary and allergy fellows and other trainees in the design and implementation of clinical trials in a network setting.

RC2 HL101543 (Raby) 09/30/09-8/31/11 .6 calendar months
NIH/NHLBI $413,042
The Asthma BioRepository for Integrative Genomics Research

The purpose of this proposal is to perform and coordinate the participation of the Childhood Asthma Research and Education (CARE) Network in the Grand Opportunity application "The Asthma BioRepository for

Integrative Genomics Research".

RC2 HL101651 (Ober) 09/30/09-8/31/11 .6 calendar months
NIH/NHLBI $99,272
The EVE Asthma Genetics Consortium: Building upon GWAS

The purpose of this proposal is to perform and provide analyses of the SHARP data (CARE and ACRN) in the Grand Opportunity application "*The EVE Asthma Genetics Consortium: Building upon GWAS*".

R21 AI088392 (Castigli) 03/01/10-02/29/12 .6 calendar months
NIH/NIAID $153,000
Impact of TLR2/Environment Interactions on Asthma Susceptibility: Mouse Models

This proposal seeks to generate an in vivo BAC transgenic model for the functional analysis of human polymorphisms in TLR2 and gene-environment interactions.

PENDING:

P50 HL107188 04/01/11-03/31/13 .6 calendar months
NIH/NIAD $300,000
Validation of Serum Biomarker Signatures Predictive of Incident COPD

This study will lead to the identification of molecules linked to the development of COPD and, in turn, may lead to potential clinical applications in primary to tertiary prevention of the disease.

RFA-HL-11-018 07/01/11-06/30/17 1.8 calendar months
NIH/NHLBI $4,045,604
Innate Immune Dysfunction in Severe Asthma

This study will elucidate mechanisms linking asthma exacerbations and morbidity as well as provide a better understanding for which to develop better therapeutics.

Sherrill, D.L.

❖ **ACTIVE GRANTS**

PI or Co-investigator on the following grants:

HL56177 (PI Martinez) 08/10/05 - 07/31/11 1.2 calendar
NIH/NHLBI $553,076
Longitudinal Study of Asthma from Birth to Adulthood
Description: The major goals of this program are to assess longitudinally the roles of lower respiratory tract illnesses (LRIs) during the first three years of life, early and late allergic sensitization, persistent respiratory symptoms during childhood, and persistent bronchial responsiveness (BHR) in relation to onset, persistence, remission, and relapse of asthma and asthma-like symptoms during childhood and into adolescence. This program aims to study the relation between physiologic landmarks occurring during adolescence (such as age at first signs of puberty and age of peak growth velocity) and changes in the prevalence of BHR and asthma-like symptoms in males and females with reference to pre-pubertal values.

U10EY013153-10S1 Supplemental (PI Harvey) 8/1/09 – 7/31/11 0.36 calendar
NIH/NEI
Amblyopia in Astigmatic Children: Development and Treatment (supplement)
Description: The goals of this study are to document developmental changes in astigmatism and aberrations in infants and young children from a population with a high prevalence of high astigmatism, to determine the relation between quality of visual experience (quality of visual input) in astigmatic and non-astigmatic infants and toddlers and visual development (normal and abnormal/amblyopic), to determine the relation between spherical aberration and coma and corrected visual acuity in young children with and without high astigmatism, and to determine the effectiveness of eyeglass treatment of astigmatism-related amblyopia in young children.

1 R01 AG027373-01A2 (PI Chen) 10/01/07 - 09/31/12 .6 calendar
NIH $3,613,327
Biomarkers and Genetic Factors Related to Sarcopenia in Women
Description: This application seeks support to identify blood biomarkers associated with sarcopenia, and interactions between genetic variations and environmental factors related with level and rate of sarcopenia in women.

2 U18 HS10385-04 (PI Woosley) 09/30/02 - 09/29/12 .6 calendar
AHRQ $4,316,298
Center for Education and Research in Therapeutics (CERT)
Project: Drug-Drug Outcomes Core
Description: The major goals of this project are to examine factors affecting the incidence of serious drug-drug interactions in the community and Veterans Affairs medical centers.

R01 HL095021-01 (PI Guerra) 12/01/08 – 11/30/13 1.2 calendar
NIH/NHLBI $1,250,000 (Direct costs)
Serum Biomarkers of COPD: a Population-based Prospective Study
Description: The major goal of this project is to use a multi-analyte approach to identify a panel of biomarkers that predict development / progression of COPD phenotypes and COPD-related mortality risk.

❖ **COMPLETED** (recently completed during the last three years)

1RO1 AR049411 (PI Chen) 07/01/03 – 06/30/08 .5 calendar
NIH/NIAMS $437,800
Longitudinal Changes in Hip Geometry
Description: The major goal of this program is to look at Longitudinal changes in hip geometry and to study effects of interventions and aging on skeletal microstructure and muscle mass among multiethnic postmenopausal women in the U.S.

2 RO1 HL062373-05A2 (PI Quan) 01/01/05 - 11/30/08 1.2 calendar
NIH/NHLIB $275,000
Impact of Childhood Sleep Disordered Breathing (TuCASA)
Description: This is a prospect study of adolescents to investigate the prevalence and risk factors for sleep disordered breathing and sleep apnea and to assess ethnic differences.

1 R01 AI084551-01 (PI Albani) 10/01/09 – 09/30/11 .3 calendar
NIH/NIAID (ARRA Funding) $755,974
Immune tolerance in the therapy of rheumatoid arthritis
Description: The major goals of this project are to demonstrate the mechanisms of action of the immuno-therapy and characterize the molecular responses.

1 R01 AR056273-01A1 (PI Albani) 10/01/09 – 09/30/14 .48 calendar
NIH/NIAID $1,919,250
Mechanisms of Immune Modulation in JIA
Description: This project aims to explore and identify mechanisms of tolerance induction from the TREAT trial in JIA.

❖ **PENDING FUNDING:**

ROI _____- (PI Malone) 9/30/09 – 9/29/2014 .36 calendar
(0.36 calendar months in Year 1, 0.6 in Years 2-4, 0.72 in Year 5)
(AHRQ)?? Agency for Health care research and quality
Using Comparative Effectiveness to Reduce Drug-Drug Interactions in Breast Cancer
Description: Specific Aim 1: Identify and quantify the burden of clinically important DDIs in women with a diagnosis of breast cancer.

1 U10 EY13153 (PI Harvey) 8/1/2010 – 7/31/2015 .6 calendar
NIH/NEI $715,257
Amblyopia in Astigmatic Children - Development and Treatment
The goals of this study are to determine factors associated with spectacle wearing compliance in Tohono O'odham children, to determine the effect of uncorrected astigmatism on uncorrected and corrected performance of complex and everyday visual tasks, to examine the relation between the visual experience of uncorrected astigmatic children and the specific patterns of best-corrected visual deficits that result, to study the stability of astigmatism in Tohono O'odham children over time, and to determine the anatomical origins of their astigmatism.

R01_____- (Spaite/Bobrow (Co-PIs) March 2011 1.2 calendar
PA-07-070: NIH/NINDS $3,400,000
Impact of Implementing the EMS Traumatic Brain Injury Treatment Guidelines.
Aim: To test the hypothesis that statewide implementation of the nationally-vetted, evidence-based TBI guidelines in the 911 EMS system will significantly reduce mortality and improve non-mortality outcomes in adults and mature children (age ≥18) with severe TBI. – (Co-Investigators: Denninghoff, Sherrill, Stolz, Gaither)

Lynn B. Gerald, PhD, MSPH

ACTIVE

Investigator **25% FTE**
The Effect of a School Based Hand Sanitizer Program on Asthma 8/1/07 – 5/31/2012
NIH/NHLBI R01HL86972 Year 1 = $724,954/Total Costs = $2,100,694
Bailey (PI) [Gerald (PI – 8/1/07 – 12/30/08)
This study will examine the effectiveness of a school based hand sanitizer program on asthma exacerbations in elementary school children.

Co-PI **10% FTE**
Maternal and Child Health Public Health Training Program 06/01/2010 – 05/31/2015
HRSA/MCHB Year 1 = $356,499/Total Costs = $1,736,297
Garcia/Gerald (PI)
The overarching goal for the training program is to increase the number and quality of culturally competent MCH professionals who will provide the next generation of MCH public health leadership for the development of evidence=based policies, programs, and program evaluation to address the health and wellness of women, children and families throughout the Southwest and Rocky Mountain region and nationally.

PI **11% FTE**
American Lung Association Asthma Clinical Research Center 01/01/10-06/31/15
American Lung Association $75,000/year
The ALA-ACRC consists of 18 clinical centers and a data coordinating center who have the mission of improving asthma care through clinical research in diverse populations. The ALA-ACRC conducts various clinical studies related to asthma. Current funded trials are listed below:

Study of Asthma and Nasal Steroids (STAN). National Institutes of Health. The purpose of this study is to determine if treatment of chronic rhinitis and/or sinusitis improves control of asthma in adults and children.

Study of Soy Isoflavones in Asthma (SOYA). National Institutes of Health. The purpose of this study is to test the hypothesis that dietary supplementation with soy isoflavones is an effective treatment in patients with asthma.

PENDING

N/A

Current and Pending Support for Eric Betterton

P42 ES04940-6 NIEHS/SBRP, $782k direct (PI – Betterton) 04/1/05-03/31/10

New Technologies for the Remediation of Halogenated Organics/Mine Tailings Dust Characterization

The major goal of the first part of the project was to treat contaminated soil vapor and ground water containing halogenated organics, with an emphasis on destruction of the target pollutant, rather than capture and disposal. The goal of the second part of this project is to characterize arsenic-contaminated dust arising from wind action on two mine tailings Superfund sites.

EPA Pollution Prevention (P2) Grant NP96913801, $240k direct (PI - Betterton) 01/10/08- 9/30/11

Pollution prevention through community participation.

The major goal of this project is to reduce the amount of hazardous substances, including metal-containing aerosols, entering the environment in parts of Tucson, AZ.

Science Foundation Arizona SRG 0375-08, $541k direct (PI – Betterton) 01/01/09- 12/31/09

Solar Photovoltaic Cavity Converter and Power Conversion Unit for High Efficiency 2-Meter Solar Collecting Dish

The goal of this project is to construct and test a 2-meter mirror to collect solar energy and convert it into electrical energy.

PENDING

NIH R21, $275k direct (PI - Betterton) 07/01/2011-06/30/2013

Modeling the Effects of Climate on Dust Exposures to Vulnerable Communities Near Contaminated Sites in Semi-AridAreas

The objective of this grant is to develop an integrated climate-dust model framework that can be used to predict long term potential health risks in communities, especially to sensitive subpopulations such as children, under varying climate conditions.

OMB Number: 4040-0001
Expiration Date: 06/30/2011

RESEARCH & RELATED BUDGET - SECTION A & B, BUDGET PERIOD 1

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2011 *** End Date:** 06/30/2012 **Budget Period** 1

A. Senior/Key Person

	Prefix	* First Name	Middle Name	* Last Name	Suffix	* Project Role	Base Salary ($)	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
1.	Dr.	Paloma		Beamer		PD/PI	[redacted]	[redacted]			[redacted]	[redacted]	[redacted]
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9.	Total Funds requested for all Senior Key Persons in the attached file												

Total Senior/Key Person [redacted]

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

B. Other Personnel

* Number of Personnel	* Project Role	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
	Total Number Other Personnel					**Total Other Personnel**	

Total Salary, Wages and Fringe Benefits (A+B) [redacted]

RESEARCH & RELATED BUDGET - SECTION C, D, & E, BUDGET PERIOD 1

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2011 *** End Date:** 06/30/2012 **Budget Period 1**

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

	Equipment item	* Funds Requested ($)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.	**Total funds requested for all equipment listed in the attached file**	
	Total Equipment	

Additional Equipment: Add Attachment Delete Attachment View Attachment

D. Travel **Funds Requested ($)**

1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2.	Foreign Travel Costs	
	Total Travel Cost	

E. Participant/Trainee Support Costs **Funds Requested ($)**

1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees **Total Participant/Trainee Support Costs**	

RESEARCH & RELATED Budget {C-E} (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION F-K, BUDGET PERIOD 1

Next Period

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2011 *** End Date:** 06/30/2012 **Budget Period 1**

F. Other Direct Costs	Funds Requested ($)
1. Materials and Supplies	39,338.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8.	
9.	
10.	
Total Other Direct Costs	39,338.00

G. Direct Costs	Funds Requested ($)
Total Direct Costs (A thru F)	118,786.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	* Funds Requested ($)
1. Modified Total Direct Costs	8.00	118,001.00	9,440.00
2.			
3.			
4.			
Total Indirect Costs			9,440.00

Cognizant Federal Agency Not Applicable

(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	128,226.00

J. Fee	Funds Requested ($)
	0.00

K. * Budget Justification 1264-BudgetJustificationPDBeamer.pdf Add Attachment Delete Attachment View Attachment

(Only attach one file.)

OMB Number: 4040-0001
Expiration Date: 06/30/2011

Previous Period

RESEARCH & RELATED BUDGET - SECTION A & B, BUDGET PERIOD 2

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2012 *** End Date:** 06/30/2013 **Budget Period** 2

A. Senior/Key Person

	Prefix	* First Name	Middle Name	* Last Name	Suffix	* Project Role	Base Salary ($)	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
1.	Dr.	Paloma		Beamer		PD/PI	[redacted]	9.00			[redacted]	[redacted]	[redacted]
2.													
3.													
4.													
5.													
6.													
7.													
8.													

9. **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person [redacted]

Additional Senior Key Persons: Add Attachment Delete Attachment View Attachment

B. Other Personnel

* Number of Personnel	* Project Role	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
	Total Number Other Personnel					**Total Other Personnel**	

Total Salary, Wages and Fringe Benefits (A+B) 81,831.00

RESEARCH & RELATED BUDGET - SECTION C, D, & E, BUDGET PERIOD 2

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2012 *** End Date:** 06/30/2013 **Budget Period 2**

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

	Equipment item	* Funds Requested ($)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.	**Total funds requested for all equipment listed in the attached file**	
	Total Equipment	

Additional Equipment: Add Attachment Delete Attachment View Attachment

D. Travel **Funds Requested ($)**

1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2.	Foreign Travel Costs	
	Total Travel Cost	

E. Participant/Trainee Support Costs **Funds Requested ($)**

1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees **Total Participant/Trainee Support Costs**	

RESEARCH & RELATED Budget {C-E} (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION F-K, BUDGET PERIOD 2

Next Period

* ORGANIZATIONAL DUNS: 8063456170000

* Budget Type: ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry * Start Date: 07/01/2012 * End Date: 06/30/2013 Budget Period 2

F. Other Direct Costs	Funds Requested ($)
1. Materials and Supplies	39,788.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8.	
9.	
10.	
Total Other Direct Costs	39,788.00

G. Direct Costs	Funds Requested ($)
Total Direct Costs (A thru F)	121,619.00

H. Indirect Costs

	Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	* Funds Requested ($)
1.	Modified Total Direct Costs	8.00	120,687.00	9,655.00
2.				
3.				
4.				
	Total Indirect Costs			9,655.00

Cognizant Federal Agency Not Applicable

(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	131,274.00

J. Fee	Funds Requested ($)
	0.00

K. * Budget Justification 1264-BudgetJustificationPDBeamer.pdf Add Attachment Delete Attachment View Attachment

(Only attach one file.)

OMB Number: 4040-0001
Expiration Date: 06/30/2011

Previous Period

RESEARCH & RELATED BUDGET - SECTION A & B, BUDGET PERIOD 3

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2013 *** End Date:** 06/30/2014 **Budget Period** 3

A. Senior/Key Person

	Prefix	* First Name	Middle Name	* Last Name	Suffix	* Project Role	Base Salary ($)	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
1.	Dr.	Paloma		Beamer		PD/PI	[redacted]	9.00			[redacted]	[redacted]	[redacted]
2.													
3.													
4.													
5.													
6.													
7.													
8.													

9. **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person [redacted]

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

B. Other Personnel

* Number of Personnel	* Project Role	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
	Total Number Other Personnel					**Total Other Personnel**	

Total Salary, Wages and Fringe Benefits (A+B) [redacted]

RESEARCH & RELATED BUDGET - SECTION C, D, & E, BUDGET PERIOD 3

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2013 *** End Date:** 06/30/2014 **Budget Period 3**

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

	Equipment item	* Funds Requested ($)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.	**Total funds requested for all equipment listed in the attached file**	
	Total Equipment	

Additional Equipment: Add Attachment Delete Attachment View Attachment

D. Travel **Funds Requested ($)**

1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2.	Foreign Travel Costs	
	Total Travel Cost	

E. Participant/Trainee Support Costs **Funds Requested ($)**

1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees **Total Participant/Trainee Support Costs**	

RESEARCH & RELATED Budget {C-E} (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION F-K, BUDGET PERIOD 3

Next Period

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2013 *** End Date:** 06/30/2014 **Budget Period 3**

F. Other Direct Costs	Funds Requested ($)
1. Materials and Supplies	39,958.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8.	
9.	
10.	
Total Other Direct Costs	39,958.00

G. Direct Costs	Funds Requested ($)
Total Direct Costs (A thru F)	124,244.00

H. Indirect Costs

	Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	* Funds Requested ($)
1.	Modified Total Direct Costs	8.00	123,989.00	9,919.00
2.				
3.				
4.				
	Total Indirect Costs			9,919.00

Cognizant Federal Agency Not Applicable

(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	134,163.00

J. Fee	Funds Requested ($)
	0.00

K. * Budget Justification 1264-BudgetJustificationPDBeamer.pdf Add Attachment Delete Attachment View Attachment

(Only attach one file.)

OMB Number: 4040-0001
Expiration Date: 06/30/2011

Previous Period

RESEARCH & RELATED BUDGET - SECTION A & B, BUDGET PERIOD 4

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2014 *** End Date:** 06/30/2015 **Budget Period** 4

A. Senior/Key Person

	Prefix	* First Name	Middle Name	* Last Name	Suffix	* Project Role	Base Salary ($)	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
1.	Dr.	Paloma		Beamer		PD/PI	[redacted]	9.00			[redacted]	[redacted]	[redacted]
2.													
3.													
4.													
5.													
6.													
7.													
8.													

9. **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person [redacted]

Additional Senior Key Persons: Add Attachment Delete Attachment View Attachment

B. Other Personnel

* Number of Personnel	* Project Role	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
	Total Number Other Personnel					**Total Other Personnel**	

Total Salary, Wages and Fringe Benefits (A+B) [redacted]

RESEARCH & RELATED BUDGET - SECTION C, D, & E, BUDGET PERIOD 4

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2014 *** End Date:** 06/30/2015 **Budget Period 4**

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

	Equipment item	* Funds Requested ($)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.	**Total funds requested for all equipment listed in the attached file**	
	Total Equipment	

Additional Equipment: Add Attachment Delete Attachment View Attachment

D. Travel **Funds Requested ($)**

1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2.	Foreign Travel Costs	
	Total Travel Cost	

E. Participant/Trainee Support Costs **Funds Requested ($)**

1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees **Total Participant/Trainee Support Costs**	

RESEARCH & RELATED Budget {C-E} (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION F-K, BUDGET PERIOD 4

Next Period

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2014 *** End Date:** 06/30/2015 **Budget Period 4**

F. Other Direct Costs	Funds Requested ($)
1. Materials and Supplies	39,995.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8.	
9.	
10.	
Total Other Direct Costs	39,995.00

G. Direct Costs	Funds Requested ($)
Total Direct Costs (A thru F)	126,809.00

H. Indirect Costs

	Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	* Funds Requested ($)
1.	Modified Total Direct Costs	8.00	126,809.00	10,145.00
2.				
3.				
4.				
	Total Indirect Costs			10,145.00

Cognizant Federal Agency Not Applicable

(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	136,954.00

J. Fee	Funds Requested ($)

K. * Budget Justification 1264-BudgetJustificationPDBeamer.pdf Add Attachment Delete Attachment View Attachment

(Only attach one file.)

OMB Number: 4040-0001
Expiration Date: 06/30/2011

Previous Period

RESEARCH & RELATED BUDGET - SECTION A & B, BUDGET PERIOD 5

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2015 *** End Date:** 06/30/2016 **Budget Period** 5

A. Senior/Key Person

	Prefix	* First Name	Middle Name	* Last Name	Suffix	* Project Role	Base Salary ($)	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
1.	Dr.	Paloma		Beamer		PD/PI	[redacted]	9.00			[redacted]	[redacted]	[redacted]
2.													
3.													
4.													
5.													
6.													
7.													
8.													

9. **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person [redacted]

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

B. Other Personnel

* Number of Personnel	* Project Role	Cal. Months	Acad. Months	Sum. Months	* Requested Salary ($)	* Fringe Benefits ($)	* Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
	Total Number Other Personnel					**Total Other Personnel**	

Total Salary, Wages and Fringe Benefits (A+B) [redacted]

RESEARCH & RELATED BUDGET - SECTION C, D, & E, BUDGET PERIOD 5

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2015 *** End Date:** 06/30/2016 **Budget Period 5**

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

	Equipment item	* Funds Requested ($)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.	**Total funds requested for all equipment listed in the attached file**	
	Total Equipment	

Additional Equipment: Add Attachment Delete Attachment View Attachment

D. Travel **Funds Requested ($)**

1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2.	Foreign Travel Costs	
	Total Travel Cost	

E. Participant/Trainee Support Costs **Funds Requested ($)**

1.	Tuition/Fees/Health Insurance	
2.	Stipends	
3.	Travel	
4.	Subsistence	
5.	Other	
	Number of Participants/Trainees **Total Participant/Trainee Support Costs**	

RESEARCH & RELATED Budget {C-E} (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION F-K, BUDGET PERIOD 5

*** ORGANIZATIONAL DUNS:** 8063456170000

*** Budget Type:** ☒ Project ☐ Subaward/Consortium

Enter name of Organization: Arizona Board of Regents, Unive

Delete Entry *** Start Date:** 07/01/2015 *** End Date:** 06/30/2016 **Budget Period 5**

F. Other Direct Costs	Funds Requested ($)
1. Materials and Supplies	39,941.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8.	
9.	
10.	
Total Other Direct Costs	39,941.00

G. Direct Costs	Funds Requested ($)
Total Direct Costs (A thru F)	129,360.00

H. Indirect Costs

	Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	* Funds Requested ($)
1.	Modified Total Direct Costs	8.00	129,360.00	10,349.00
2.				
3.				
4.				
	Total Indirect Costs			10,349.00

Cognizant Federal Agency Not Applicable

(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	139,709.00

J. Fee	Funds Requested ($)
	0.00

K. * Budget Justification 1264-BudgetJustificationPDBeamer.pdf Add Attachment Delete Attachment View Attachment

(Only attach one file.)

UNIVERSITY OF ARIZONA BUDGET JUSTIFICATION
PI: Paloma Beamer, Ph.D.

This budget was constructed for the 5 year period between the 2011-2012 academic year through the 2015-2016 academic year.

The indirect cost and benefit rates used are those most recently negotiated with the Department of Health and Human Services and are the rates appropriate for the time frame proposed.

All effort and expenses charged to this project will be for services specific to the project and not for the general support of the academic activity of the faculty or department.

A cost-of-living increase of 3% was assumed for salaries, according to guidelines approved by the University of Arizona, and a 3% inflation rate was assumed for all other categories. All effort and expenses charged to this project will be for services specific to the project and not for the general support of the academic activity of the faculty or department.

SENIOR PERSONNEL:
Paloma Beamer, Assistant Professor. This proposal is for a career development award. Dr. Beamer will devote 75% (9 calendar months) of her time in each project year towards the training and research plan. Dr. Beamer will oversee all aspects of this study and supervise the data manager and laboratory technician funded through this project. Dr. Beamer will develop the GIS framework conduct data analysis, and develop the intervention.

OTHER PERSONNEL:
Data Manager – The data manager will be responsible for geocoding and digitizing traffic data, as well as for verification of GIS calculations. The data manager will be responsible for setting up templates for the environmental data to be combined with the databases at the Arizona Respiratory Center. These tasks will require 6 calendar months in Years 1-3.

Laboratory Technician – The laboratory technician will be responsible for helping Dr. Beamer evaluate the intervention. This will include developing standard protocols for measurement of the air pollutants and evaluating the effectiveness of different control technologies that will be determined by the findings of the research plan through laboratory analysis. These tasks will require 6 calendar months in Years 4 and 5.

FRINGE BENEFITS:
Faculty: 28.4% for FY11
Classified Staff: 44.9% for FY11

TRAVEL: Funding is requested for domestic travel to disseminate results of research and further training at two conferences annually ($1500 * 2 conferences per year = $3000) , except for year 2 where funding is requested to attend 3 conferences to provide additional training ($1500 * 3 conferences per year = $4500). Additional funding is requested to allow Dr. Beamer to attend two 1-week courses at University of Michigan ($1200) during years 1 and 2, and ($600) for asthma education workshop year 1. We have included 3% inflation for Years 2-5 in addition to travel costs.

COURSE FEES: $425 is requested during year 1 and 2 for the courses at University of Michigan. An additional $300 is requested during year 1, $70 during year 2, and $115 during year 3 for Dr. Beamer to participate in asthma education workshops. Additional money is requested during years 1-3 to cover registration fees for the courses at the University of Arizona. There will be 3 courses taken during Year 1, 4 courses taken during Year2 and 2 courses taken during Year 3 at the rate of $120 per course. We have included 3% inflation for Years 2 and 3 in addition to the course fees. (Note: Tuition type proposed cost excluded from computation of guidance stipulated facility and administrative (f&a) cost. Workshop cost proposed have been included in the computation of f&a cost.)

MATERIALS AND SUPPLIES: Funding is requested in the amount of $500 to cover the annual costs of equipment maintenance, printers, and other office supplies (including color ink cartridges, and large format

paper for printing GIS maps) to be used by the personnel in carrying out the proposed research. This amount will also cover the cost of books and supplies for the courses Dr. Beamer will take. An additional $50 dollars per year has been requested for communication expenses related to the proposed research. This will include postage for mailings, long distance calls and faxes as appropriate with NHLBI program officers, journals for article publication, conference registration, and enrollment in courses for didatic training. To present the results of the proposed research to the scientific community, $150 per page has been requested for page charges in journals. We are requesting $50 per year for photocopying charges. Much of the data for the proposed project is archived as hard copies. We will have to make copies for us to use outside of the archive.

Since this project is computationally intensive and will access and store large databases we will need supplies solely decided to this project. $1,500 is specifically requested for the first year of the grant for the purchase of one Dell Precision Workstations which will aid the computational effort. This computer contains two 250 GB hard drives, UltraSharp monitors, and Dual Core Intel Processors operating at 2.13 GHz. An additional $1000 has been requested for annual computer software licenses and supplies. Furthermore $1,728 is being requested to support the 2 computers being used by the PI and Data Manager. This cost is based on the rate approved by FSO for the COPH's IT Office of $72/Mo per computer. This cost includes support for operating each computer along with having the computers connected to the COPH server.

A total of $4,900 is requested over Years 3-5 for Dr. Beamer to buy equipment and supplies to develop the intervention. This will require her to not only purchase various control technologies, depending upon the findings of the research, but to also supplies for the air measurements and analysis. Dr. Beamer will supplement this with funds from her start-up package supplied by MEZCOPH, and other pilot project grants as available.

RESEARCH & RELATED BUDGET - Cumulative Budget

	Totals ($)	
Section A, Senior/Key Person		[redacted]
Section B, Other Personnel		
Total Number Other Personnel		
Total Salary, Wages and Fringe Benefits (A+B)		[redacted]
Section C, Equipment		
Section D, Travel		
1. Domestic		
2. Foreign		
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		199,020.00
1. Materials and Supplies	199,020.00	
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		620,818.00
Section H, Indirect Costs		49,508.00
Section I, Total Direct and Indirect Costs (G + H)		670,326.00
Section J, Fee		0.00

PHS 398 Cover Page Supplement

OMB Number: 0925-0001

1. Project Director / Principal Investigator (PD/PI)

Prefix:	Dr.
* First Name:	Paloma
Middle Name:	
* Last Name:	Beamer
Suffix:	

2. Human Subjects

Clinical Trial? ☒ No ☐ Yes

* Agency-Defined Phase III Clinical Trial? ☐ No ☐ Yes

3. Applicant Organization Contact

Person to be contacted on matters involving this application

Prefix:	Ms.
* First Name:	Sherry
Middle Name:	L.
* Last Name:	Esham
Suffix:	
* Phone Number:	520-626-6000
Fax Number:	520-626-4137
Email:	sponsor@email.arizona.edu
* Title:	Director, Sponsored Projects Services
* Street1:	P.O. Box 3308
Street2:	
* City:	Tucson
County/Parish:	Pima
* State:	AZ: Arizona
Province:	
* Country:	USA: UNITED STATES
* Zip / Postal Code:	85722-3308

PHS 398 Cover Page Supplement

4. Human Embryonic Stem Cells

* Does the proposed project involve human embryonic stem cells? ☒ No ☐ Yes

If the proposed project involves human embryonic stem cells, list below the registration number of the specific cell line(s) from the following list: http://stemcells.nih.gov/research/registry/. Or, if a specific stem cell line cannot be referenced at this time, please check the box indicating that one from the registry will be used:

Cell Line(s): ☐ Specific stem cell line cannot be referenced at this time. One from the registry will be used.

Tracking Number:GRANT10738842 Funding Opportunity Number:PA-10-062 Received Date:2010-11-09T16:37:33-04:00

PHS 398 Checklist

OMB Number: 0925-0001

1. Application Type:

From SF 424 (R&R) Cover Page. The responses provided on the R&R cover page are repeated here for your reference, as you answer the questions that are specific to the PHS398.

* Type of Application:

☐ New ☒ Resubmission ☐ Renewal ☐ Continuation ☐ Revision

Federal Identifier: HL103970

2. Change of Investigator / Change of Institution Questions

☐ Change of principal investigator / program director

Name of former principal investigator / program director:

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

☐ Change of Grantee Institution

* Name of former institution:

3. Inventions and Patents (For renewal applications only)

* Inventions and Patents: Yes ☐ No ☐

If the answer is "Yes" then please answer the following:

* Previously Reported: Yes ☐ No ☐

4. * Program Income

Is program income anticipated during the periods for which the grant support is requested?

☐ Yes ☒ No

If you checked "yes" above (indicating that program income is anticipated), then use the format below to reflect the amount and source(s). Otherwise, leave this section blank.

*Budget Period	*Anticipated Amount ($)	*Source(s)

5. * Disclosure Permission Statement

If this application does not result in an award, is the Government permitted to disclose the title of your proposed project, and the name, address, telephone number and e-mail address of the official signing for the applicant organization, to organizations that may be interested in contacting you for further information (e.g., possible collaborations, investment)?

☒ Yes ☐ No

PHS 398 Career Development Award Supplemental Form

OMB Number: 0925-0001

1. Application Type:

From SF424 (R&R) Cover Page. The response provided on that page, regarding the type of application being submitted, is repeated here for your reference, as you attach the sections that are appropriate for this Career Development Award.

☐ New ☒ Resubmission ☐ Renewal ☐ Continuation ☐ Revision

2. Career Development Award Attachments:

Please attach applicable sections, below.

Introduction (if applicable)				
1. Introduction to Application *(for RESUBMISSION applications only)*	1250-1FinalIntro.pdf	Add Attachment	Delete Attachment	View Attachment
Candidate Information				
2. Candidate's Background	1251-2Background.pdf	Add Attachment	Delete Attachment	View Attachment
3. Career Goals and Objectives	1252-3Goals.pdf	Add Attachment	Delete Attachment	View Attachment
4. Career Development/Training Activities During Award Period	1253-4Training.pdf	Add Attachment	Delete Attachment	View Attachment
5. Training in the Responsible Conduct of Research	1254-5Responsible.pdf	Add Attachment	Delete Attachment	View Attachment
6. Mentoring Plan *(when applicable)*		Add Attachment	Delete Attachment	View Attachment
Statements of Support				
7. Statements by Mentor, Co-Mentors, Consultants, Contributors *(as appropriate)*	1255-7Statements.pdf	Add Attachment	Delete Attachment	View Attachment
Environment and Institutional Commitment to Candidate				
8. Description of Institutional Environment	1256-8Environment.pdf	Add Attachment	Delete Attachment	View Attachment
9. Insitutional Commitment to Candidate's Research Career Development	1257-9Institution.pdf	Add Attachment	Delete Attachment	View Attachment
Research Plan				
10. Specific Aims	1258-10SpecificAims.pdf	Add Attachment	Delete Attachment	View Attachment
11. * Research Strategy	1259-11Researchv217.pdf	Add Attachment	Delete Attachment	View Attachment
12. Inclusion Enrollment Report *(for RENEWAL applications only)*		Add Attachment	Delete Attachment	View Attachment
13. Progress Report Publication List *(for RENEWAL applications only)*		Add Attachment	Delete Attachment	View Attachment
Human Subject Sections				
14. Protection of Human Subjects	1260-14Humansubjects.pdf	Add Attachment	Delete Attachment	View Attachment
15. Inclusion of Women and Minorities	1261-15WomenKids.pdf	Add Attachment	Delete Attachment	View Attachment
16. Targeted/Planned Enrollment	1262-16TargettedPlannedEnrollment	Add Attachment	Delete Attachment	View Attachment
17. Inclusion of Children	1263-17Children.pdf	Add Attachment	Delete Attachment	View Attachment

Tracking Number:GRANT10738842 Funding Opportunity Number:PA-10-062 Received Date:2010-11-09T16:37:33-04:00

PHS 398 Career Development Award Supplemental Form

2. Career Development Award Attachments (continued):

Other Research Plan Sections

18. Vertebrate Animals		Add Attachment	Delete Attachment	View Attachment
19. Select Agent Research		Add Attachment	Delete Attachment	View Attachment
20. Consortium/Contractual Arrangements		Add Attachment	Delete Attachment	View Attachment
21. Resource Sharing Plan(s)		Add Attachment	Delete Attachment	View Attachment

Appendix (if applicable)

22. Appendix Add Attachments | Delete Attachments | View Attachments

*3. Citizenship:

☒ U.S. Citizen or noncitizen national

☐ Permanent Resident of U.S.
(If a permanent resident of the U.S., a notarized statement must be provided by the time of award)

☐ Non-U.S. Citizen with temporary U.S. visa

1. INTRODUCTION

We were pleased by the reviewers' enthusiasm that our proposal has a "high likelihood of propelling the candidate toward independence," particularly because of the "excellent candidate, mentors, infrastructure and training plan." The reviewers stated that the research plan provides an "excellent training vehicle" through the "clever use of existing high quality cohort data" to address "important scientific questions," but also provided constructive suggestions. Their primary concerns are addressed below with the reviewer identified in brackets. As the application was completely rewritten to respond to the concerns and to condense to the new page limits, we have not highlighted changes.

1. *Tucson is not an appropriate geographic area due to lack of association with traffic density estimates. [1,2]*

Because of my preliminary data, I have tightened the focus of the research plan towards diesel exhaust pollutants rather than traffic density estimates. Although there is concern that Tucson may not be an appropriate setting for this study due to its good air quality, the two freeways are among the most heavily used in the Western US.[1] This and the unusual topography and meteorology result in a spatial diesel exhaust gradient not commonly observed in other cities, making Tucson a unique place to conduct such a study. Many of the studies that determined significant associations between traffic exposure and health outcomes were also completed in areas with good air quality and overall pollutant concentrations below the national standards.[2-5]

2. *Big assumption that relative pollutant concentrations between census tracts are not likely to have changed between cohort enrollment during 1980s and the 1996 EPA exposure database. [2]*

Our study utilizes health outcomes from two birth cohorts. One cohort, the Infant Immune Study, was enrolled 1997-2004 and thus corresponds with the EPA exposure databases from 1996-2002. Unfortunately there is no data for diesel exhaust pollutant exposures from the 1980s in Tucson, which would correspond to enrollment of the other cohort, the Tucson Children's Respiratory Study. However, the same two freeways, among the most heavily used in the Western US, were the primary source of diesel exhaust in Tucson at that time and traffic volumes between 1980 and 1996 are also highly correlated ($p<0.000000001$) even after accounting for spatial auto-correlation. Diesel concentration by census tract is also highly correlated between the 1996 and 2002 databases ($p=0.006$). Although not ideal, using the highly correlated1996 EPA database provides the opportunity to estimate exposures to diesel-related pollutants to assess for relation with the extensive health outcome data available on this unique cohort.

3. *Separate analyses for children who move between birth and data collection time may not be helpful as exposures vary with time and subjects were not all enrolled simultaneously. [1]*

While exposures will vary by minute, hour, day and over the years that the subjects were enrolled, relative average or "chronic" exposures associated with the spatial gradient from truck traffic remain correlated over time by location. By assessing relations for children who move between birth and the outcome assessment, separately from those who have not moved, we can begin to assess if chronic exposures during certain developmental periods are more important.

4. *Future research focus: asthma, COPD or something else? [2]*

Asthma and related wheezing disorders remain among the most common chronic diseases in children. My future research will be focused on identifying environmental risk factors for these diseases and developing effective interventions to reduce these exposures, aimed at the primary prevention of asthma and wheezing.

5. *Program can be completed in 3-4 years. [2]*

Completion of the research project will require intensive training of the candidate during years 1 and 2, and continued formal training during year 3. Years 3-5 will be necessary to provide the candidate with adequate time to complete the necessary analyses, and develop the community-based intervention for future grant proposals. This includes evaluating different devices for reducing exposures to key pollutants.

6. Other issues

- Bronchial hyperresponsiveness will be treated as a continuous variable. [1]
- We have complete addresses histories for IIS participants. We will obtain address histories from continuing CRS participants to supplement the address histories we already have. [2]
- Positive skin test reaction is wheal of ≥ 3mm after subtraction of reaction to negative glycerin control. [2]
- Unfortunately no data on diet other than breastfeeding was collected. Although there may be effects of diet on respiratory events, we cannot control for it in our analyses. [2]
- The health outcome data for analysis was collected prospectively however the exposure assessment will be retrospective. Our current analyses will be longitudinal [2].

THE CANDIDATE

My professional goal is to develop an independent research career centered on designing and testing hypotheses addressing the role of environmental exposures in childhood respiratory diseases such as asthma. With my current training as an environmental engineer, I must rely on collaborations with others to link my detailed exposure assessments with health outcomes. To become an independent investigator, I need to complement my quantitative background with further training in biostatistics, epidemiology, toxicology, immunology, intervention development and evaluation. With support from my mentors and collaborators, I propose to use spatial techniques to assess the role of early life diesel exhaust exposures in developmental alterations of the immune and respiratory systems that may result in transient wheezing or asthma in children. To achieve this goal, I will use data acquired from two on-going longitudinal birth cohort studies at the Arizona Respiratory Center (ARC) within the University of Arizona (UA). A K25 Mentored Quantitative Research Award will enable me to acquire the necessary skills to develop my own independent research program, and to apply these skills under the supervision of well-established mentors. My long-term goal is to gain the expertise and training necessary to develop creative, well-formulated research studies for understanding the role of environmental factors in respiratory diseases.

2. Candidate's Background

2.A. Undergraduate Training: I received a B.S. in Civil and Environmental Engineering at the University of California, Berkeley in 2000. The program gave me a strong theoretical foundation in the basic sciences as well as a broad background in applied environmental techniques that has allowed me to learn and incorporate methods from a variety of fields into my current interdisciplinary research. As an undergraduate I had multiple internships including one with the Environmental Protection Agency (EPA) US-Mexico Border Team, and the opportunity to study in Santiago, Chile where the adverse consequences of air pollution on human health are very apparent. These early experiences were formative in developing my ambition to understand human exposure to environmental contamination, the resulting health effects and to engineer effective interventions.

2.B. Graduate Training: I completed both my M.S. and Ph.D. in Civil and Environmental Engineering at Stanford University. Although my ultimate career objective was to enter the environmental health field, I felt that continuing my studies in engineering at the doctoral level would allow me to develop a unique skill set for assessing human exposure to environmental chemicals. As a graduate student, I was able to receive additional formal training in several interdisciplinary areas including: atmospheric modeling, stochastic processes, physiology, analytical chemistry and microbial risk assessment, as well as in molecular biology, bioethics and the responsible conduct of research as a fellow of the NIH Graduate Training Program in Biotechnology. I also had the opportunity to coordinate a field project to collect activity patterns in farmworker children. This project enabled me to obtain experience in staff management and research with human subjects through development and administration of questionnaires and protocols, and subject recruitment. My dissertation research involved utilizing these activity patterns to develop a simulation model that accounts for complex environmental processes and child-specific pharmacokinetics to estimate exposure and dose of pesticides to these farmworker children. The broad educational experiences I had at Stanford have prepared me for assessing human exposure to toxicants via multiple media and exposure routes, utilizing field measurements and Monte-Carlo simulation exposure modeling techniques.

2.C. Post-Doctoral Experiences: Immediately following completion of my doctoral degree, I joined the faculty at the Mel and Enid Zuckerman College of Public Health (MEZCOPH) in the Environmental Health Sciences section at UA as an Assistant Professor in August of 2007. I have continued to research the role that activity patterns and physical processes play in exposure assessment (see biosketch). I was awarded a small pilot project grant to collaborate with my mentor to assess the relationship between traffic-related exposures and incidence of respiratory illnesses in children. While working on this project, it has become apparent that I need additional didactic training in the biomedical sciences in order to develop an independent research program focused on conducting population-based studies that evaluate environmental exposures and health outcomes.

3. Career Goals and Objectives: Scientific Biography

Professional Goal: To develop an independent research career centered on designing and testing hypotheses assessing the relationship between environmental exposures and childhood respiratory diseases.

3.A. Career Theme

The central motivation behind my research is the development of tools that can provide more robust exposure and dose estimates for use in epidemiological analyses of environmental factors and respiratory health consequences, particularly amongst vulnerable populations (i.e., children and minority communities). As environmental exposures may play a substantial role in the disproportionate burden of childhood asthma experienced by certain communities, my career objective is to develop new skills in epidemiology, intervention development, and evaluation methods that will allow me to: 1) assess the relationship between environmental exposures and respiratory diseases, 2) translate findings into engineering interventions, and 3) subsequently evaluate the effectiveness of these interventions in reducing respiratory diseases and health disparities.

3.B. Rationale for Seeking a Career Development Award

I was fortunate to be directly recruited from graduate school to a tenure-eligible position at UA. I accepted the position because I knew that at UA I would have the opportunity for additional interdisciplinary training with renowned scientists such as my mentoring team. Although I am confident in my abilities to assess human exposures to environmental agents, at this very early stage in my career development I do not have adequate experience to relate these exposures to adverse health outcomes or to formally evaluate interventions that I design. This Mentored Quantitative Research Career Development Award (K25) is an ideal mechanism to provide me with the opportunity to enhance my interdisciplinary quantitative training with additional training in the biomedical sciences in order to reach my career goals. First, despite my strong foundation in environmental engineering and science necessary for understanding the physical processes resulting in human exposure to environmental agents, I have not had sufficient training in evaluating how these exposures might result in adverse health outcomes. The K25 will allow me to: 1) receive didactic training in toxicology and immunology to understand how environmental toxicants affect the developing human body; 2) obtain training in epidemiology and biostatistics to learn how to assess the relationships between environmental risk factors and diseases in population-based studies; and 3) acquire formal training in how to develop and evaluate public health interventions. Second, the K25 will facilitate collaborations with senior individuals in the fields of: pediatrics, epidemiology, biostatistics, health promotion, atmospheric sciences, and geo-spatial analyses. Under the guidance of my primary mentor, Dr. Fernando Martinez, I have been able to recruit an interdisciplinary team of well-established investigators to advise me, to evaluate my progress and to ensure that I develop a successful independent research program at its completion. Third, the K25 will provide me with the protected research and training time necessary to develop these additional capabilities, utilize them to complete the research plan, and publish the results in peer-reviewed journals. Finally, the K25 will allow me to obtain preliminary data to successfully compete for future R01s aimed at understanding environmental exposures and respiratory disease. At completion of this K25, I will have a rare skill set that will allow me to combine my environmental engineering background in assessing exposures and designing interventions with new competencies to evaluate the role of these exposures in development of respiratory diseases and the effectiveness of the interventions in reducing these diseases. Ultimately this unique interdisciplinary training combination will enable me to establish my independence as a biomedical researcher.

3.C. Short-Term Professional Goals

My short-term professional goals include the following:

1. Develop relationships with mentors who can help me advance my career and reach my professional goals.
2. Acquire training in immunotoxicology, epidemiology, statistics, intervention development and evaluation.
3. Obtain experience in analyzing health outcomes from two longitudinal birth cohort studies.
4. Develop and apply my modeling skills to estimate geographically-related environmental exposures.
5. Publish peer-reviewed manuscripts in appropriate journals.
6. Successfully compete for extramural funding.

3.D. Long-Term Professional Goals

The long-term professional goals that I hope to achieve are:

1. Develop mechanistic models and sampling methods for exposure assessment.
2. Conduct community-based interventions to reduce environmental exposures and respiratory diseases.
3. Contribute towards reducing health disparities by evaluating exposures unique to underserved populations.
4. Mentor and train future students in the fields of environmental health and epidemiology.

5. Apply these techniques to future studies on emerging environmental contaminants.

4. Career Development/Training Activities During the Award Period

4.A. Career Development Plan

My sponsors, collaborators and I have developed a career development plan to achieve my professional goal that includes formal mentoring, structured training through additional coursework, and attendance at seminars and conferences. Each of the structured training activities for the K25 career development award is designed to enhance my previous training as an environmental engineer with additional expertise in the biomedical sciences. We have also developed a research project that will utilize my new capabilities, and provide preliminary data for a R01 grant application to conduct a community intervention based on findings from the proposed research. This mentored career development plan will allow me to develop the skills and experience necessary for becoming an independent quantitative researcher in the biomedical sciences.

4.B. Career Development Sponsor, Co-Sponsor and Collaborators

My sponsors and collaborators are well-established senior investigators at UA who will provide expertise, education and support to develop my research potential. All have demonstrated continued commitment to mentoring young investigators. Table 1 lists the individuals who will serve in this capacity and are essential to development of this career plan. As my goal at completion of this K25 is to become a quantitative biomedical researcher, my sponsors and collaborators include both biomedical and quantitative researchers. UA has a long history of interdisciplinary research that has allowed me to develop this team exclusively at my own research institution, which will facilitate their mentorship and future collaborations.

Table 1. List of Sponsor, Co-sponsors, and Collaborators

Name	Title	Expertise
Sponsor		
Fernando Martinez, M.D.	Swift-McNear Regents Professor, Director of Arizona Respiratory Center and Bio5 Institute	Pediatric pulmonology, epidemiology, gene-environment interactions
Co-Sponsors		
Duane Sherrill, Ph.D.	Professor, Associate Dean of Research	Biostatistics and study design
Lynn Gerald, Ph.D., MSPH	Professor, Canyon Ranch Endowed Chair	Asthma, community based clinical trials
Eric Betterton, Ph.D.	Professor, Chair, Department of Atmospheric Sciences	Atmospheric chemistry and physics
Collaborators		
Anne Wright, Ph.D.	Professor, Associate Dean of Faculty Affairs	Allergy and immunology, epidemiology
Andrew Comrie, Ph.D.	Professor, Associate Vice President for Research	Urban air pollution and spatial analysis

Dr. Martinez will provide overall mentorship and training in how to assess the role of environmental risk factors in development of respiratory diseases. He will also provide guidance in study design, data management, and analyses of longitudinal birth cohort studies from his experiences as Principal Investigator of the Tucson Children's Respiratory Study (CRS) and the National Children's Study in Arizona. Dr. Sherrill will provide tutelage in the areas of statistical methods and longitudinal analyses to complement the didactic training components. Dr. Gerald will provide me with formal training in how to translate findings from the proposed research plan into designing future community-based intervention studies. She will also provide direction in grantsmanship through her course as part of the proposed didactic training, workshops she conducts at MEZCOPH, and one-on-one mentorship. Dr. Betterton will complement my existing background in environmental engineering with additional instruction in the atmospheric transport of air pollutants and their control. Dr. Wright will collaborate through her role as Principal Investigator of the Infant Immune Study (IIS) and as one of the founders and co-Principal Investigator of the CRS. Dr. Comrie, collaborator, will provide assistance with spatial analysis techniques based on his experience with modeling urban air pollution in Tucson. All of my sponsors and collaborators are highly successful investigators who will provide mentorship and guidance in establishing my independent interdisciplinary research career.

4.C. Structured Training Activities

Formal Coursework: As part of the career development award I will complete the Arizona Clinical Research Training Program (AzCRTP) at UA. Although I am not a clinician, this innovative graduate certificate program provides an excellent didactic training experience as entry to biomedical research and is administered by my co-sponsor, Dr. Sherrill. For the AzCRTP, I will complete the following courses: Biostatistics in Public Health, Biostatistics for Research, Basic Principles of Epidemiology, Epidemiologic Methods, Granstmanship for a Winning Proposal, and Bioethics, Regulations and Repercussions in Research. In addition to the AzCRTP, I will take a course in immunotoxicology to obtain a broad overview of the immune system and the processes by which toxins can stimulate immune responses and a course in spatial analysis to further develop my modeling skills through GIS techniques. I will also take a course in public health evaluation to learn how to formally develop and assess interventions. To complement my training at UA, I will take two summer courses at the

University of Michigan as part of their renowned graduate summer session in epidemiology focused on spatial and environmental/occupational epidemiology. I will participate in the American Lung Association Asthma Educator Institute to learn pathophysiology, risk factors and management of asthma.

Participation in seminars, professional meetings and other exchanges: I will augment formal coursework with additional training at seminars, conferences, and research team meetings. I plan on attending at least two conferences per year, including annual meetings of the following organizations: American Thoracic Society, American Academy of Allergy, Asthma, and Immunology, International Society of Exposure Science, International Society of Environmental Epidemiology, American Association for Aerosol Research and the International Society for Children's Health in the Environment. At these meetings I will be updated on the newest research findings and techniques in the field, interact with senior colleagues and potential collaborators from other institutions, gain new research ideas and improve my skills at presenting study results. I will attend the weekly internationally-known ARC research conference and weekly seminars in general public health, biostatistics/epidemiology, and environmental health. Throughout the award, I will attend the weekly Infant Immune Study Working Group meetings to participate in discussion of new ideas, analyses and data collection logistics. This will ensure that I am actively involved in the ongoing cohort study whose data I am using, and it will provide me the ability to observe firsthand how cohort studies are organized, led and conducted.

Evaluation: I will meet with Dr. Martinez, my primary mentor, on a weekly basis to obtain hands-on training, to troubleshoot data analysis and discuss progress with my research project and career plans. I will meet on a monthly or bi-monthly basis with my co-mentors for advance tutorials (as specified above). In addition to informal meetings, I will have formal structured quarterly meetings with my entire committee for evaluation of my career development and research progress to ensure I am progressing towards independence. We have set a goal for me to publish at least two papers per year.

4.D. Timeline of training activities and distribution of effort

I will devote 75% of my effort exclusively to this K25 award, of which 30% will be focused on coursework during years 1-3. The remainder of my effort will be focused on the research project, meeting with mentors, development of the intervention, manuscript and grant preparation. There is a logical progression to the career development activities leading towards independence at the end of the award period (Table 2). In addition, during each of the 5 years of the award I will develop my skills by attending and presenting at scientific meetings, attending pertinent seminars and workshops at UA, having regularly scheduled meetings with mentors, participating in research meetings, and writing manuscripts for peer-review and publication.

Table 2. Dr. Beamer's Career Development Plan Timeline for Completion of the K25 Award

Period	Training and Research Activities
Year 1 7/11-6/12	Coursework: Biostatistics in Public Health, Basic Principles of Epidemiology, Spatial Analysis and Modeling, GIS for Epidemiology, ALA Asthma Educator Institute Research: Obtain CRS address histories and freeway truck traffic emissions, map pollutant exposures from EPA database for 1996-2002, map CRS and IIS addresses and obtain exposures for each data collection period
Year 2 7/12-6/13	Coursework: Immunotoxicology and Immunopharmacology, Epidemiologic Methods, Biostatistics for Research, Bioethics, Regulations, and Repercussions in Research, Environmental and Occupational Epidemiology Research: Apply CALINE4 model to Tucson for years (1980-2010) and obtain exposures for CRS and IIS, assess exposures for collinearity and create index estimates, conduct analyses with respiratory symptoms (Aim 1)
Year 3 7/13-6/14	Coursework: Grantsmanship for a Winning Proposal, Public Health Research and Evaluation, AARC Ethics Course Research: Conduct analyses with lung function and bronchial hyperresponsiveness (Aim 1), begin analyses with immune function (Aim 2), in preparation for R01 begin identifying and evaluating devices for controlling exposures
Year 4 7/14-6/15	Research: Complete analyses with immune function and allergic sensitization (Aim 2), in preparation for R01 identify and develop relationships with community partners for intervention and identify key pollutants and immune outcomes
Year 5 7/15-6/16	Research: Evaluate intervention design, develop methods for measurements of pollutants and immune outcomes, submit R01, complete manuscripts

5. Training in Responsible Conduct of Research

As a fellow in the NIH Training Program at Stanford, I successfully completed a course in Responsible Conduct of Research. In 2009, I was re-certified to conduct biomedical research involving human subjects at UA. As part of AzCRTP, I will take the course “Bioethics, Regulations, and Repercussions of Research,” designed to meet NIH requirements for educating investigators about ethical issues in clinical research. I will also complete the “Ethics Course” offered by the American Association of Respiratory Care. This certificate course provides instruction into the theories of ethical decision making as it applies to: scope of practice, informed consent, confidentiality, discrimination, conflicts of interest, illegal or unethical acts, fraud, and research.

7. Statements by Sponsors, Co-Sponsors, And Collaborators

Please see attached letters.

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MENTOR'S STATEMENT
MENTOR: FERNANDO D. MARTINEZ, MD

I am pleased to provide a mentor's statement for Paloma Beamer, who is applying for a K25 award from the National Heart, Lung and Blood Institute (NHLBI). This statement includes and extends the one provided for the previous K25 application.

1. Introduction

Centers of Excellence at the Arizona Health Sciences Center. Many of the sponsored research activities at the University of Arizona occur in centers of excellence. One of which is the Arizona Respiratory Center that I direct. The main objective of these centers of excellence is to provide an interdisciplinary environment in which investigators from different disciplines can collaborate to study complex clinical or biological challenges. The main objective of the Arizona Respiratory Center is to study asthma and chronic obstructive pulmonary disease (COPD), their genetic and environmental risk factors, natural history, complex clinical presentation, and novel therapeutic approaches for their prevention and treatment. The Center is nationally and internationally renowned for its contributions to our understanding of these two conditions. Individuals from several departments and colleges (Medicine, Pediatrics, Pharmacology, Immunobiology, Cell Biology, Physiology, and Radiology in the College of Medicine; and from the Colleges of Public Health, Agriculture and Life Sciences, and Engineering) collaborate, apply together for grant funding, and publish together in all the above mentioned areas of asthma and COPD research. As part of these interdisciplinary collaborations, a large number of trainees have been mentored by Center affiliated researchers and most continue now to perform research and teach in interdisciplinary environments in institutions in the United States and all over the world. Thus, the mentors involved in this proposal have experience in creating collaborative environments in which trainees can thrive, get comprehensive education and training, and develop successful independent research careers.

My experience as researcher and mentor. I have worked on risk factors and natural history of asthma for the last 25 years. I have been at the Arizona Respiratory Center since 1987 and director of the Center for the last 13 years. I have been a member of the Expert Panel from the National Asthma, Education and Prevention Program (NAEPP) of the National Institutes of Health (NIH) which wrote the two latest versions of the guidelines for the treatment of asthma for the last 14 years. I was honored with the Amberson award by the American Thoracic Society in 2008, the most important recognition given each year by the Society to one of its almost 20,000 members. The center that I direct has made very important contributions to our understanding of the etiology and pathogenesis of asthma and COPD, and has pioneered work on the complex gene by environment interactions that determine the development of the

disease. During my career, I have mentored tens of trainees in epidemiology and genetics of asthma. Many of these trainees are now leaders in the field of pediatric asthma in Europe, South America, and in the United States. For example, Erika von Mutius, MD, who trained in our Center, is a leader of pediatric asthma research in Europe, as is Renato Stein, MD, in Brazil. I recently was awarded, one of nine Asthma Network (AsthmaNet) Centers in the United States, in collaboration with Duke University. This will allow us to participate in collaborative research trials for the prevention and treatment of asthma for the next 7 years and to further train experts in this area of research. I am also the Principal Investigator for the Arizona Center, National Children's Study

The Trainee. I met Dr. Paloma Beamer when she became and Assistant Professor at the College of Public Health at our University. She almost immediately contacted me and we started discussing ways in which the expertise she had developed in assessment of environmental exposures could be channeled towards the study of research outcomes related to such exposures. It became immediately clear that we had the opportunity to train her in epidemiological and statistical methods and in longitudinal approaches to the epidemiology of asthma and related traits, and she in turn could begin to apply to our longitudinal data sets modern approaches to the assessment of exposure to environmental pollutants, which had never been studied before in our studies. These studies, the Children's Respiratory Study and the Infant Immune Study, both birth cohorts started in the early 80s and in the early 90s, respectively, are absolutely unique and considered by many as national resources. They are both general population samples in which clinical outcomes, lung function, bronchial hyperresponsiveness, and immune parameters have been studies respectively and, in the case of the Children's Respiratory Study, up to the age of 25 years. The results of these studies have significantly contributed to identify the different asthma-related phenotypes and immune phenotypes that arise at different ages during childhood and that constitute the bulk of the respiratory morbidity in this age group. Both studies pioneered the concept that the exposures occurring very early in life have long term effects on lung development, immune response development, and both protection and risk for asthma and related traits during early life. Dr. Beamer thus has the unique opportunity both to obtain training in excellence in the understanding of chronic respiratory diseases during childhood but also to contribute new knowledge as to the effects of different contaminants on all of a large array of respiratory-related outcomes that we have collected prospectively during the last 30 years. For this purpose she will leverage not only on our mentoring experience but also that of experts in the evaluation of environmental contamination at the University of Arizona.

2. Plan for the Candidates Training and Research Career Development

In the section entitled "Career Goals and Development" Dr. Beamer has explained in detail the career development plan that all mentors have elaborated with her. I will not repeat it here, and refer the reviewers to that section. As Principal Investigator of the Children's Respiratory Study and Director of the Arizona Respiratory Center, I commit to providing Dr. Beamer full and unrestricted access to each and all of the data that has been collected as part of this study for the last 25 years. Similarly, Dr. Anne Wright, Principal Investigator of the Infant Immune Study, has also committed to provide similar access to Dr. Beamer. Also, Dr. Beamer will be provided access to all HIPAA- and informed consent-compatible data that will allow her to recreate a history of the

domiciles and potential environmental exposure of all enrolled subjects and their nuclear families. Dr. Beamer is expected to publish no less than 2 papers per year based on these data, and she is guaranteed to be first author of all papers in which the role of environmental pollution is assessed and of which she will be the main analyst and writer. Fostering first authorship of papers related to our longitudinal study has been a tradition of both the Children's Respiratory Study and the Infant Immune Study as can be easily ascertained through our bibliography. Of note, papers using data from the Children's Respiratory Study have been published almost invariably in first rate journal of high impact and have been quoted a mean of over 70-times, with an H-factor of 50.

I am firmly committed to providing Dr. Beamer the support needed to use data from our longitudinal studies for the purpose of obtaining independent research funding. Since we expect to continue follow up of the now adults enrolled in the Children's Respiratory Study, we are considering the possibility of applying for a program project in which early life risk factors for adult asthma- and COPD-related outcomes are studied in an integrated manner. We are particularly interested in the study of gene-environment interactions in early life and determinants of such outcomes and I will support in any way I can the participation of Dr. Beamer as the Principal Investigator of a project within such a program project during the time of her K25 award. We are also committed to providing her all the logistic support that would be necessary to enroll a new population in which the effects of air pollution could be studied using novel epigenetic and genomic approaches, if that possibility would open in the future.

3. Sources of Anticipated Support for the Candidate Research Project

The institutional support provided to the candidate by her college is described in the letter by the College of Public Health, Dr. Iman Hakim. She is the person with authority to commit to such support and I refer to her letter enclosed to this application.

Dr. Beamer has also obtained funding from a pilot program by the Southwest Environmental Health Sciences Center (SWEHSC) grant to perform some of the preliminary data is that is contained in her application. As explained in the research project, all of the outcome data that she will use for her studies has already been obtained and will be made available to her without restrictions. In addition, the Arizona Respiratory Center commits to providing any support necessary to retrieving all exposure data for the City of Tucson and its surrounding metropolitan area that could be useful to determine the exposures that Dr. Beamer wants to assess in our two population samples.

4. The Nature and Extent of Supervision and Mentoring of the Candidate

Although all training environments require dedicated and assiduous mentoring, my experience shows that trainees working in interdisciplinary environments require particular attention and dedication on the part of their mentors. The main reason for this special requirement is that often trainees working in these types of environments have training in only one aspect or discipline of the many that participate in such interdisciplinary endeavors. This is also the case for Dr. Beamer. Dr. Beamer has had outstanding training and initial success in her career as an environmental engineer. However, she has had limited experience in working directly on health effects of

exposure, and her knowledge about asthma and related traits is limited, thus is her background in epidemiological techniques and longitudinal studies. As mentor, I am fully committed to coordinate the efforts of all persons that will be involved in providing her with the training she will need to become an independently funded interdisciplinary researcher in this area. I will personally meet with her as often as necessary and in any case, not less often than once a week. I will also organize monthly meetings of all mentors with her to assess her advances, to discuss her difficulties and obstacles, and to advise her as to ways in which she can continue progressing in her work. I consider trainees' education and supervision as my most important job, and I believe that my track record speaks for itself in this area. In Dr. Beamer's case, I believe there is the potential for her to contribute major new information in our understanding of the role of air pollution and air contaminants in the development of asthma and related traits. Her training, therefore, will not only be important to help her in developing her own career but also may open new ways of understanding a disease to which I have dedicated all my efforts during the last quarter century. I am thus fully committed to her success.

5. The Candidate's Anticipated Teaching Load for the Period of the Award

Once again, this particular aspect is explained in detail in the letter by Dr. Iman Hakim, Dean of the College of Public Health, who has the institutional responsibility of assigning teaching loads to faculty members in her college. I am delighted that Dr. Hakim has committed to providing all the time that Dr. Beamer will need to develop the work that is described in this application and to limit her administrative and teaching load to less than 25% of her time.

6. Plan for Transitioning Dr. Beamer from the Mentor Stage to the Independent Investigator Stage by the End of the Project Period.

As I have described earlier, I have a track record of having successfully trained 20 physicians and postdocs in the study of asthma and related traits at the Arizona Respiratory Center for the last 20 years. I have also mentioned two of the international leaders that were trained in my laboratory, but the successes of my training experience are not limited to those two individuals as can be seen in the enclosed table, a majority of the trainees that have gone through my laboratory occupy faculty positions or have job descriptions indicate that they have been successful in developing an independent investigator career. As I have described earlier, I will stimulate Dr. Beamer from the very beginning to develop her own ideas based on the results of the work she will accomplish through this application and to transform those ideas into specific aims for research projects that she will fund autonomously or in the framework of program projects in our Arizona Respiratory Center. Of note, our center has pioneered the study of gene-environment interactions in the field of asthma. One potential area that I would stimulate Dr. Beamer to move into would be the study of the genetic variance that modulate the effects of environmental pollution on different asthma-like phenotypes during the first years of life. It would certainly be possible for her to partner with geneticists who participate in our genetic studies to accomplish these goals. This is only provided as a potential example; there are many other areas in which she could thrive by using the interdisciplinary environment that exists at our center.

7. Activities since the previous version of this application.

After submitting the previous version of this application, Dr. Beamer was on maternity

leave for some months. In continuous consultation with her advisors and mentors, she diligently worked to address the concerns of the referees. She replotted the addresses of the study participants in two different ways to address reviewers' requests; recalculated all the traffic density exposure variables (12 in all for each set of maps); searched the microfiche database for missing and questionable addresses; completed all the analyses, with exposure as continuous variables and as quartiles, quantiles, tertiles, etc.; and presented the results at the American Thoracic Society meeting in New Orleans. I firmly believe that the process of editing and extending the application has substantially improved it and should persuade the referees that the studies proposed are not only possible, but will shed important light on the role of environmental exposures in the pathogenesis of recurrent respiratory illnesses during the growing years.

In summary, I am convinced that Dr. Beamer has a very solid training in environmental engineering and brings a novel, fresh approach to our longitudinal studies of the natural history of childhood asthma. As a mentor, I am committed to doing all I can to provide her with the support and the environment at the Arizona Respiratory Center that will be necessary for her to accomplish her goals.

Feel free to contact me if further information is needed.

Sincerely,

Fernando D. Martinez, MD
Regents' Professor
Director, Arizona Respiratory Center
Director, BIO5 Institute
Director, Arizona Clinical Translational Science Institute
Swift-McNear Professor of Pediatrics

Name of Mentor	Trainees a (Status while in Training)	Training Period	Degree	Title of Research Project While Training With This Mentor	Current or Last Known Position	Current or last known research type and topic; Sources of Support	Approximate number of publications
Fernando D. Martinez, MD	Von Mutius, Erika Post-doc	1992-1994	University of Munich (1984) MD	Role of prematurity and older siblings in asthma	Professor, University of Munich Children's Hospital, Germany	Epidemiology of asthma and allergy. Support from University of Munich.	231
	Stein, Renato Post-doc	1994-1998	School of Medicine: Pontificia Universidade Catolica do R.G.S (1979) MD	Respiratory Syncytial virus as a risk factor for asthma in early life	Professor, Pontificia Universidad e Católica Medical School, Porto Alegre, Brazil	Viral respiratory illnesses and association with development of chronic lung disease in disadvantaged children in Brazil. Funding unknown.	57
	Lombardi, Enrico Post-doc	1994-1997	University of Florence, Italy (1991) MD	Bronchial responsiveness as a predictor of subsequent asthma	Associate Professor, University of Florence, Italy	Infant and young child pulmonary physiology.	89
	Baldini, Mauro Post-doc	1996-2002	University of Pisa (1990) MD	Polymorphisms in the CD14 gene and asthma and allergies	Faculty, University of Pisa, Italy	N/A	13
	Karakoc, Fazilet Post-doc	1998-2000	Marmara University (1995) MD	Eosinophilia as a risk factor for asthma	Associate Professor, Marmara University, Istanbul Turkey	N/A	34
	Remes, Sami Post-doc	1998-2000	University of Kuopio (1995) MD	Exposure to pets in early life as a protective factor asthma	Scientist, National Public Health Institute, Kuopio Finland	Asthma and hygiene hypothesis.	21
	Martinez, Maria Post-doc	1996-1999	University of Navarra (1984) MD	Ethnic differences in asthma and recurrent wheeze in the Southwest	Private Practice, Phoenix, AZ	N/A	2
	Gwinn, Jane	1997-1999	Medical University	Lower respiratory	Private Practice	N/A	1

	Post-doc		of South Carolina (1981) MD	tract illnesses in the first 3 years of life	(Pediatric Pulmonology), Greenville, SC		
	Fong, Edward	1998-2004	University of Hawaii (1998) MD	Bronchial Responsiveness and Level of Lung Function at Age 6 Independently Predict the Level of Lung Function Attained by Age 16 in an Unselected Birth Cohort	Associate Pulmonologist, Children's Hospital and Research Center of Oakland, California	DNase in Status Asthmaticus	1
	Castro-Rodriguez, Jose Post-doc	1998-2001	Universidad Peruana Cayetano Heredia (1987) MD	Role of obesity in the incidence of asthma during puberty in girls	Assistant Professor, University of Chile, Santiago, Chile	N/A	45
	Guerra, Stefano Post-doc	1999-2003	University of Milan (1996) MD University of Arizona (2001) MPH	Determinants of persistence of asthma in adolescence	Assistant Professor, College of Public Health, University of Arizona	Epidemiology of asthma and allergy. Institutional support and a ATS/Alpha One Foundation research grant	14
	Tesse, Riccardina Post-doc	2000-2002	University of Bari (1998) MD	Role of polymorphisms in the IL12B gene in asthma and allergies	Post-doc, University of Bari	Currently finishing subspecialty degree in Pediatrics.	11
	Crestani, Elena Post-doc	2001-2003	University Verona (1999) MD	Parental history of asthma as a risk factor for allergic sensitization	PhD student, University of Arizona	Role of immune system in the development of asthma	4
	Minervini, Maria Cristina Post-doc	2002- 2004	Catholic University of Cordoba (1982) MD	Tucson Children's Respiratory Study (epidemiology and natural history of asthma)	Staff, Catholic University of Cordoba	N/A	2

	Siroux, Valérie Post-doc	2004-2005	Université Paris XI (2003) PhD	Genetics of asthma	Staff Epidemiologist, CHU Grenoble, France	Genetic and environemtnal risk factors for severe asthma	27
	Eder, Waltraud Post-doc	2001-2005	University of Graz/Universitas Carola Francisca (1989) MD	Interactions of endotoxin exposure and polymorphisms in TLR4 and other innate immunity genes as determinants of asthma	Head of Training in Pediatrics, School of Medicine, University of Salzburg, Salzburg	Genetics of asthma in the context of the hygiene hypothesis	18
	Otsuka, Kim Post-doc	2002-Present	University of Hawaii (1998) MD	Positional mapping of asthma-related genes by use of linkage disequilibrium approaches.	Pediatric Pulomonologist in Loma Linda, CA	Regulation of TLR2 Expression & Impact of Polymorphisms (F32 AI065078)	1
	Laing, Ingrid Post-doc	2007-2008	University of Western Australia (2006) PhD	Genetics of viral infection	Post doctoral scientist AREST CF (www.arestcf.org) Division of Clinical Sciences Telethon Institute for Child Health Research & Research Fellow School of Paediatrics and Child Health The University of Western Australia	Determinants of Acute Respiratory Illness in Papua New Guinea	28
	Bosco, Anthony Post-doc	2008-Present	University of Western Australia (2007) PhD	Genetics of gene-expression in asthma and allergies.	Visiting Research Scholar	TVW Telethon Institute & NHMRC Fellowship	10

	Rebordosa, Cristina	2009-Present	Autonomous University of Barcelona, Spain (2009) PhD	Genetic and environmental factors and asthma susceptibility in children	Postdoctoral Fellow (CREAL Institute)	Fellowship training from CREAL	5
	Phan, Hanna	2009-Present	University of Arizona (2008) PhD	Genetics of growth response to inhaled corticosteroids	Clinical Assistant Professor, University of Arizona		5

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October 27, 2010

Dear Review Committee:

It is with great enthusiasm that I have agreed to serve as a Co-Sponsor for Dr. Paloma Beamer's Career Development Award. I am currently the Associate Dean for Research in the Mel and Enid Zuckerman College of Public health and a Professor in Biostatistics. In addition, I have been conducting collaborative research for over twenty years with the Arizona Respiratory Center (ARC) and have been a co-investigator on the Tucson Children's Respiratory Study grant for over ten years.

My expertise is in the methodology for longitudinal analysis and I have published several review articles on this topic. My research interests include assessing risk factors for developing chronic respiratory diseases, which includes acute exposures, genetics, and interactions between these two factors.

Regarding my mentoring experience, over the past tens years I have been the chair and research advisor for five PhD students in Epidemiology, whose dissertation research has focused on respiratory diseases and was done in collaboration with the ARC. I have also worked with several MS and MPH students doing similar types of projects for their thesis and internship projects. As the Director of the Arizona Clinical Research Training Program (AzCRTP) since 2000, I have mentored over ten physicians through this program. The AzCRTP is a graduate certificate program which prepares clinician scientists for the complexities of clinical research through high-quality didactic instruction and mentored research experiences. Completion of this program is also part of Dr. Beamer's proposed training.

I look forward to working with Dr. Beamer on her proposed project as I am certain that it will lead to important information hopefully leading to a better understanding of the natural history of asthma which we know is a very complex disease involving both exposures and genetic predisposition.

I give my highest possible support to Dr. Beamer's Career Development Award application. This award will give her an excellent chance to further her career goals and work with an internationally known team, Directed by Dr. Martinez, at the Arizona Respiratory Center.

Sincerely,

Duane Sherrill, PhD
Associate Dear for Research
Professor Biostatistics
Mel and Enid Zuckerman College of public Health

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October 27, 2010

Dear Review Committee,

It is my pleasure to serve as a Co-Mentor for Dr. Paloma Beamer's Career Development Award. I am currently the Canyon Ranch Endowed Chair for Lifestyle and Behavioral Health and Professor in the Mel and Enid Zuckerman College of Public Health. In addition, I am an active member of the Arizona Respiratory Center. My expertise is in the design, implementation, and evaluation of community based interventions related to asthma. I have an excellent funding record from NHLBI related to community based asthma interventions. Currently, I am an Investigator for an NHLBI funded R01 related to the Effect of a School Based Hand Sanitizer Program on Asthma Exacerbations. I served as Principal Investigator of this grant until December 31, 2008 at which time I transferred to the University of Arizona. Prior to joining the faculty at the University of Arizona, I was the Director of the Lung Health Center at the University of Alabama at Birmingham where I supervised over 25 multi-disciplinary faculty and staff in 25 active research protocols with approximately 6 million per year in active funding. I have also been very actively involved in the American Thoracic Society serving in numerous leadership positions including Chair of the Behavioral Science Assembly Planning Committee, Chair of the 2008 Behavioral Science Assembly Program Committee, and currently serving as a member of the Board of Directors and Chair for the Behavioral Science Assembly. In these roles, I have served as an active mentor for many faculty, post-doctoral fellows, and graduate students. During the past 10 years I have mentored over 20 pre-doctoral students, 3 post-doctoral fellows, and 6 junior faculty. I especially enjoy mentoring junior faculty on the development and implementation of research projects.

I look forward to working with Dr. Beamer in her proposed project as I am confident that it will lead to important information that we can translate into community based interventions. My office is located on the same floor as Dr. Beamer's in the College of Public Health which facilitates interaction. During the award period for Dr. Beamer's Career Development Grant, I will provide mentoring to facilitate the accomplishment of her career development and research objectives. The focus of my mentoring will be on the areas of asthma, research methods, and community based interventions. As part of her Career Development, Dr. Beamer will complete the University of Arizona's Clinical Research Training program. I am a faculty member in this program and teach the Grant Writing course. I believe this training program will greatly enhance her educational goals and will supplement this activity with one-on-one discussions focused on how to apply her research findings to community based interventions.

I give my strong support to Dr. Beamer's Career Development Award application. This award will provide her with an excellent opportunity to further her career goals and work with an internationally known team, Directed by Dr. Martinez, at the Arizona Respiratory Center. The project proposed takes advantage of two unique, very rich datasets and can provide answers to important questions related to the development of asthma. As a community based researcher, I am very excited about the potential possibilities of the outcomes of Dr. Beamer's research. The findings are likely to lead to results which can be feasibly implemented to improve health outcomes among children.

Sincerely,

Lynn B. Gerald, PhD, MSPH
Canyon Ranch Endowed Chair/Professor

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November 3, 2010

Dear Review Committee,

I have read Dr. Paloma Beamer's Career Development Award application, and I give it my strongest support. It is a great pleasure to serve as her Co-Sponsor. I am currently Head of the Department of Atmospheric Sciences and Director of the Institute of Atmospheric Physics at the University of Arizona. My expertise includes urban air pollutants, dispersion modeling, and aerosol particulate matter, all of which are of central importance to Dr. Beamer's proposed research plan.

My research has been supported, in part, over the past 15 years by an NIH/NIEHS Superfund grant - currently focused on the characterization and dispersion of arsenic-laden dust arising from mine tailings operations at two Arizona Superfund sites. Also of relevance to Dr. Beamer's K Award application, I am the PI on an EPA Pollution Prevention (P2) grant studying community exposure to metal-containing particulates in economically disadvantaged areas of Tucson.

A major purpose of the K award is to provide support and "protected time" for an intensive, supervised career development experience. Throughout my academic career, I have devoted time to supporting and developing some of the nation's most talented young scientists. For example, I served on and eventually chaired the National Academies' National Research Council (post-doctoral) Associateships review panels for 17 years, I chaired the American Geophysical Union (AGU) Committee on Public Affairs that selects a Congressional Science Fellow to serve on Capitol Hill every year, and I was a founding member of the University of Arizona NASA Space Grant Fellowship advisory committee that selects both undergraduate and graduate students for funded research experiences in laboratories across campus.

I have advised over 20 graduate students and a similar number of undergraduate students, and I have mentored young faculty members and post-doctoral students in my home Department, and in the Department of Chemical and Environmental Engineering, where I have a courtesy appointment. I also have a courtesy appointment in the college of Public Health where I have served on two faculty search committees.

I have especially enjoyed working with Dr. Beamer who sought me out soon after she arrived on campus. There is considerable overlap between our research interests and we already share laboratory equipment. I look forward to supporting Dr. Beamer on her proposed project on the potential effects of traffic-related air pollutants on the respiratory systems of young children. I expect that it will lead to important discoveries

that we can translate into community based interventions. I have served on the citizen's advisory board for the Pima County Department of Environmental Quality for more than a decade and so I can easily facilitate Dr. Beamer's access to County traffic and air quality records that she might need.

I will provide mentoring to ensure that Dr. Beamer's early academic career develops in the most successful manner possible, ultimately leading to a positive promotion and tenure decision. The focus of my research mentoring will be on the areas of gaseous and particulate air pollutant emissions estimation, dispersion modeling, and community involvement (through my EPA P2 grant). I propose meeting with her on a monthly basis to formally discuss her progress and also informally, as the need arises, to discuss specific research-related questions. I will read and comment on drafts of each of the publications arising from her work - there should be many. To facilitate her transition from the mentored stage of her career to the fully independent stage, I will guide her selection of future research directions and I will help identify potential funding sources.

It is noteworthy that this award will provide Dr. Beamer with an opportunity to work closely with Dr. Fernando Martinez, the internationally known Director of the Arizona Respiratory Center, which is a particularly good fit for this asthma-related research proposal.

Sincerely,

Eric A. Betterton, PhD

Head/Director

Department of Atmospheric Sciences/Institute of Atmospheric Physics

THE UNIVERSITY OF ARIZONA.
College of Medicine

Associate Dean,
Faculty Affairs
College of Medicine

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October 27, 2010

To Whom It May Concern:

I am delighted to serve as a consultant to Dr. Paloma Beamer for this project. I am a Professor in the Department of Pediatrics and the Arizona Respiratory Center. My primary research interest for the last 3 decades has been the epidemiology of childhood asthma. Central to Dr. Beamer's research are two well known birth cohort studies, the Tucson Children's Respiratory Study (CRS) and the Infant Immune Study (IIS). I was one of the founders of the CRS and have been responsible for its day-to-day operation since its inception in 1980; I am currently co-Principal Investigator of the CRS. I am also the founder and Principal Investigator of the IIS.

Our work through these two birth cohort studies is known internationally and has been a model for new birth cohort studies on the risk factors for asthma all over the world. Through more than 110 publications, these studies have made fundamental contributions to the understanding of the risk factors for and the natural history of asthma, the most common chronic disease in childhood. For example, we showed that distinct wheezing phenotypes exist both early in life and throughout childhood, each of which has different risk factors and prognosis for asthma and growth in pulmonary function. This seminal work, published in 1995 in the New England Journal of Medicine, has been cited more than 1300 times since its publication and provides the foundation for epidemiologic investigations of this disease. We have also been leaders in studies that have shown that early life exposures may provide either risk or protection against later asthma.

Dr. Beamer's interests dovetail neatly with this research and our collaboration will be mutually beneficial. As an engineer, Dr. Beamer brings unique expertise to our investigations into the role of environmental exposures in the origin of childhood asthma, allowing us to develop a new area of study pertaining to the role of air pollution as a modifier of immune system development and risk for asthma. For her part, Dr. Beamer will benefit from collaboration in these projects as the data sets make available to her a wide range of immune system and lung function outcomes at multiple ages, which will permit comprehensive investigations into potential pathways by which traffic exposure may impact respiratory health.

In addition to its international reputation as the home of these influential birth cohort studies, the Arizona Respiratory Center is known throughout the College of Medicine as a unit with a critical mass of investigators that provides a collaborative and supportive environment for junior researchers. There are regular seminars in which basic science and epidemiology are brought together with diverse presentations and lively discussions. Dr. Beamer will also participate in weekly IIS meetings, when new ideas, analyses and data collection issues are discussed.

As PI of IIS and co-PI of CRS, I will consult on how to best utilize the rich data available from the CRS and IIS to address Dr. Beamer's research questions. I will be responsible for facilitating access to the complex data sets created through the longitudinal studies. Many hundreds of analyses have been conducted using the data generated through these studies, and multiple constructed variables already exist. It is important from the standpoint of the project that there be

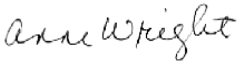
consistency in how certain outcomes are defined. Nevertheless, new variables will need to be constructed, and I will provide guidance as to how they should be created. I will also supervise and facilitate data retrieval and processing. Finally, my expertise in defining and assessing asthma-related phenotypes in childhood will be important in considering the biological plausibility of the findings.

I have had the opportunity to mentor outstanding graduate students from the Anthropology department (Drs. David Van Sickle, Elizabeth Cartwright, Steve Wind and Namino Glantz), from the PhD program in the College of Public Health (Janet Rothers, Melisa Celaya, Wen Zang, Margaret Kurzius-Spencer), and from other programs at the University of Arizona (Dr. Vijay Joish, Pharmacy; Dr. Leslie Schwindt, Political Science). I have served on dissertation committees in the Anthropology Department (Drs. Nancy Vuckovic, David Van Sickle, Steve Wind, Elizabeth Cartwright) and the College of Public Health (Janet Rothers, Melisa Celaya). I have also mentored two pediatric pulmonary fellows (Drs. Esmeralda Morales and Maria Martinez), both of whom were awarded Minority Supplements from NIH in conjunction with my R01s, as well as several international research fellows who now have active careers in their countries of origin (Drs. Jose Castro Rodriguez [Peru], Sami Remes [Finland], Wendy Oddy [Australia], and Fazilet Karakok [Turkey]). I mentor junior faculty in the Department of Pediatrics (Drs. Tom Ball, Conrad Clemens, Theresa Guilbert), and in other departments in the College of Medicine (Dr. Tricia Levan, Pharmacology). Two of these faculty have received NIH funding under my mentorship: Dr. Ball received a K23 ($469,908) and Dr. Guilbert a K08 ($562,329).

Since 2006 I have been the Associate Dean for Faculty Affairs for the College of Medicine. In this role, I have been committed to the creation of structures that support mentoring and development of junior faculty. I have created a series of distinct Career Development workshops for faculty which tap into the expertise of different presenters for different audiences. Finally, I have been actively involved in the advancement of women faculty at the Arizona Health Sciences Center, organizing workshops, providing financial support for women to attend national career development seminars, working towards salary equity and publishing on barriers to the advancement of women faculty.

I am enthusiastic about working with Dr. Beamer. She approaches research with a very logical mind, a willingness to work hard, and exceptional organizational skills. I am also excited about the perspective she will contribute to our understanding of childhood asthma. This collaboration will provide an opportunity for an outstanding junior faculty member to investigate important scientific questions while gaining skills and experience, and will strengthen two world renowned birth cohort studies by expanding the research questions they are able to address.

Sincerely,



Anne L. Wright, PhD
Professor, Department of Pediatrics and Arizona Respiratory Center
Associate Dean, Faculty Affairs, College of Medicine

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November 8, 2010

K23 Research Career Development Award Committee
National Institutes of Health
Washington, DC

Re: Andrew C. Comrie, PhD – Statement for Dr. Paloma Beamer's Career Development Proposal

Dear Colleague:

I am a Professor of Geography & Development and a Professor of Atmospheric Sciences at the University of Arizona. I also serve as Associate Vice President for Research and Dean of the Graduate College at the University of Arizona. In the 17 years that I have been at the University of Arizona, I have focused on building an interdisciplinary research program in climate variability and change, with particular emphasis on the connections between climate and human environmental issues including health, air quality, and environmental policy. My research has been funded by a range of agencies, and I am currently Principal Investigator on an EPA grant examining climate controls on valley fever (coccidioidomycosis, caused by a soil fungus). I am also currently co-PI on an NSF project that includes climate-based dynamic modeling of mosquitoes as disease vectors, and co-PI for an ongoing large center project assessing climate impacts in the Southwest funded by the National Oceanographic and Atmospheric Administration (NOAA). In recent years I was also PI on two grants in which my work focused on mapping atmospheric variables, including air quality and climate. Both of these projects involved spatial modeling, as does my currently-funded work, and it is in this area that my expertise is particularly relevant to Dr. Beamer's career development proposal.

I am committed to the role of mentor at multiple levels of training. My grant funding sustains undergraduates, graduate students and postdoctoral scientists through my Applied Climatology for Environment and Society (ACES) research laboratory. I have been closely involved in training undergraduates on multiple projects (e.g., via an NSF Research Experience for Undergraduates grant and via NASA Space Grant support). At the graduate level I have chaired 23 master's student committees and 12 doctoral committees. While these students reap obvious rewards from their degree programs and working in my lab, I too gain deep satisfaction from mentoring them and it is the power of this relationship that drives me in my current administrative role as graduate dean. My PhD students have gone on to postdoc and tenure-track positions at major universities as well as to Federal agencies and the private sector. I have trained 5 postdoctoral scholars in my lab, and I have served as formal faculty mentor for three junior professors.

My major contribution to Dr. Beamer's career development plan is to provide her direct mentoring on the use of spatial techniques in her analyses of early-life diesel exhaust exposures that may result in asthma later in life. Exposure modeling of air quality relies on accurate

treatment of regional and microscale atmospheric processes. Spatial analysis and modeling techniques, including GIS but also covering multivariate statistical approaches as well as dynamic modeling, require great care in their application. Geographic epidemiology is an exciting area of analysis that brings together geographers and public health researchers. Geographic information science goes beyond computerized mapmaking to enable the creation, testing and validation of hypotheses in the spatial domain. Dr. Beamer's work will provide key advances in this field in the realm of air pollution exposure analysis. Her combination of engineering and public health makes her almost uniquely qualified to carry out innovative analyses that use quantitative spatial approaches to solve exposure problems.

In my role as consultant I will meet regularly with Dr. Beamer, with special emphasis on periods when she is integrating geospatial approaches with her urban air pollution and exposure studies. The crux of this work is providing good estimates of ambient air pollution across space, accounting for complex patterns of traffic, roadway configuration, and prevailing atmospheric conditions. I will provide advice and supervision to Dr. Beamer as necessary for these dimensions of her research. Our interactions will occur several times per year at the baseline level, with more frequent meetings, phone calls, emails, etc. when we deal with specific research issues. This schedule will facilitate the review of her progress at the level of career and research goals, while simultaneously enabling discussions of project details, individual analysis results and review of manuscripts. I will also provide Dr. Beamer with references to the important research literature pertaining to her work in my area. I am delighted to be able to advise Dr. Beamer on her career development and research – she has outlined an ambitious but achievable goal that I am confident she will reach.

Sincerely,

Andrew C. Comrie, Ph.D.
Professor of Geography & Development
& Atmospheric Sciences
Associate Vice President for Research
Dean of the Graduate College

ENVIRONMENT AND INSTITUTIONAL COMMITMENT TO THE CANDIDATE

8. Description of the Institutional Environment

The University of Arizona

The University of Arizona (UA) is the leading public research university in the American Southwest, and is an ideal interdisciplinary academic community for the proposed career development award. UA is a land grant public university and a member of the Association of American Universities. UA has a 387-acre campus in Tucson, Arizona including 159 buildings on the main campus and 25 buildings at the adjacent Arizona Health Sciences Center. With greater than 37,000 students enrolled in 19 colleges and 12 schools, UA provides an amazing environment for interacting with students, faculty and researchers from many diverse disciplines. UA has 14 libraries including over 5 million print volumes. The University's commitment to research was recognized by its ranking in 2008 from the National Science Foundation as 16th among public and 24th among all universities in the United States for research and development expenditures with over $545 million in annual research funding.

The University is committed to providing a cadre of scientists and educators who, through interdisciplinary training, are able to develop new and imaginative methods of teaching and research, and create new fields of endeavors as evident by 14 recognized graduate interdisciplinary programs. To consolidate the University's standing as one of the top research universities in America, UA is dedicated to strengthening research and outreach in 9 interdisciplinary areas that are critical to Arizona's future through enhancing education and addressing social, cultural and economic needs. Dr. Beamer's career research goals align directly with two of the strategic areas and she can serve as a bridge: Climate, Environmental, Water and Energy Sustainability and Biomedical and Behavioral Health. Recently, the University completed two major faculty hiring initiatives to further establish the University of Arizona's leading positions in Environmental Science, Engineering, and Policy and in Translational Medicine. These two initiatives demonstrate the University's commitment to investing in these strategic priorities and will provide Dr. Beamer with additional collaborators across multiple colleges and programs.

With a central focus on environmental and biomedical research, the UA provides an unparallel opportunity for Dr. Beamer to develop an independent research career with collaborations and support of several colleagues from across the University as evident by the mentoring team. There are several interdisciplinary research centers for Dr. Beamer to continue to develop collaborations and that provide access to core resources. These include the Arizona Respiratory Center, Bio5 Institute for Collaborative Bioresearch, Arizona Cancer Center, Institute for Environment & Society, Southwest Environmental Health Sciences Center, Superfund Basic Research Program, and US-Mexico Binational Center for Environmental Science and Toxicology. In addition to Dr. Beamer's current home in Environmental Health Sciences, there are several long-standing departments throughout UA in both quantitative and biomedical fields that have faculty who try to understand the effects of environmental pollutants on human health. These include: Atmospheric Sciences, Environmental Engineering, Soil Water and Environmental Science, Geography, Toxicology, Cell Biology, Cancer Biology, Epidemiology, Pediatrics and Microbiology.

In the State of Arizona there is a centrally funded commitment towards the environment and bioresearch through the Technology Research Infrastructure Fund (TRIF). These funds are from a state sales tax increase approved as a proposition by Arizona voters in 2000. The funds are for creative translational research in critical high tech areas: bioresearch, optical sciences and technology, water and environmental sustainability. A portion of these funds is devoted towards providing resources for junior faculty. Dr. Beamer has received a small grant for a pilot project ($40,000) and a resource infrastructure grant ($150,000) for developing her laboratory space. In addition she also received a pilot project grant ($40,000) from the Southwest Environmental Health Sciences Center for gathering the preliminary data for the current proposal. Due to the outstanding resources and intellectual opportunities available, the research environment of the University of Arizona, is uniquely suited to allow Dr. Beamer's to expand upon her quantitative training as an environmental engineer and develop an independent research career in the biomedical sciences through the K25 mechanism.

The Arizona Health Sciences Center

The Arizona Health Sciences Center (AHSC) is a 48-acre complex adjacent to UA. It includes the Colleges of Medicine, Nursing, Pharmacy and Public Health, the University Medical Center and 11 additional centers officially recognized by the Arizona Board of Regents. There are over 1500 students enrolled in these colleges.

During fiscal year 2008, AHSC generated almost 128 million dollars in grants and contracts that can be applied to research, patient care, and education. The Arizona Health Sciences Library (AHSL), located within the University Medical Center, contains the state's largest collection of health information resources and is open 24 hours a day to UA employees. AHSL provides electronic full text access to almost 10,000 journals and there is a librarian dedicated to aiding researchers in public health. Inclusion of these 4 colleges within AHSC allows for ease of collaboration between the units and resource sharing of laboratories and educational facilities.

The Mel and Enid Zuckerman College of Public Health

The Mel and Enid Zuckerman College of Public Health (MEZCOPH) was established in January 2000 by the Arizona Board of Regents and was accredited in 2003 by the Council on Education for Public Health. Located within the 103,000 square-foot Roy P. Drachman Hall, MEZCOPH instructional space includes three lecture halls, two distributed learning classrooms, five interactive learning classrooms and a computer instruction classroom. Drachman Hall is also home to all administrative and support offices, academic divisions and research programs for the College. Laboratory space is provided in the Medical Research Building adjacent to Drachman Hall. This state-of-the-art facility, completed in Summer 2006 contains 6,225 net square feet of open, shared core facilities, wet labs, and faculty/student office space designed to maximize collaborative research and interaction among students and faculty. MEZCOPH also has an additional 4,000 square feet of wet-laboratory space in the Biomedical Research Laboratories building. MEZCOPH awards Masters of Public Health (MPH) and/or Master of Science (MS) degrees in Biostatics, Environmental and Occupational Health, Epidemiology, Family and Child Health, Health Behavior and Health Promotion and Public Health Policy and Management as well as a Public Health Certificate. Additionally, MEZCOPH also awards Ph.D. degrees in both Biostatistics and Epidemiology and a Dr.P.H. degree with a concentration in Maternal Child Health or Public Health Policy Management. The M.S./Ph.D. program in Environmental Health Sciences was approved in 2009, and enrolled students in Fall of 2010. Historically, the College's budget is comprised of 70% extramural funds; these funds include NIH, CDC and other federal agencies as well as multiple contracts with the Arizona Department of Health Services. Research strengths within MEZCOPH are diverse, in keeping with the mission "to promoting the health of individuals and communities with a special emphasis on diverse populations and the Southwest." The Environmental Health Sciences section has 7 primary faculty members and 19 adjunct faculty members. MEZCOPH in general, and the Environmental Health Sciences Section in particular, have an established track record of supporting interdisciplinary research. All Section faculty members are involved with teaching and research activities throughout UA, including, but not limited to, the BIO5 Institute, Institute of Study of Environment & Society, Arizona Respiratory Center, Southwest Environmental Health Sciences Center, Superfund Basic Research Program, the Arizona Cancer Center, and the U.S.-Mexico Binational Center for Environmental Sciences and Toxicology. MEZCOPH has demonstrated an institutional commitment to faculty development and research, there are several faculty Principle Investigators who have received developmental awards (K-series and equivalent), including the current Dean, as well as other investigator-initiated awards (R01, R03 and equivalent).

Arizona Respiratory Center

The Arizona Respiratory Center (ARC) was the first Center of Excellence created by the College of Medicine at the University of Arizona during its first year of existence and remains an integral part. Founded in 1971 (founding Director, Benjamin Burrows), the ARC was dedicated to the study of the epidemiology of asthma and chronic obstructive lung disease. Dr. Burrows served as PI on a SCOR grant from NHLBI at the inception of the program and maintained that grant through 1997, making it the longest continuously funded SCOR grant in the history of that program. Under the current Director, Fernando Martinez (sponsor for current K25 proposal), the ARC has expanded in new research areas including genetics and functional genomics. Under Dr. Martinez's leadership annual funding for the ARC has increased from $1.6 million in 1998 to over $8 million in 2008 and contributes close to 15% of the total funding received by the College of Medicine. The ARC has almost 20,000 square feet of space within AHSC, including offices for faculty and staff, data analysis and epidemiology research areas, wet laboratories, and clinical space. The ARC currently has over 23 funded projects and has published several hundred articles in the peer-reviewed literature. Members of the ARC are have been members of study sections and national review panels for the assessment of grant proposals for organizations such as NIH, US EPA and the Health Effects Institute.

The main mission of the ARC is to create a multidisciplinary environment that fosters research, training and service in the area of respiratory health and disease, with special emphasis on asthma, allergy related risk factors and sleep-associated respiratory disorders. A strong emphasis on multi-disciplinary approaches

provides a complete circuit from bedside (identifying phenotypic alterations) to bench (applying epidemiology, molecular and cellular biology, immunology, genetics and genomics to mechanisms of disease pathogenesis, prevention and therapy) back to the bedside (clinical research related to prevention and therapy). The research approaches encompass state-of-the-art, high throughput techniques that enhance data gathering, enlarge the context of analysis, and hasten application. To fulfill this mission the ARC is committed to the following objectives: 1) to make substantial contributions to the advancement of scientific understanding of the mechanistic pathogenesis of airways diseases, especially asthma, allergy and sleep disorders, and to create and test new modes of prevention and treatment of airways diseases; 2) to meet the educational needs of graduate students, postdoctoral fellows and junior faculty by providing research training and mentoring to facilitate career growth; and 3) to serve as a state and national resource of expertise in asthma, chronic obstructive lung disease, lung injury and sleep-related and neuromuscular breathing disorders.

The Center today is recognized as one of the leading institutions in the world in the field of respiratory disease epidemiology, of particular relevance for this career development plan. Important indicators of success in this area are the two major epidemiological grants currently in their 29th and 12th year of continuous funding from NIH. The Tucson Children's Respiratory Study, begun in 1980 is internationally regarded as one of the most important birth cohort studies on the natural history of asthma. This study is investigating the principal mechanisms and risk factors that modify incidence and persistence of asthma from birth into early adult life. The Infant Immune Study, begun in 1997, is investigating three immunologic pathways that appear to protect against asthma, and assessing how asthma susceptibility genes may interact with environmental influences to protect against asthma. NIH has also funded several additional projects in both immunobiology and genetics using the same populations. From these two cohorts researchers at the ARC have established their expertise in the characterization of risk factors for and the natural history of asthma. The ARC continues to contribute by providing new ideas about the etiology of asthma, and testing new hypotheses, some of which have clinical applications. Major findings from the ARC have highlighted the importance of events occurring during early life for the development of asthma, stressed the role immune factors as essential correlates of asthma prevalence, and described in great detail the association between asthma-like symptoms and the development of lung function both during childhood and adult life. The ARC has made a significant contribution to the understanding of asthma as a developmental disease in which environmental and genetic factors interact dynamically at times during which both the immune system and the lungs go through critical periods of growth.

In line with mission of UA as a land grant institution, a special concern of the ARC has been to extend the findings from its epidemiologic studies towards clinical trials in the Tucson community and throughout the state of Arizona and contribute towards reducing health disparities. Specifically, the ARC has been successful in obtaining funding from NIH to develop preventative strategies for asthma in children living in South Tucson as part of a national effort, the National Inner City Asthma Program. In addition, the ARC has also extended its work towards the Native American communities in the Northern part of Arizona. With the recent addition of Dr. Lynn Gerald, co-sponsor and former director of the University of Alabama Birmingham Lung Health Center, the ARC will expand its involvement in community-based clinical trails for prevention of asthma.

The ARC has fostered the careers of several promising junior investigators from around the world by providing training and the ability to work on the large and unique databases within these cohorts. Dr. Beamer will also take advantage of tapping into these two on-going longitudinal birth cohort studies at the ARC to complete the research plan of this proposal. The ARC has provided the institutional environment for several K mechanism awardees from NIH, including the current Director and proposal sponsor, Dr. Martinez. As a national center of reference for the current level of understanding of asthma, the ARC provides an opportunity without equal for Dr. Beamer to extend her training and reach her professional goals. Drawing upon almost 40 years of experience, the ARC will provide Dr. Beamer with the appropriate environment to develop her career focused on understanding the role of environmental exposures in respiratory diseases in order to develop community-based interventions aimed at reducing health disparities.

9. Institutional Commitment to Candidate's Research Career Development

Dr. Paloma Beamer's primary appointment is in the Mel and Enid Zuckerman College of Public Health. Please see the attached letter from Dr. Iman Hakim, Dean of the Mel and Enid Zuckerman College of Public Health outlining the UA commitment to Dr. Beamer's research career development.

THE UNIVERSITY OF ARIZONA
Mel and Enid Zuckerman College of Public Health

Office of the Dean

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October 29, 2010

Dear Colleague:

I write in full support of Dr. Paloma Beamer's K-25 application for a Mentored Quantitative Research Career Development Award. Her proposed educational and research plan will allow her to complement her classic training as environmental engineer with biomedical skills, allowing her to develop an independent research career and become a leader in understanding the role of environmental exposures in development of respiratory diseases.

The University of Arizona (UA) is dedicated to advancing research that enhances education and addresses social, cultural and economic needs. We have identified 9 central strategic areas to target future investment and research programs. We are committed to supporting Dr. Beamer's career as her research interests and goals unite two of the strategic areas: Climate, Environmental, Water and Energy Sustainability, and Biomedical and Behavioral Health. Recently, our Provost announced two major faculty hiring investment initiatives to strengthen UA as a leader in Environmental Science, Engineering and Policy and Translational Medicine. Each of these initiatives is a demonstration of the investment that UA is focusing on these two strategic areas. We are confident that this will provide Dr. Beamer with an exceptional and unique community of scholars to develop her interdisciplinary career.

In addition, her commitment to working with vulnerable populations directly meets the mission of the Mel and Enid Zuckerman College of Public Health (MEZCOPH) to "promote the health of individuals and communities with a special emphasis on diverse populations and the Southwest." Because of how well her interests align with the University and the College strategic plans, my colleagues and I were so excited at the prospect of Dr. Beamer joining us that that we recruited her directly from her PhD program at Stanford University as a tenure-eligible Assistant Professor. We believed that she is an exceptional academician who brings much to the University, our College and academic programs. We, in turn knew that we and the University could provide her with the ideal intellectual community for additional training to develop her research career.

The Mel and Enid Zuckerman College of Public Health (MEZCOPH) was established in 2000 by the Arizona Board of Regents. Environmental Health Sciences is one of the fastest growing sections within the College. Recently, a MS/PhD program in Environmental Health Sciences was approved by the Arizona Board of Regents. In addition, there is an environmental and occupational health emphasis within our new undergraduate BS in Public Health. Currently, we are hiring two additional faculty for the Environmental Health Sciences Section. We selected Dr. Beamer from over 40 applicants, because we knew that her unique quantitative background as an environmental engineer and her research interests would help us develop our Environmental Health Sciences program and foster collaborations from many diverse programs on campus.

We have committed many resources to Dr. Beamer to help develop her career. We provided her with $75,000 for start-up expenses with an additional $75,000 provided from the Office of the Vice Provost for Research. We have provided Dr. Beamer with a 118 square feet office in our new building Drachman Hall. We have also provided her with 860 square feet of laboratory space and 113 square feet of administrative space in the new Medical Research Building, adjacent to Drachman Hall. The Medical Research Building, completed in 2006, is a unique laboratory facility designed to foster interdisciplinary collaboration. As a further demonstration of our commitment to Dr. Beamer we have also helped facilitate a postdoctoral position for her husband in the College of Education by providing half of his salary for two years.

In addition to support from MEZCOPH, Dr. Beamer has received support from the University at large. She successfully received a Research and Recruitment Initiative Infrastructure Investment in the amount of $145,650 from the Technology Research Infrastructure (TRIF) Fund for laboratory development and remodeling. TRIF is supported from a state sales tax increase and designed to fund research in critical high tech areas including bioresearch, environmental sustainability, and optical sciences. In the two years that Dr. Beamer has been employed by us, she has also successfully received 3 pilot project grants from multiple centers at UA: the Superfund Basic Research Program (funded by TRIF), Arizona Cancer Center, and the Southwest Environmental Health Sciences Center (SWEHSC). These grants serve as a testament to the potential that Dr. Beamer has demonstrated as a junior faculty and the commitment from various senior level investigators from around the University towards developing her research career.

I am very excited by the research and training proposal that Dr. Beamer has developed with her mentoring team for this K-25 application. Her proposal takes full advantage of the outstanding academic and research resources of MEZCOPH and the Arizona Respiratory Center. Both are located within the Arizona Health Sciences Center, and the spatial proximity will make communication among these resources convenient. The training program will allow Dr. Beamer to expand on her existing training in engineering and receive formal training in biomedical methods including epidemiology and biostatistics. The research proposal will not only allow Dr. Beamer to develop and utilize these skills but also addresses a relevant question and will provide a foundation for her to develop future research proposals.

Dr. Beamer has also developed an exceptional very experienced mentoring team. Dr. Fernando Martinez is one of the top researchers at the University assessing environmental causes of disease with a history of mentoring junior colleagues. He is also in charge of the Translational Medicine New Faculty Initiative. Two of the co-mentors, Dr. Duane Sherrill and Dr. Lynn Gerald, are also faculty in MEZCOPH and will help ensure that Dr. Beamer is successfully proceeding towards promotion and tenure in our College. Dr. Eric Betterton will help her continue to develop her quantitative environmental science skills and help provide future collaborations with scientists at UA in those fields. Dr. Anne Wright has extensive experience with both cohorts for this proposal and as Associate Dean for Faculty Affairs for the College of Medicine, I am confident that she will also help to develop Dr. Beamer's career. Dr. Andrew Comrie has long-standing collaborations with our Environmental Health Sciences faculty and will provide additional support for the GIS modeling and as Associate Vice President for Research will be able to help identify additional research resources and collaborations for Dr. Beamer throughout the University. This unique group of mentors, made possible by the interdisciplinary culture of the University, is without a match anywhere else to help Dr. Beamer develop and flourish as an independent researcher.

Institutional Agreement

In support of the K-25 Research Career Development Award application, the Mel and Enid Zuckerman College of Public Health at the University of Arizona agrees to:

1. Dr. Beamer will retain her current academic appointment as an Assistant Professor (tenure-eligible) within MEZCOPH. The appointment, the rights and privileges pertaining to full-faculty status, and the continuation of the salary are not dependent on this award.

2. We are committed to ensuring that Dr. Beamer maintain a 75% research appointment throughout the K award funding period to devote towards the proposed research and educational activities.

3. Assign teaching, administrative and committee duties such that they are related to career development, increase Dr. Beamer's potential for a research career in academia, and not interfere

with her protected research and training time. Dr. Beamer will teach one course per year, the equivalent of 10-15% of her time, allowing her the remainder of her time for attendance at seminars, conferences, preparation of grant applications, presentations, publications, and various administrative duties.

4. Continue to provide Dr. Beamer with her laboratory and office space and administrative support staff.

5. Provide the mentor and co-mentors with the time and resources that are required for their participation in the research and career development plan outline in this application.

MEZCOPH is committed to developing, educating, retaining and advancing young faculty members who show promise of making important contributions to the research program and MEZCOPH mission. I would like to reiterate that we recruited Dr. Beamer directly out of her doctoral program because we saw so much potential for her research career and wanted to cultivate her as one of our own. I'm impressed with the skills that Dr. Beamer has demonstrated for someone so early in her career in development of her laboratory, grant administration, teaching and commitment to service.

I am enthusiastic in my support of Dr. Beamer's application, and hope this letter documents our strong institutional commitment to helping her become an independent researcher. Successful completion of this K-25 proposal would provide Dr. Beamer with a unique set of skills from additional training in the biomedical sciences to complement her environmental engineering background, and allow her to build collaborations between the quantitative environmental sciences (i.e., atmospheric sciences, environmental engineering, geography) and those studying the resulting health effects including Dr. Martinez and his group, as well as environmental toxicology and cell biology. This will make her a valuable contributor not only to our College, but to the University.

Please feel free to contact me if I can be of additional service to your review process.

Sincerely yours,

Iman Hakim, MD, PhD, MPH
Dean and Professor
Mel and Enid Zuckerman Endowed Chair in Public Health

10. SPECIFIC AIMS

Project Goal: The research objective of this K25 Mentored Quantitative Scientist proposal is to assess if exposure to diesel-related pollutants is associated with development of transient wheezing or asthma in childhood. This will be the first study to investigate how developmental alterations of the respiratory and immune system are associated with these exposures.

Key Observations: Asthma and related wheezing disorders are among the most common chronic diseases in children[6] and typically first manifest during the preschool years.[7] The factors that determine the beginnings of asthma and related wheezing disorders have not been completely elucidated, but it is now well established that asthma is heterogeneous, and that the natural history, risk factors and clinical expression of the disease may vary between different asthma and wheezing phenotypes.[8] Several studies have shown that common to all forms of asthma and wheezing disorders is intermittent or persistent airway inflammation, which first appears during critical time periods of development as a result of altered immune responses to viral infection, allergic sensitization, or environmental irritants.[9] Many of the pollutants from diesel have been associated with poor respiratory outcomes such as early life wheezing, asthma and decreased lung function.[10-12] While most studies have been cross-sectional or case-control in design, a few prospective studies have demonstrated that exposure during the first few years of life may be most important.[13, 14] In addition, laboratory studies have linked exposure to diesel exhaust and associated pollutants with inflammatory markers associated with increased wheezing and asthma risk, such as production of IgE, inflammatory cytokines and chemokines, and allergic sensitization.[15-17] The proposed study will determine if exposure to diesel exhaust in early life is associated with the immune outcomes identified in the laboratory studies and respiratory alterations prior to development of asthma.

Specific Aims: Two aims will be pursued, using data already obtained from two cohorts.

Aim 1. To assess longitudinally the role of early life diesel exhaust exposures in the incidence of asthma-related respiratory symptoms, lung function development, and bronchial hyperresponsiveness. Hypotheses. Increased exposure to diesel-related pollutants in early life is associated with: 1) increased respiratory symptoms from age 4 months through 6 years, 2) decreased lung function, and 3) increased bronchial hyperresponsiveness at age 6.

Aim 2. To assess longitudinally the role of early life diesel-related pollutant exposures in immune function and allergic sensitization. Hypotheses. Increased exposure to diesel-related pollutants in early life is associated with: 1) predominance of Th2 versus Th1 cytokine production within first year of life, and 2) increased allergic sensitization as measured by total and allergen-specific IgE from 3 months through 6 years, and skin prick tests at age 6.

The proposed project will use data collected from two on-going prospective birth cohort studies at the Arizona Respiratory Center (ARC). These two cohorts enrolled children at birth and have extensive longitudinal data for 1728 children including IgE and cytokines levels, lung function, and respiratory symptoms. Therefore, these studies provide a unique opportunity to examine longitudinally the relationships between exposure to diesel-related pollutants at a critical developmental window (e.g., the first years of life) and a wealth of respiratory and immune system outcomes assessed prospectively at various ages through childhood and adolescence.[18, 19] Dr. Beamer will use geographic information systems (GIS) techniques to model diesel-related pollution exposure for each of the participants based upon their birth and childhood addresses. The existing extensive data collected from these cohorts for several childhood wheezing phenotypes and Dr. Beamer's exposure modeling expertise provide an ideal opportunity to examine the role of diesel-related pollutant exposure in respiratory and immune outcomes.

Impact: Further investigation of how exposure to diesel-related pollutants in early life alters development of respiratory and immune systems can aid in development of appropriate intervention strategies to reduce avoidable cases of asthma and early childhood wheezing at inception. In addition to the relevant research question to be addressed, this research plan provides an unparalleled experience for Dr. Beamer to develop and use additional competencies acquired from the didactic training portion of this K25 Mentored Quantitative Science proposal, and to collaborate with an exceptional group of mentors to develop the foundation for her future research aimed at reducing the burden of respiratory disease associated with environmental exposures.

11.A. RESEARCH STRATEGY: SIGNIFICANCE

Childhood asthma and related wheezing disorders remain the most common chronic diseases in children.[6] Racial and ethnic disparities in asthma morbidity and mortality may be explained by the greater proportion of minorities residing in urban environments where asthma rates are higher regardless of race and ethnicity.[20, 21] This geographic risk factor may be due to environmental exposures associated with urban regions, where motor vehicles are the primary source of air pollution.[22] Consequently, research aimed at understanding the role of urban environmental exposures, such as diesel-related pollution, in the development of asthma and specific wheezing phenotypes is necessary. This research will allow us to develop more effective interventions and policies for prevention of avoidable causes of asthma and early childhood wheezing.

11.A.1. Respiratory and Immune Outcomes Associated with Diesel-Related Exposures

As stationary sources of air pollution (e.g., factories) have decreased over the past 30 years, vehicle exhaust has become the primary source of urban air pollution.[23] Many of the pollutants from traffic, in particular diesel-powered vehicles, are capable of causing airway inflammation and oxidative stress. Diesel exhaust is a complex mixture of both particulate and gaseous pollutants. Diesel particulate matter (DPM) and nitrogen oxides (NO_x) are often measured as indicators of diesel exhaust and typically have high spatial variability associated with truck traffic density and proximity to freeways.[5, 24, 25]

Increased exposures to diesel-powered vehicles (e.g., trucks and buses) as well as to the specific pollutants DPM and NO_x have been related to various respiratory and allergic outcomes in children (Table 3). Most of these studies are cross-sectional or case-control in design. A few prospective birth cohort studies have demonstrated the potential importance of early life exposures for asthma risk in children but did not examine associations with immunologic precursors of asthma or lung function development, discussed below.[13, 14]

Table 3. Health outcomes associated with specific diesel exhaust pollutants[a]

Health Outcome	Truck Traffic	NO_x[b]	DPM[c]
Asthma	10, 26, 27	12, 28-32	31, 32
Wheeze	11, 33-36	29, 31, 32, 37-40	32
Decreased lung function	25	2, 25, 41-47	25, 48
Respiratory symptoms (cough, chest tightness, prevalence)	11	31, 44, 47, 49-55	31, 32, 49
Respiratory illnesses (bronchitis, ear/nose/throat infections, flu/ colds)	11	28, 30, 32, 40, 44, 50, 56, 57	32, 57
Poorly controlled asthma (rescue medication use, school absence)		2, 39, 58	58
Increased total or allergen specific serum IgE, skin test response	59	32, 37, 60, 60	32, 60
Hay fever, rhinitis eczema	27, 33, 34, 36	37, 61	50

[a]Numbers correspond to references cited. [b]Includes NO and NO_2. [c]Includes black/elemental carbon, soot and absorbance of $PM_{2.5}$.

Controlled diesel exhaust or NO_x challenge studies in humans indicate that these exposures may be associated with development of childhood wheezing through several mechanisms (Table 4). First, diesel exhaust and NO_x exposure have been linked with increased numbers of bacterial and viral receptors in bronchial biopsies that could indicate susceptibility to lower respiratory illnesses (LRIs). Second, these pollutants are capable of both decreasing T-helper 1 (Th1) responses and supporting T-helper 2 (Th2) inflammation that could lead to an atopic Th2 predominance. Finally, diesel exhaust may be a powerful adjuvant for allergic sensitization and is also capable of inducing sensitization to allergens.[62, 63] Although these effects have been demonstrated in laboratory studies, associations of diesel exhuast and NO_x exposure with these immunologic precursors of asthma have not evaluated in population-based studies. **Thus, it is imperative to determine if there are associations between early life diesel-related exposures and immunologic precursors of infant wheezing and asthma and lung function development.**

Table 4. Health outcomes measured from laboratory *in vivo* human challenge studies to specific traffic-related pollutants*

Health Outcome	NO_x[a]	Diesel Exhaust[b]
Decreased lung function	64, 65	25, 41-43
Increase in inflammation biomarkers (ECP, CC16, ENA-78)	66	16
Increase in Th2 related cytokines (IL-4, IL-5, IL-8, IL-10, IL-13, GM-CSF, GRO-α)	67, 68	15, 17, 62, 69-71
Increased allergen specific IgE		15
Decreased Th1 related cytokines (IFN-γ, IL-2)		15, 70
Degree of hyperresponsiveness		71
Increased airway resistance		71

*Numbers correspond to references cited.

11.A.2. Lung Function Deficits and Immunologic Precursors as Determinants of Wheezing and Asthma Risk

The proposed project will utilize data collected from two on-going prospective birth cohort studies conducted by Dr. Martinez, Dr. Wright and colleagues at the ARC. The Tucson Children's Respiratory Study (CRS) and the

Infant Immune Study (IIS) have extensive longitudinal data for 1728 children including IgE and cytokine levels, lung function, allergic sensitization and respiratory symptoms. These studies have been key in demonstrating how lung function deficits and immunologic precursors determine wheezing and asthma risk in children. The data sets now provide a unique opportunity to examine the role of environmental exposures in development of these respiratory and immune alterations.

Several longitudinal cohorts, including the CRS, have demonstrated that lung function deficits associated with asthma are not established at birth but develop by school age, indicating there might be a critical "window of susceptibility" for lung function development during the first few years of life.[7, 72-74] This is the time period of alveolarization and rapid growth of the lungs, where inflammatory responses to environmental stimuli in the airways could result in permanent lung function deficits.[75] Although decreased lung function is associated with diesel exhaust exposure (Table 3), it has not been assessed longitudinally in children during the first few years of life. The extensive longitudinal lung function measurements obtained from 2 months of age through adulthood as part of the CRS provide a unique data set for examining the role of diesel-related exposures during this critical time period of lung function development.

It has been suggested that atopy and viral infections in early childhood are both synergistic and independent predictors of asthma risk through impairment of Th1 immune responses involved in defense from infectious agents, and predominance of Th2 immune responses associated with atopy.[76, 77] Diminished levels of IFN-γ (Th1 cytokine) have been measured in infants and children from the CRS and IIS that develop LRIs, wheezing, allergies and asthma[19, 78-80] and confirmed by other cohorts.[81-84] Conversely, polarization towards a Th2 profile (i.e, increased levels of IL-4, IL-5, and IL-13) is associated with allergic sensitization and asthma.[85-88] Diesel exhaust exposure is associated with both Th2 inflammation and decreased Th1 responses in laboratory studies with adults (Table 4) but has not been assessed in children. The extensive cytokine measurements obtained at multiple times during early life in the IIS cohort offer a good opportunity to assess the role of diesel-related exposures and the Th1/Th2 balance during this developmental time period.

Asthma prevalence is associated with early allergic sensitization demonstrated by total serum IgE, allergen specific IgE and skin test reactivity in the CRS[7, 89] and in other cohorts[72, 90-92] In both the CRS and IIS cohorts, total IgE levels during the first year, but not at birth are associated with recurrent wheezing.[19, 89] These changing IgE levels demonstrate that risk for allergic diseases *develops* in the first year of life possibly due to early life environmental exposures.[18] Unpublished results from the IIS cohort also indicate a significant positive correlation between production of Th2 cytokines during 1 year with IgE up to age 5. Although diesel exposure is associated with total and allergen specific IgE levels in children and adults (Tables 3 and 4), the CRS and IIS cohorts provide an opportunity to determine if diesel exhaust exposure is associated longitudinally with changes in IgE levels during infancy and early childhood.

In addition to the determinants previously described, one of the key observations of the CRS was that there are 3 distinct wheezing phenotypes associated with different risk factors and prognosis:[18, 80, 89]

1. Transient early wheezing: ≥ 1 LRI with wheeze by age 3 years, no wheezing at age 6; associated with diminished lung function in infancy, maternal smoking, low infant IFN-γ production
2. Late-onset wheezing: no LRIs during first 3 years, active wheeze at age 6; associated with maternal asthma, rhinitis, skin test reactivity, normal lung function through adolescence
3. Persistent wheezing: ≥ 1 wheezing LRI before age 3 plus active wheeze at age 6; associated with maternal asthma, maternal smoking, rhinitis, eczema, low infant IFN-γ production, increased serum IgE levels, skin-test reactivity, normal infant lung function but diminished lung function by age 6.

The richness of these data sets and the specificity of the CRS wheezing phenotypes, unmatched by any other data set, provide a unique opportunity to assess the role of diesel exhaust pollution with developmental alterations of the respiratory and immune systems leading to these distinct wheezing phenotypes.

11.A.3. Summary: Significance of the Proposed Project

Asthma prevalence is increasing worldwide, and is associated with urbanization.[93] Thus, it is imperative to determine what environmental factors are contributing to this increase in asthma and related wheezing disorders in order to develop interventions for the prevention of avoidable cases. There is now convincing evidence from several studies that "developmental windows of susceptibility" for environmentally induced changes in immune responses and lung function exist.[7] Asthma in childhood is a heterogeneous condition consisting of different wheezing phenotypes including: transient early wheezing, non-atopic and atopic wheezing.[8] As demonstrated by findings from the CRS and IIS, Th2 predominance, allergic sensitization, and

diminished lung function by early childhood are associated with these distinct wheezing phenotypes*. Although several studies have demonstrated the link between diesel exhaust exposure and asthma, there is a need to examine how these exposures are related with developmental alterations of the respiratory and immune system associated with asthma and these wheezing phenotypes.*

I propose to investigate if early life diesel-related pollutant exposure is associated with development of immune system parameters, and lung function deficits associated with different asthma and wheezing phenotypes. Collaboration with my mentor, Dr. Martinez, will provide me access to resources at the ARC, including the CRS and IIS data sets. These data sets comprehensively document the respiratory health and immune system development of two population-based birth cohorts through childhood, and demonstrate how immunologic precursors and lung function deficits present in early childhood are consistent with early transient, non-atopic and atopic wheeze. They provide a rare, if not unique, opportunity for me to use my exposure assessment expertise to examine the role of early life diesel exhaust exposure with these wheezing phenotype risk factors. Specifically, I propose to investigate how diesel-related pollutant exposures as an infant are related with lung function deficits, Th2 polarization, and allergic sensitization. This will help me identify key diesel-related pollutants to target and the most sensitive immunologic precursors to assess in *age-appropriate interventions in future community-based trials aimed at the primary prevention of asthma and wheezing in early childhood*.

11.B. RESEARCH STRATEGY: INNOVATION

This would be the first study in a non-selected prospective birth cohort to examine early life exposures to diesel exhaust pollutants with developmental alterations of the respiratory and immune system that are associated with asthma and wheezing phenotypes. The CRS and the IIS provide a unique opportunity for this research as they are among the first studies to examine immunologic outcomes and lung function repeatedly during the first few years of life. This allows me the opportunity to assess the importance of early life exposures on maturation of the immune and respiratory systems. This would also be the first study to use the US EPA's National Scale Air Toxics Assessment (NATA) database to assess respiratory outcomes from diesel-related pollutants in a cohort study. While I will focus my analyses on diesel particulate matter (DPM) and 16 other diesel-exhaust related pollutants, these methods could be used to assess asthma risk from exposure to the other 160 toxic air pollutants in the database, many of which have not been assessed in non-selected or non-occupational cohorts. As the database provides toxic air pollutant exposure estimates for every census tract in the country, these analyses could be extended to other cohort studies. For example, these analyses could be used to prioritize toxic air pollutants for measurement and evaluation in the National Children's Study.

11.C. RESEARCH STRATEGY: APPROACH

The objective of this K25 research plan is to **assess longitudinally the role of exposure to diesel-related pollutants during infancy in developmental alterations of the immune and respiratory systems that may result in transient early wheezing or asthma**. To achieve this goal I will utilize GIS techniques to estimate exposures to diesel exhaust pollutants for two longitudinal birth cohorts, CRS and IIS. This project provides me with the opportunity to develop and use new skills in epidemiological research design, GIS exposure modeling, and statistical analyses obtained from the didactic training portion of this career development proposal. Completion of the specific aims will enable me to launch an independent career aimed at understanding the role of environmental exposures in childhood respiratory disease. Specifically, it will assist me in identifying key developmental alterations and specific diesel exhaust pollutants in order to engineer more effective interventions aimed at preventing early life wheezing and asthma for future community-based evaluations.

11.C.1. Study Populations

The Tucson Children's Respiratory Study (CRS) is a longitudinal birth cohort study that enrolled 1246 infants from 1980 to 1984, to examine risk factors for acute LRIs in early life and later chronic lung disorders.[94] More than 660 of the original subjects still participate in the study.[18] Participants had extensive evaluations of every LRI during the first 3 years. Questionnaires were administered and blood samples were taken from the participants during the first 3 years and multiple in depth follow up evaluations were conducted (Table 5). Pulmonary function tests were completed in a subset of infants, and all available participants during the follow-up visits.[74] Participants were

Table 5. Number of index subjects in the CRS with data at each evaluation

Age of index subjects	Birth to 3 y	6 y	11 y	16 y	20 y
Respiratory questionnaires	1055 (age 2 y)	1025	955	767	735
LRI evaluations through age 3 y	888	—	—	—	—
Skin prick tests	—	762	709	536	479
Serum IgE	1120 (at birth)	534	601	404	397
Peripheral blood eosinophils	880 (at 9 mo)	522	596	467	397
Pulmonary function studies	176 (at 4 mo)	676	627	485	456
Bronchial hyperresponsiveness	—	368	397	398	342

tested for bronchial hyperresponsiveness (BHR) by a cold air challenge at age 6 and a methacholine challenge at other ages.[95, 96] At age 6, CRS subjects were classified into wheezing phenotypes. Dr. Martinez, my sponsor, is Principal Investigator and Dr. Wright, collaborator, is one of the founders of the CRS and co-PI.

The Infant Immune Study (IIS) is a longitudinal birth cohort study that enrolled 484 infants *in utero* from 1997-2003, to provide a comprehensive picture of patterns of immune system maturation in early life, to determine how these patterns influence asthma risk, and to assess the genetic and environmental factors that alter these relations.[97] 409 of the original subjects are still enrolled in the study. Respiratory questionnaires and blood samples have been obtained repeatedly and analyzed for immunologic precursors of asthma (Table 6). Dr. Wright, collaborator, is Principal Investigator of the IIS.

Table 6. Number of index subjects in the IIS with data at each evaluation

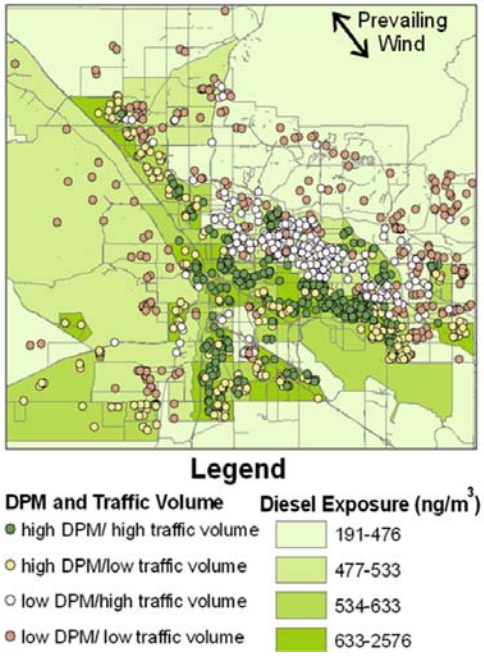
Age of index subjects	Birth	3 m	12 m	24 m	36 m	60 m
Respiratory questionnaires	—	422	422	362	371	373
Total and Specific IgE	387	358	344	291	294	267
Cytokines	293	322	315	265	272	266

11.C.2. Assessment of Diesel-Related Pollutant Exposures

I will utilize geographic information systems (GIS) techniques to obtain estimates of diesel-related pollutant exposures at each participant's home address. GIS provide an infrastructure for combining disparate types of information to perform analyses of complex disease-environment linkages.[98] I will map the enrollment address for each participant of the CRS and IIS. Because the objective of this research plan is to understand the role of early life diesel-related pollutant exposures with immune and respiratory alterations observed later in life, I will also digitize addresses for CRS and IIS participants corresponding to data collection time periods. Although spatial analysis was not an objective of the CRS and addresses were not included in the databases, to date 1163 CRS birth addresses, and 489 addresses of CRS participants at age 4 years have been recovered. Of these 197 (39%) were residing at their birth address. Subjects still participating in the CRS (n=661) will be contacted for their address histories corresponding to the data collection time periods. For the IIS, address histories were retained for 481 participants. A total of 186 (39%) participants were residing at their birth address at age 5 years. Comparison of results for participants who moved with those who did not, will help us elucidate the role of early life diesel-related pollutant exposures.

I will obtain average diesel-related pollutant exposure concentrations at all available CRS and IIS home addresses from the US EPA National-scale Air Toxics Assessment (NATA) database. The air pollutant exposure estimates in the NATA database are derived from a Gaussian air dispersion model that incorporates emission inventories from mobile, point and area sources and simulates the impact of atmospheric processes like wind, temperature, chemical decay, and deposition to obtain average exposure at the census tract level.[99] Currently the database includes estimates for over 160 pollutants based on 1996, 1999 and 2002 emission inventories. I will focus my analyses on the pollutants associated with diesel exhaust, including: acetaldehyde, acrolein, DPM, formaldehyde, benzene, n-hexane, polycyclic organic matter, 1,3-butdiene, styrene, toluene, dioxin/furans, xylene, arsenic, chromium, lead, manganese, mercury, and nickel compounds. I will construct census tract maps for each pollutant and then overlay the address maps for the CRS and IIS participants to assign the corresponding pollutant concentration (Figure 1). Exposures for the IIS will be obtained by using the database that corresponds most closely to the data collection period being assessed. Analyses for the CRS will focus on the 1996 database.

Figure 1. Map with DPM exposure and traffic volumes of CRS subjects.

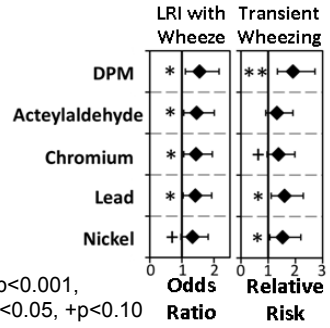


Tucson has only two freeways that cut through the center of town, and unique wind patterns and topology that result in little dispersion of pollutants from the freeway. This leads to a dramatic diesel exhaust gradient. As the highways represent the primary source of diesel exposure to the greater Tucson metro area (Figure 1), I will also estimate the concentration of DPM and NO_2 from truck traffic on the highways at each address using CALINE4, an air pollutant dispersion model. Developed by the California EPA, CALINE4 is computer-based Gaussian-line model used to estimate the concentration of air pollutants emitted from vehicles as a function of distance from roads while incorporating meteorological conditions and has been used to assess the relationship between traffic exposure and respiratory outcomes.[12] Truck volume flows and

emission factors for each year of analysis (1980-2008) will be obtained from Arizona Department of Transportation. As Tucson winds tend to be dominated throughout the year by upslope and downslope flow along the Santa Cruz riverbed, parallel to the freeway (Figure 1), annual wind speed averages will be adequate for this study. This additional variable will also allow us to ascertain the relationship between increased truck traffic in Tucson with decreased emissions from motor vehicles between the CRS and IIS enrollment periods, as well as between the CRS enrollment periods and the 1996 NATA database. Dr. Betterton and Dr. Comrie will provide consultations based on their extensive experience with modeling air pollution in Tucson.

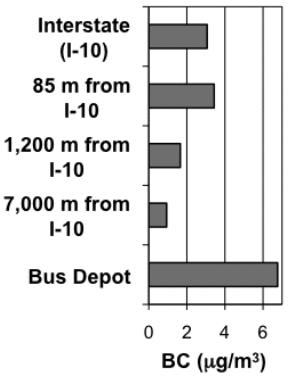
Preliminary Studies. With the support of my mentor, Dr. Martinez, I received funding from the NIH-funded Southwest Center for Environmental Health Sciences at UA for a pilot project to develop methods for this K25 application. For the pilot study I used the 1996 NATA database to obtain diesel-related pollutant exposures for CRS and IIS participants based on enrollment address. Exposures above the median were classified as high prior to completing logistic regressions to assess the relationship with incidence of LRIs and wheezing phenotype. Incidence of wheezing LRIs (exam only) during the first 3 years of life and transient wheezing among CRS participants was associated with exposure to several diesel related pollutants (Figure 2). Stratified analyses indicate that these effects may be greater for some groups of children such as those with no exposure to maternal smoking. These sub-groups will be evaluated in the proposed studies.

Figure 2. Logistic regression with diesel pollutants.



As part of the pilot study I also assessed the relationship of incidence of LRIs and wheezing phenotypes in the CRS with exposure to traffic density using historical traffic volume maps corresponding to the enrollment period. I computed various traffic volume metrics within 50, 200 and 500-meter buffers of each participant's enrollment address. There were no significant associations with any of these traffic density variables and the respiratory outcomes. As demonstrated by the map there are several areas of Tucson with high traffic volumes but relatively low DPM by census tract, indicating that traffic volumes alone are not a good indicator of diesel exposure in Tucson (Figure 1).

Figure 3. Average DPM at several locations in Tucson



We have confirmed the diesel exhaust gradient with ambient air DPM measurements at several locations (Figure 3). There was a clear decrease in average concentration of DPM as a function of distance from the freeway even though the measurements were taken on streets with high traffic volumes. At the time of the measurements much of the traffic was diverted to the frontage road at 85 m from the freeway due to exit closures. For comparison, DPM concentration measured in the Bronx ranged from 2.6-7.3 $\mu g/m^3$, a community with heavy truck traffic and high asthma prevalence.[100] Our comparable measurements indicate that although the Tucson metro has good air quality overall, the spatial variability of diesel exhaust levels should be sufficient to assess adverse health outcomes.

Potential Limitations and Solutions. Although not an issue for our analyses with IIS participants, one of the major limitations of the study with CRS outcomes is that I am using the NATA emissions database from 1996, more than 10 years after the birth of CRS participants. However, the primary source of DPM is the freeways, which were in place prior to the CRS and the relative concentrations between census tracts are not likely to have changed to a large extent. After accounting for auto-correlation with a spatial-lag model the DPM exposure concentrations for 1996 and 2002 are highly correlated ($p=0.006$) and the traffic volumes for 1980 and 1996 are also highly correlated ($p<0.000000001$). Although ideally we would use exposure data obtained during the same time period as the CRS enrollment, the high correlation and the fact that the relative exposures have not changed for different areas of the city allow us to use the 1996 NATA database to estimate exposure to multiple diesel-related pollutants in relation to health outcomes for CRS subjects.

Although there is concern that Tucson may not be an appropriate setting for this study due to its good air quality, the two freeways are among the most heavily used in the Western US.[1] This results in a spatial diesel exhaust gradient not commonly observed in other cities which makes Tucson an ideal place to conduct such a study. Many of the studies that determined significant associations between traffic exposure and health outcomes were also completed in areas with good air quality, and overall pollutant concentrations below the national standards.[2-4, 41]

Additional concerns include exposure misclassification due to participants spending significant time in other environments such as day care and positional error through automated geo-coding. All analyses will be adjusted for attendance at day care in early life and will be completed separately for children who did and did not attend day care to determine if there is an exposure misclassification effect. To assess automated geocoding positional error, I will select 100 addresses at random from each time period to plot using the automated geocoding tool in ArcGIS 9.3 and by hand individually. Positional error will be evaluated by comparing the identified census tract from each method. If it is determined that automated geocoding results in a large positional error that could bias results, all addresses will be mapped by hand. Preliminary results have demonstrated that the automated geocoding tool in ArcGIS 9.3 is appropriate for use in the Tucson metro area.

11.C.3. Data Management and General Analyses

My mentors at the ARC have developed sophisticated means of managing the range of data obtained in the study. Collaborating with them will provide me with opportunities to learn appropriate data management techniques for my future cohort studies. All exposure variables obtained from this study will undergo QA/QC by myself and then be added to the CRS and IIS databases by the ARC data manager.

Basic descriptive statistics and variable distributions will be examined for each diesel-exhaust exposure variable. Analyses will be performed with each exposure variable treated as continuous or categorized as appropriate. Exposures to the multiple diesel-exhaust pollutants will be assessed for collinearity while accounting for spatial auto-correlation. If pollutant exposures are found to be highly correlated we will combine the chemicals into mechanistic groups and calculate summary index scores for analysis.[99] All analyses will be assessed for potential confounders including: gender, birth season, maternal smoking, home cooling/heating methods, home cooking fuel, maternal education, attendance of day care, and breast feeding. I will test each hypothesis within each cohort prior to combining them for analysis. To elucidate the role of early life diesel exhaust pollutant exposures rather than exposures concurrent with data collection, I will conduct separate analyses for children who have moved between birth and the data collection time period.

11.C.4. Analyses Pertinent to Specific Aims

Aim 1. To assess longitudinally the role of early life diesel exhaust exposures in the incidence of asthma-related respiratory symptoms, lung function development, and bronchial hyperresponsiveness.

Rationale. This aim seeks to understand if early exposure to diesel-related pollutants is associated with incidence of respiratory symptoms, altered lung function and BHR. I hope to confirm the associations between childhood respiratory symptoms with early life diesel exhaust exposure reported by other prospective studies (Table 3). Children in the CRS who developed persistent wheezing had significantly reduced lung function at age 6, but not shortly after birth.[74] This indicates that there might be a critical window during the first few years of life where inflammatory insults cause alterations in lung function associated with asthma. Although not all studies have found a consistent association,[13] asthmatic subjects demonstrated an increased degree of BHR following exposure to DPM.[71] In school-age children the relation between respiratory symptoms and traffic exposure was almost entirely restricted to children with BHR.[60] **The longitudinal data collected from the CRS and IIS cohorts provide a unique opportunity to assess if there is a critical window in early life where exposure to diesel exhaust may result in more symptoms and developmental alterations of the respiratory system than exposures at other ages.**

Health Outcome Data Collection Procedures. Studies for this Aim will make use of the following data.

1. Respiratory symptoms collected via questionnaire at 2 and 6 years in the CRS cohort and 1,2,3, and 5 years in the IIS cohort.
2. Pulmonary Function as $Vmax_{FRC}$ at 4 months measured using a chest compression technique and a custom-built pneumaotach-based system at age 6 years in CRS subjects.
3. BHR at age 6 years in CRS subjects assessed via isocapnic hyperventilation with cold dry air.

Hypothesis Testing. Increased exposure to diesel-related pollutants in early life is associated with: 1) increased respiratory symptoms from age 4 months through 6 years, 2) decreased lung function, and 3) increased BHR at age 6.

For hypothesis 1, I will examine if diesel-related pollutant exposure as defined by the previously described exposure variables at the birth address results in a greater incidence of respiratory symptoms, including: wheeze, persistent phlegm, cough, chest tightness, rhinitis, dysponea, and rescue medication use. The respiratory symptom variables will be converted to binary variables. Since they are measured longitudinally their association with early life exposure will be determined using Generalized Linear Mixed Models (GLMM)

that allow subjects to have missing data and for the time intervals between surveys to be unequal. The GLMM will be fit assuming a binary family distribution, a logit link function, and subjects as random effects, thus the output will yield Odds Ratios similar to those from the logistic regression.

To test hypothesis 2, I will determine the relationship between diesel-related pollutant exposure at birth address with $Vmax_{FRC}$ at 4 months and 6 years of age. Pulmonary function values will be Z scored to make their distributions comparable (Normal with mean=0 and variance=1) since they have different units and are assessed with different techniques. Statistical analysis for differences in pulmonary function related to levels of exposure will be completed using Linear Mixed Models (LMM), a longitudinal method for continuous outcomes that allows subjects to have missing data and for the time intervals between surveys to be unequal. This method also allows for time dependent covariates for example environmental tobacco smoke exposures or weight and height at each time point to be fitted. Both Random Effects and Random Coefficient models will be tested and selection of the best model will be made using Akaike's information criterion (AIC) and Likelihood Ratio Test, which ever is appropriate. The time dependent variables will include values indicating original residence to adjust for subjects that move during the course of the study (i.e. auto-correlation).

For hypothesis 3, I will assess if diesel-related pollutant exposure in early life is associated with BHR at 6 years of age in CRS participants. To assess BHR we will calculate a two-point slope as the log of the slope of the percent decline from the baseline $Vmax_{FRC}$ after the dose of cold air and fit using multiple regression.[95, 101]

Aim 2. To assess longitudinally the role of early life diesel-related pollutant exposures in immune function and allergic sensitization.

Rationale. This aims seeks to understand the relationship between diesel exhaust exposure in early life and immunologic markers of wheezing and asthma risk. Previous results from analysis of CRS and IIS data have demonstrated that decreased levels of Th1 cytokines and increased levels of Th2 cytokines as an infant are associated with allergic sensitization and transient and persistent wheeze in childhood.[19, 78] Although studies have demonstrated that humans exposed to diesel exhaust and related pollutants in laboratory settings also have a Th1/Th2 imbalance (Table 4), no population-based studies are available that have assessed diesel-related pollutant exposures with Th1 and Th2 cytokine production. Findings from the CRS and IIS have also demonstrated that IgE serum levels a few months after birth but not at birth are associated with persistent atopic wheezing, demonstrating that risk for allergic diseases develops in the first year of life possibly due to early life environmental exposures.[18, 19, 89] Diesel exhaust exposure induced sensitization to allergens in a nasal challenge study[62] and is also associated with IgE levels and positive skin pricks (Table 3). **The longitudinal data collected from the CRS and IIS cohorts provide a unique opportunity to assess if there is a critical window in early life where exposure to diesel exhaust may result in developmental alterations of the immune system associated with wheezing and asthma risk.**

Health Outcome Data Collection Procedures. Studies for this Aim will make use of the following data.

1. Cytokine production (IL-4, IL-5, IL-13, and IFN-γ) at 3 months and 1 year in the IIS cohort after mitogen stimulation using commercially available ELISA kits.
2. Specific IgE to 6 inhalant allergens and 2 foods at 3 months, and 1,2,3, and 5 years in the IIS cohort.
3. Total IgE in serum at 9 months and 6 years in the CRS cohort measured PRIST, and at 3 months, and 1,2,3, and 5 years in the IIS cohort measured with the AutoCAP FEIA assay.
4. Skin prick reactivity to house-dust mix, *Alternaria*, Bermuda grass, careless weed, mesquite, mulberry or olive at age 6 in the CRS cohort. Atopy was defined as a positive skin-test reaction (horizontal and vertical wheal sum ≥ 3mm after subtraction of the negative control).

Hypothesis Testing. Increased exposure to diesel-related pollutants in early life is associated with: 1) predominance of Th2 versus Th1 cytokine production within first year of life, and 2) increased allergic sensitization as measured by total and allergen-specific IgE from 3 months through 6 years, and skin prick tests at age 6.

To test this hypothesis 1, I will determine whether diesel-related pollutant exposure at birth is associated with reduced production of the Th1 cytokine, IFN-γ, increased production of three Th2 cytokines (IL-4, IL-5, IL-13) and a reduced ratio of IFN-γ to each Th2 cytokine, considered as continuous variables, in IIS subjects at 3 months and 1 year of age. The LMM described in Aim 1 will be used in the same manner to test for differences in cytokine production related to levels of exposure. Since the cytokine production measures often have values below the Lower Limit of Detection (LLD), tobit regression will be used if %LLD exceeds 5%. As production of

some cytokines in very young children may be low, if appropriate each cytokine will be categorized as "suppressed" if it is below the median, in the bottom quartile or undetectable for cytokines in which there is a high proportion (>20%) of undetectable values. In this case the GLMM will be used for analyses.

For hypothesis 2, allergic sensitization is defined as being above the median for total IgE at any age, any specific IgE, or any positive skin test response. The association between skin prick tests, specific IgE, and total IgE (ever above vs. always below median) with exposure will be estimated using logistic regression. Total IgE levels will also be log-transformed and treated as a continuous variable to assess for differences associated with diesel exhaust exposure using the LMM. All statistical analysis will be completed under the guidance of my co-mentor, Dr. Sherrill, a biostatistician with experience in analyzing longitudinal data.

11.C.5. Power Calculations

Our preliminary data indicated that the threshold for a respiratory response occurred at the median DPM exposure equal to 0.5 $\mu g/m^3$ (Figure1). As our sample size is fixed for each health outcome (Tables 5 and 6), I calculated what minimum difference in means that would be detectable at a power of 80% (two sided alpha=0.05) for relations between DPM exposure and continuous outcomes for our study (Table 7). To be conservative I assumed that only 25% of the population would be exposed. I calculated the minimum difference based on the variability among the CRS and IIS cohorts,[74, 89, 95, 102] which is consistent with other studies that have measured change in lung function in relation to diesel.[2, 25] Although cytokines and total serum IgE as a continuous variable have not been assessed in relation to diesel pollutants at ambient levels, these are well within the differences seen for other environmental exposures.[97, 103]

Table 7. Min. detectable difference, continuous variables

Outcome	Fixed Sample Size		SD	Min. Diff.
	Exp.	Unexp.		
$Vmax_{FRC}$ (ml/sec)	44	132	96	46
BHR (%Δ $Vmax_{FRC}$)	92	276	24.1	8.1
IFN-γ (pg/mL)	81	243	0.56	0.20
IL-4 (pg/mL)	81	243	0.11	0.04
IL-5 (pg/mL)	81	243	0.38	0.14
IL-13 (pg/mL)	81	243	0.31	0.11
Total IgE (IU/mL)	370	1110	7.25	1.22

Using our fixed sample size, I calculated what Odds Ratios would be detectable at a power of 80% (two sided alpha=0.05), for each of our dichotomous variables assuming that 25% of the population is exposed to higher levels of DPM (Table 8). These Odds Ratios are of similar magnitude with the effects observed in my preliminary results (Figure 1) and by other studies (Table 4). *Thus, our power calculations show that I will have adequate power to test our hypotheses.*

Table 8. Min. detectable difference, dichotomous variables

Outcome	Fixed Sample Size		Min. Detect. OR
	Exp.	Unexp.	
Total IgE above median	375	1125	1.38
Specific IgE detected	97	291	1.94
Positive skin prick test	191	571	1.61
Respiratory symptoms	369	1107	1.38

11.C.6. Development of Intervention

Findings from the research plan of this K25 application will help me determine the key pollutants that need to be evaluated and controlled for in my future interventions. The results will also help identify the most sensitive immunologic precursors to assess in a follow-up intervention study aimed at reducing these exposures. Part of years 3-5 of this K25 career development award will be devoted to designing and developing an intervention to reduce exposures to these key diesel-related pollutants. I will need to identify and evaluate age-appropriate interventions specific to the targeted pollutants that can be deployed in the homes of infants such as filters, UV light devices or room-air cleaners. I will also develop appropriate methods for evaluating the intervention through air sampling measurements. Additional efforts will also be directed towards identifying appropriate community partners for recruitment of subjects. My co-mentor, Dr. Lynn Gerald, has expertise in the development, implementation, and evaluation of community-based asthma interventions and will work with me to develop and propose community trials of the interventions that may result from my project.

11.C.7. Anticipated Results

The goal of this K25 career development award is to launch my independent research career centered on addressing the role of environmental exposure in childhood respiratory diseases. Thus, this career development plan includes didactic training to complement my current skill set and give me experience investigating associations of early life diesel-related pollutant exposures with immunologic precursors of asthma and lung function development. A great advantage of the data sets that I will utilize is that they provide longitudinal data collected prospectively from birth for a large number of asthma and wheezing phenotype risk factors. This will allow me to identify which developmental alterations that ultimately result in asthma or wheezing are associated with increased exposure to specific diesel-exhaust related pollutants. As a follow up to this research project, I will apply for additional funding to use the results from this research to engineer age-appropriate interventions aimed at preventing these immune and lung function alterations. Completion of this

career development award will help promote my career as an independent scientist and allow me to contribute to the body of knowledge that is needed to reduce the prevalence of asthma and childhood wheezing from environmental exposures, especially in urban and minority communities.

14. Protection of Human Subjects

14.A. Risks to Human Subjects

14.A.1. Human Subjects Involvement and Characteristics

The proposed research involves the analysis of existing human subject data. The data was collected from participants recruited into two on-going longitudinal birth cohort studies, the Tucson Children's Respiratory Study (CRS) and the Infant Immune Study (IIS). We anticipate using data from a total of 1728 children in the proposed study. These participants are mostly Caucasian. They were enrolled as infants and all the data that will be utilized for the current research was collected before they were 7 years of age. As this study aims to understand how diesel-related pollutant exposure during infancy may result in developmental alterations of the respiratory and immune systems, it is important to use data gathered prospectively from infants and children. All children were healthy at birth. Otherwise these were unselected cohorts. We have complete address histories for children in the IIS. We will be contacting continuing participants in the CRS for their childhood address histories.

14.A.2 Sources of Materials

Most materials utilized for this study have been previously collected from the CRS and IIS cohorts under Human Subject protocols approved by the University of Arizona IRB. The only new data to be collected for this study will be childhood address histories of continuing CRS participants. The sources of materials that will be obtained for all participants include: 1) addresses at birth and during childhood as available; 2) gender; 3) birth season; 4) birth year; 5) maternal smoking; 6) home heating methods; 7) home cooling methods; 8) home cooking fuel; 9) attendance at day care; 10) exposure to older siblings; 11) breastfeeding; and 12) maternal education level. In addition for the CRS participants additional sources of materials to be used in the proposed study include: 1) respiratory symptoms collected via questionnaire at 2 and 6 years of age; 2) pulmonary function at 4 and 6 months of age; 3) bronchial hyperresponsiveness at 6 years of age; 4) total IgE in serum at 9 months and 6 years of age; and 5) skin prick reactivity to aeroallergens at 6 years of age. In addition for the IIS participants additional sources of materials to be used in the proposed study include: 1) respiratory symptoms collected via questionnaire at 1, 2, 3, and 5 years; 2) cytokine production at 3 months and 1 year; 3) specific IgE to inhalant allergens at 3 months, and 1, 2, 3, and 5 years; and 4) total IgE in serum at 3 months, and 1, 2, 3, 5 years of age.

Files used for geocoding participants addresses will only contain the subject id, address and year for reported address. This will allow us to code the participant's address onto the hazardous air pollutant map corresponding to the appropriate year in the NATA dabase. Once addresses have been coded they will be converted to GPS coordinates in the file, and street addresses will be deleted. The geocoded points will be used to extract the necessary hazardous air pollutant exposure variables from the maps. Afterwards the event maps of participants will be shifted an unspecified amount to conceal the addresses true location for future presentations. For all presentations either shifted participant locations or a random assignment to census tract (Figure 2) without any labeling will be utilized. All files containing addresses and birth year will be encrypted and password protected on the PI's and the data manager's computers. All other files are maintained by the ARC according to their rigorous protocols for maintenance of Human Subjects data. Geocoded files will be provided to the ARC for storage in their password protected databases and will be deleted from the PI's and the data manager's computers at completion of the proposed work.

14.B. Adequacy of Protection Against Risks

14.B.1. Recruitment and Informed Consent

No participants will be recruited for the current study, as existing data will be used. All participants have signed informed consent approved by the University of Arizona Institutional Review Board for their participation in the CRS and IIS. The proposed study will be submitted for review by the University of Arizona Institutional Review Board. A waiver of informed consent will be requested for use of the existing data as was granted for the pilot study, because the proposed study does not provide any additional risks to participants and it would be a large burden to obtain consent from all the study subjects as some have not participated in over 25 years. Informed consent will be obtained from continuing CRS participants who provide their childhood address histories.

14.B.2 Protection Against Risk

The confidentiality of all study documents and data will be protected in several ways. All study material is kept in locked rooms and/or on password-protected computers. In addition, participants were assigned a study identification number that is used for all data analysis. Names of participants will not be necessary or available. Addresses will be converted to GPS coordinates and deleted from data files as soon as possible. Approval of protocols must be granted from The University of Arizona Institutional Review Board and permission from CRS and IIS principal investigators prior to obtaining data for the current study and the specific types of data necessary must be requested in a formal process. No medical attention will be necessary for participants as we are using primarily existing data. Although we will request childhood address histories of continuing CRS participants this should present no more than minimal risk and not require medical attention. All existing data to be utilized for this study was collected from children with additional protections as described in the DHHS regulations Subpart D, and was collected under protocols approved by The University of Arizona Institutional Review Board.

14.C. Potential Benefits of the Proposed Research to Human Subjects and Others

There is very little direct benefit of the proposed research to the study participants. The proposed research aims to understand if diesel-related pollutant exposures during the first years of life may result in developmental alterations of the respiratory and immune system that may lead to asthma. As the participants in the CRS are all adults and the participants in IIS are at least 6 years of age, it is likely that these developmental alterations have already taken place and predisposed them for respiratory disease. However, the proposed study utilizes primarily existing data and does not present any additional risks to study participants. In addition, findings from this study can help us identify critical time periods of development to target interventions aimed at the primary prevention of asthma and wheezing in early childhood by reducing exposure to environmental pollutants. Therefore, the results may be of benefit to the general population.

14.D. Importance of the Knowledge to be Gained

The knowledge to be gained from this research is of importance to identification of modifiable risk factors for development of asthma and wheezing in early childhood. If diesel-related pollutant exposure is related to the development of alterations in the immune and respiratory symptoms, then appropriate interventions can be developed. Findings from this study will help us determine what are the most sensitive immunologic precursors and key environmental pollutants to assess in an intervention study aimed at reducing these exposures. Therefore, the minimal risks involved with this research are reasonable in light of the knowledge that can be reasonably expected to be gained from the proposed work.

15. Inclusion of Women and Minorities

The proposed study utilizes existing data therefore all enrollment has been completed. Please see the Targeted/Planned Enrollment Table for complete numbers. Both the CRS and IIS were unselected birth cohorts enrolled through collaborating physicians. Both male and female children are included in these existing data sets; with 51% female and 49% male children represented. There were no exclusions based on minority status for either the CRS or the IIS. The combined population for this proposed study include minorities and is 22% Hispanic, 0.5% American Indian, 1% Asian, and 3% Black. The category White includes 57 female and 61 male children who reported more than one race, reported their race as other or did not report any race, which may lead to an overestimation of the White category.

Targeted/Planned Enrollment Table

This report format should NOT be used for data collection from study participants.

Study Title: Relation of Traffic-Related Exposures to Respiratory and Immunologic Outcomes in Early Life

Total Planned Enrollment: 1728

TARGETED/PLANNED ENROLLMENT: Number of Subjects			
Ethnic Category	**Sex/Gender**		
	Females	**Males**	**Total**
Hispanic or Latino	191	188	379
Not Hispanic or Latino	693	656	1349
Ethnic Category: Total of All Subjects *	884	844	1728
Racial Categories			
American Indian/Alaska Native	5	3	8
Asian	10	12	22
Native Hawaiian or Other Pacific Islander	0	0	0
Black or African American	25	21	46
White	844	808	1652
Racial Categories: Total of All Subjects *	884	844	1728

* The “Ethnic Category: Total of All Subjects” must be equal to the “Racial Categories: Total of All Subjects.”

17. Inclusion of Children

All proposed participants will be children as this is a study examining risk factors for the development of wheeze and asthma in children. All sources of materials to be used for the proposed study were collected from children participating in two on-going birth cohort studies. Childhood addresses histories will be collected from continuing CRS participants. All of who are now adults and can provide informed consent. All existing data to be utilized for this study was collected from children with additional protections as described in the DHHS regulations Subpart D, and was collected under protocols approved by The University of Arizona Institutional Review Board.