THE SRIHER-UC BERKELEY COLLABORATION

The Department of Health Engineering (EHE), at Sri Ramachandra University (SRU) has been involved in a long standing research and training collaboration with University of California, Berkeley School of Public health(UCB, SPH) over the last two decades. Spearheaded by Profs. Smith and Balakrishnan and supported by the NIH Fogarty International Center through it's "International Training and Research Program In Environmental and Occupational Health" program, the collaboration has created the most extensive capacities for occupational and environmental health research in India, at SRU. Shri. V.R. Venkatachalam, the Chancellor of SRU and Dean Dr. Steven Shortell of UC Berkeley facilitated an unprecedented level of exchange on research and training that involved more than a dozen faculty members from both institutions. The numerous opportunities for advanced scientific exchange provided through the collaboration were critical in enabling Sri Ramachandra University to merit recognition as a national and global center of eminence in occupational and environmental health. An important outcome of this collaboration was also the development of a full-fledged MPH program in Occupational and Environmental Health, the only one in India.

(Left) UCB Dean Dr. Steven Shortell and SRU Chancellor Mr. VR Venkatachalam at the launch of the MPH Program in 2010; (Center)The SRU team with Professor Kirk Smith of UC Berkeley and SRU university Vice Chancellor JSN Murthy, Dean(Research) SPThyagarajan and Dean of Faculties KV Somasundaram at the renewal of the MOU in 2013. (Right) US Secretary of State Hillary Clinton with Professor.Kalpana Balakrishnan of SRU at a demonstration of cookstovestove assessments during her visit to Chennai, India in 2011.

Using a combination of long- and short-term exchanges between faculty and students, the partnership produced an extensive range of research outputs (See the list of publications below). In particular, Drs. Smith and Balakrishnan, made joint contributions to numerous international assessments of relevance to India and other developing countries including the World Health Organization Air Quality Guidelines in 2006 and 2014, The International Agency for Research and Cancer Monograph on carcinogenicity of household fuels in 2007 and ambient air pollution in 2013, the Global Energy Assessment in 2010 and the Global Burden of Disease Assessment in 2000 and 2010 . With a network of more than 40 institutional collaborators and accreditations as a WHO Collaborating Center (WHO-CC) for Research and Training in Occupational and Environmental Health (OEH) and a Center for Advanced Research in Air Quality, Climate and Health for the Indian Council of Medical Research Government of India, EHE–SRU is now actively engaged in numerous national and regional capacity building activities as well as in policy relevant research efforts concerning air quality. Notably, the SRU-UCB partnership and it's contribution for environmental health interventions concerning household air pollution was hailed as "pioneering" by the visiting US Secretary of State Ms.Hillary Rodham Clinton in 2011.

SRIHER-UC Berkeley
Research Projects (2014 to 2019)

- Project entitled "Increasing LPG Use During Pregnancy: A Pilot evaluation of the GIU Campaign" in collaboration with KEMRHC, Pune and UC Berkeley. Funded by Implementation Science Network, NIH, USA.
- Household Air Pollution and Health: a multi-country LPG intervention trial. (As Advisor)

SRIHER-UC Berkeley Publications
Journal Articles and Editorials

1. Joshua Rosenthal, Kalpana Balakrishnan, Nigel Bruce, David Chambers, Jay Graham, Darby Jack, Lydia Kline, Omar Masera, Sumi Mehta, Ilse Ruiz Mercado, Gila Neta, Subhrendu Pattanayak, Elisa Puzzolo, Helen Petach, Anthony Punturieri, Adolfo Rubinstein, Michael Sage, Rachel Sturke, Anita Shankar, Kenny Sherr, Kirk Smith, Gautam Yadama, 2017 Implementation Science to Accelerate Clean Cooking for Public Health. *Environ Health Perspectives*. A3-A7. doi: 10.1289/EHP1018.
2. Ambuj Sagar, Kalpana Balakrishnan, Sarath Guttikunda, Anumita Roychowdhury, Kirk R. Smith, 2016 (forthcoming), India leads the way: A health-centered strategy for air pollution, *Environ Health Perspectives*.
3. Kalpana Balakrishnan, Sankar Sambandam, Santu Ghosh, Krishnendu Mukhopadhyay, Mayur Vaswani, Narendra K. Arora, Darby Jack, Ajay Pillariseti, Michael N. Bates, Kirk R. Smith. Household Air Pollution Exposures of Pregnant Women Receiving Advanced Combustion Cookstoves in India: Implications for Intervention. *Ann Glob Health*. 2015 May-Jun;81(3):375-85. doi: 10.1016/j.aogh.2015.08.009.
4. Arnold, Benjamin, Khush, Ranjiv, Ramaswamy, Padmavathi, Rajkumar, Paramasivan, Durairaj, Natesan, Ramaprabha, Prabhakar, Balakrishnan, Kalpana, Colford, John (2015) Reactivity in rapidly collected hygiene and toilet spot check measurements: a cautionary note for longitudinal studies. *Am J Trop Med Hyg*. 2015 Jan;92(1):159-62. doi: 10.4269/ajtmh.14-0306. Epub 2014 Nov 10.
5. Sankar Sambandam, Kalpana Balakrishnan, Santu Ghosh, Arulselvan Sadasivam, Satish Madhavan, Rengaraj Siva, Maitreya Samanta, Hafeez Rehman, Veerabhadran Ramanathan (2015). Can currently available advanced combustion biomass cook-stoves provide health relevant exposure reductions? Results from initial assessment of select commercial models in India. *EcoHealth* March 2015 10.1007/s10393-014-0976-1 Epub 2014 Nov 8.
6. Pillarisetti A, Vaswani M, Jack D, Balakrishnan K, Bates MN, Arora NK, Smith KR(2014). Patterns of stove usage after introduction of an advanced cookstove: the long-term application of household sensors. *Environ Sci Technol.*48(24):14525-33. doi: 10.1021/es504624c. Epub 2014 Dec 2
7. Smith K, Bruce N, Balakrishnan K, Adair-Rohani H, Balmes J, Chafe Z, et al. (2014). Millions dead: How do we know and what does it mean? Methods used in the comparative risk assessment of household air pollution. *Ann Rev of Public Health* 35:185–206. doi:10.1146/annurev-publhealth-032013-182356
8. Balakrishnan K, Cohen A, Smith KR. (2014).Addressing the burden of disease attributable to air pollution in India: the need to integrate across household and ambient air pollution exposures. *Environ Health Perspect*. 122(1):A6-7.doi: 10.1289/ehp.1307822.
9. Kalpana Balakrishnan, Santu Ghosh, Bhaswati Ganguli, Sankar Sambandam, Nigel Bruce, Douglas F Barnes, Kirk R Smith (2013). State and national household concentrations of PM2.5 from solid cookfuel use: Results from measurements and modeling in India for estimation of the global burden of disease. *Environmental Health*, 12:77. doi: 10.1186/10.1186/1476-069X-12-77.
10. Epstein MB, Bates MN, Arora NK, Balakrishnan K, Jack DW, Smith KR. (2013). Household fuels, low birth weight, and neonatal death in india: The separate impacts of biomass, kerosene, and coal. *Int J Hyg Environ Health* 216:523-532. http://dx.doi.org/ 10.1016/j.ijheh.2012.12.006
11. Khush RS, Arnold BF, Srikanth P, Sudharsanam S, Ramaswamy P, Durairaj N, London A.G, Ramaprabha P, Rajkumar P, Balakrishnan K, Colford J. (2013). H2s as an indicator of water supply vulnerability and health risk in low-resource settings: A prospective cohort study. *The American Journal of Tropical Medicine and Hygiene* 89:251-259. doi: 10.4269/ajtmh.13-0067.
12. Smith KR, Frumkin H, Balakrishnan K, Butler CD, Chafe ZA, Fairlie I, et al. (2013). Energy and human health. *Annu Rev Public Health* 34:159-188.
13. Stephen S Lim, Theo Vos, Abraham D Flaxman, Goodarz Danaei, Kenji Shibuya, Heather Adair-Rohani, Markus Amann, H Ross Anderson, Kathryn G Andrews, Martin Aryee, Charles Atkinson, Loraine J Bacchus, Adil N Bahalim, Kalpana Balakrishnan et al. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: A systematic analysis for the global burden of disease study 2010. The *Lancet* 380:2224-2260.
14. Mukhopadhyay R, Sambandam S, Pillarisetti A, Jack D, Mukhopadhyay K, Balakrishnan K, Vaswani M, Bates MN, Kinney PL, Arora N, & Smith, KR (2012). Cooking practices, air quality, and the acceptability of advanced cookstoves in Haryana, India: an exploratory study to inform large-scale interventions. *Global Health Action*; 5. doi:10.3402/gha.v5i0.19016.
15. Priscilla Johnson, Kalpana Balakrishnan, Padmavathi Ramaswamy, Santu Ghosh, Muthukumar Sadhasivam, Omprakash Abirami, Bernard W.C. Sathiasekaran, Kirk R. Smith, Vijayalakshmi Thanasekaraan, Arcot S. Subhashini (2011). Prevalence of Chronic Obstructive Pulmonary Disease in rural

women of Tamilnadu: implications for refining disease burden assessments attributable to household biomass combustion. G*lobal Health Action* 4: 7226. DOI: doi: 10.3402/gha.v4i0.7226.

16. Benjamin F. Arnold, Ranjiv S. Khush, Padmavathi Ramaswamy, Alicia G. London, Paramasivan Rajkumar, Prabhakar Ramaprabha, Natesan Durairaj, Alan E. Hubbard, Kalpana Balakrishnan, and John M. Colford, Jr. (2010). Causal inference methods to study nonrandomized, preexisting development interventions. *Proc. Natl. Acad. Sci.* 107 (52) 22605-22610; doi:10.1073 /pnas.1008944107.
17. Straif K., Baan R., Grosse Y., Secretan B., Ghissassi F.E., Cogliano V., Smith K., Chen G., White P., Gao Y.-T., Yu I.T., Sinton J., Balakrishnan K., Romieu I., Chapman R.S., Bruce N., Barnes D., Bond J., DeMarini D., Lan Q., Lewtas J., Reed M.D., Wallace L., Wu A., Zhang J.Carcinogenicity of household solid fuel combustion and of high-temperature frying (2006). *The Lancet Oncology*. 7(12):977-978.
18. Balakrishnan, K; Sambandam, S; Ramaswamy, P; Mehta, S; Smith, KR (2004). Exposure assessment for respirable particulates associated with household fuel use in rural districts of Andhra Pradesh, India*. J. Expo. Anal. Env. Epidemology*, 14: S14-S25 Suppl. 1.
19. K Balakrishnan, S Mehta, S Kumar, P Kumar. Exposure to Indoor air pollution: Evidence from Andhra Pradesh, India (2003). World Health Organisation Regional Health Forum,7; 1: 56-59.
20. Balakrishnan K, Sankar S, Padmavathi R, Mehta S, Smith KR, Respirable particulate levels in rural households of Andhra Pradesh, India - daily concentrations and exposures (2002). *J. Environ. Studies and Policy*, 5 (2): 87-97.

Book Chapters

21. Kalpana Balakrishnan, Zoë Chafe, Tord Kjellstrom, Thomas E. McKone, Kirk R. Smith, "Energy Poverty and Public Health: Impacts from Solid Cookfuel," in Antoine Halff, J Rozhon and BK Sovacool (Eds.) *Energy Poverty: Global Challenges and Local Solutions* 2014.
22. Kalpana Balakrishnan, Sumi Mehta, Santu Ghosh, Michael Johnson, Michael Brauer, Jim Zhang, Luke Naeher, Kirk R Smith*. In The World Health Organisation Air Quality Guideline*s: Household Air Pollution Chapter 6. Household air pollution and exposures: a global review. 2014
23. Smith, K. R., K. Balakrishnan, C. Butler, Z. Chafe, I. Fairlie, P. Kinney, T. Kjellstrom, D. L. Mauzerall, T. McKone, A. McMichael and M. Schneider. Chapter 4 - Energy and Health. In Global Energy Assessment - Toward a Sustainable Future, Cambridge University Press, Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria (2012); pp. 255-324.
24. K. Balakrishnan, S Mehta, P Kumar, P Ramaswamy, S Sambandam, S Kumar, KR Smith (2004). Indoor air pollution associated with household fuel use in India: An exposure assessment and modeling exercise in rural districts of Andhra Pradesh, India. World Bank Report, ESMAP, June 2004. http:// wbln0018. worldbank.org /esmap/site.nsf/ files/India.pdf

Member:

- Member, Clean Cooking Implementation Science Network for The Fogarty International Center, National Institutes of Health, Bethesda, MD, USA, April 20, 2015.
- *Invited Speaker* at Fogarty International Center Advisory Board Meeting at National Institutes of Health Talk entitled" Strategic directions for global research on household air pollution", February 6,2015 Bethesda, MD, USA

The SRIHER-CLARKSON UNIVERSITY Collaboration

Exposure to indoor and outdoor airborne pollutants is one of the leading risk factors contributing to burden of disease in India. The interrelated nature of ambient and household exposures, and the resultant health effects requires their joint consideration while framing policy actions in India. In addition, the dependence of air quality on our choice of energy sources and on the state of the atmosphere makes it critical to understand the connection between climate and air quality. Interventions that reduce (climate relevant) emissions and (health relevant) exposures would fit well within a co-benefits framework whereby benefits could accrue for health and climate at national and global scales. To develop such interventions, there is a critical need for personnel with inter-disciplinary expertise in Indian Institutions.

The Indo-US Knowledge initiative aims to address the above-mentioned national needs through Indo-US collaboration between two well-recognized research groups at Clarkson University (CU), USA and Sri Ramachandra Institute for Higher Education and Research (SRIHER), India. As part of this initiative, SRIHER and CU have partnered with the Indian Council for Medical Research, to develop and deploy a suite of inter-disciplinary short courses on air quality, human health, and climate change, conduct multi-lateral visits between scientists of the three institutions, and initiate novel research programs at the three institutions concerning the development and validation of low-cost air quality sensors.

Short Description of Course

The short courses being developed as part of the collaboration are being offered to wider network participants in India from academic and Governmental collaborating institutions of ICMR and SRIHER. They target doctoral students, faculty, and scientists in public/environmental health disciplines to provide knowledge on **application** of the science of air pollution and its interrelated consequences on **human health and climate change**, especially in India. They provide a mixture of lectures and hands-on activities using electricity generation as an example to highlight the interconnections between the three topics.

Activities and Learning Outcomes

- Identify primary source of air pollutants and trends that contribute to human health and climate change impacts
- Access and analyze air quality data from CPCB (India) and Airnow (US EPA)
- Navigate and use the WHO Air Q+ software to assess impacts of air pollutants on health – general and specifics for Cardiovascular and Respiratory Disease
- Use low-cost optical sensors to measure $PM_{2.5}$ at different sources
- Engage in a role-play activity that models how decisions related to India's future electric power generation will affect climate and human health impacts


Dr Suresh Dhaniyala, Bayard D. Clarkson Distinguished Professor Mechanical & Aeronautical Engineering / Co-Director of CARES (Center for Air Resources Engineering and Science), Clarkson University, USA with SRU university Vice Chancellor JSN Murthy, Dean(Research) SPThyagarajan and Dr. Kalpana Balakrishnan Associate dean of Research and Director, Center for Advanced Research On Environmental Health, SRIHER at the launch of the MOU in 2016.

Training Workshops:

- Training Workshop on Air Pollution, Climate Change and Human Health in India: Interlinked Challenges", Clarkson-SRU-ICMR Knowledge Initiative Project, SRMC&RI(DU) from Dec 18 to 20,2017.

- Clarkson-SRU-ICMR Indo-US Knowledge Initiative Project Training Workshop on Air pollution, climate change and human health in India: Interlinked Challenges" ,SRMC&RI(DU) from January 8-10, 2019

- Training Workshop on Air Pollution, Climate Change and Human Health in India: Interlinked Challenges", Clarkson-SRU-ICMR Knowledge Initiative Project, Clarkson University, Potsdam, New York from August 5-9, 2019.

Participants:

1.	Dr. Krishnendu Mukhopadhyay	SRIHER
2.	Dr. Naveen Puttaswamy	SRIHER
3.	Dr. Tanvir Kaur	ICMR
4.	Dr. Rajnarayan Tiwari	NIREH,ICMR
5.	Dr. Swasthi Shubam	NIREH, ICMR
6.	Dr. Sindhuprava Rana	NIREH, ICMR
7.	Dr. Asim Saha	ROHC, ICMR
8.	Dr. Ankit Viramgani	NIOH, ICMR

Research Projects:

- Project entitled "Air Pollution, Health and Climate in India: Building Capacities for Health Research and Program Evaluation" Funded by Indo-US Knowledge Initiative, USIEF

Publications:

- Suresh Dhaniyala, Praney Dubey, Kalpana Balakrishnan ,"Air Quality in rural India : Role of Ultrafine Particles from cookstoves " in J. of Air and Waste Management Association,2011 8: 14-18.

The SRIHER-Indian Council of Medical Research, ICMR Collaboration

This has been one of the most engaging and involving collaboration that SRU has been privileged to have over the last 9 years. It was first initiated through informal exchanges with the National Institute of Occupational Health that were responsible for SRU meriting the recognition as a WHO-CC in Research and Training and Occupational Health in 2007. Since then the collaboration was extended with formal MOU with NIE inn 2010, for the conduct of the newly developed MPH program at both institutions. Since 2010, ICMR has supported the development of the Center for Advanced Research for Environmental Health: Air Pollution under the leadership of Professor. Balakrishnan. The team at SRIHER was extended the fullest levels of technical and administrative support by ICMR not only for the successful execution but also widespread dissemination through research publications. Salient features of this collaboration are 7 publications in Lancet that were co-authored by the SRIHER-ICMR team as part of the Capstone papers being published for the Global Burden of Disease 2015 exercise. The formulation of the MOU represents a major step forward in our inter-institutional collaboration. This will enable SRU to expand its contributions to national health programmes and policies under the stewardship of ICMR while fostering inter-institutional research collaborations amongst institutions of national eminence.

Air pollution in the household and ambient environment is among the leading contributors to the burden of ill health in India. The Indian Council for Medical Research (ICMR) has set up a Center for Advanced Research on Air Quality, Climate and Health at Sri Ramachandra University in Chennai, Tamil Nadu to strengthen the scientific evidence base for health effects of air pollution and increase the momentum on air quality actions in India. This builds on earlier work commissioned by the ICMR to examine the health effects of household and ambient air pollution in rural-urban cohorts of pregnant women, children and adults in Thiruvallur and Kancheepuram Districts of Tamil Nadu.

The Center is headed by Professor. Kalpana Balakrishnan, an eminent global environmental health expert at SRU. The Center has been sanctioned 4 major international projects to be executed in initial 5 year term with others under advanced stages of review. The projects will

(I) establish relationships between fine particulate matter, respiratory health (lung function) and early stage cardiovascular disease(CVD) markers (blood pressure, endothelial dysfunction, arterial stiffness and intima-media thickness in Tamil Nadu, with funding from the UN Foundation (Global Alliance for Clean Cookstoves) and Public Health Institute

(II) compare the feasibility, cost, and effectiveness of alternate strategies to increase LPG adoption and sustained use with specific focus on pregnant women in Mahrashtra, with funding from the Implementation Science Network of the US National Institutes of Health

(III) partner with ICMR to conduct a randomized controlled trial of LPG stove and fuel distribution in 800 households in Tamil Nadu as part of global multi-centric effort being conducted in India, Guatemala, Peru and Rwanda to deliver rigorous evidence regarding potential health benefits of clean fuel use for pregnant women, young children and adult women with funding by the US National Institutes of Health

(IV) partner with ICMR to develop and deploy a suite of inter-disciplinary short courses on air quality, human health, and climate change with funding by the The Indo-US Knowledge Initiative.

The projects involve collaboration with an extensive network of eminent US universities including Emory University, Johns Hopkins University, Colorado State University, Tufts University, Clarkson University in addition to an on-going partnership with long term SRU collaborators at the University of California, Berkeley.

The funding available through these projects and the long history of formal collaborations between SRU and ICMR allow an unprecedented opportunity for augmenting scientific outputs as well as scientific capacities in the domain of air quality, climate and health.

Dr Soumya Swaminathan , Director General of Indian Council Of Medical Research at the launch of the new Center for Advanced Research on Air Quality, Climate and Health at SRU , with Vice Chancellor JSN Murthy, Dean(Research) SPThyagarajan and Dr. Kalpana Balakrishnan

SRIHER-ICMR Research Projects

- Project entitled "Prenatal Exposure to Air Toxics and Birth outcome assessment in rural and Urban Tamil Nadu" funded by Indian Council of Medical Research
- Project entitled "Impact of meteorological changes and air pollution on respiratory health & morbidity: A retrospective multicentric study" funded by Indian Council of Medical Research.
- Project entitled "Exposures to Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons associated with use of Kerosene as a Household Fuel through integrated environmental and bio-monitoring in rural and urban Tamil Nadu: a follow-up study on air toxics in the ICMR-CAR cohort" funded by Indian Council of Medical Research.
- Project entitled "Center for Advanced Research on Environmental Health: Air Pollution" funded by Indian Council of Medical Research.

SRIHER-ICMR Publications
Journal Articles and Editorials

1. Sanchez M, Ambros A, Milà C, Salmon M, Balakrishnan K, Sambandam S, Sreekanth V, Marshall JD, Tonne C. Development of land-use regression models for fine particles and black carbon in peri-urban South India,2018. Science of the Total Environment. 4;634:77-86. doi: 10.1016/j.scitotenv.2018.03.308
2. Balakrishnan K , Ghosh S, Thangavel G , Sambandam S , Mukhopadhyay K , Puttaswamy N , Sadasivam A , Ramaswamy P , Johnson P , Kuppuswamy R , Natesan D , Maheshwari U , Natarajan A , Rajendran G , Ramasami R , Madhav S , Manivannan S , Nargunanadan S , Natarajan S , Saidam S , Chakraborty M , Balakrishnan L , Thanasekaraan V. Exposures to fine particulate matter (PM2.5) and birthweight in a rural-urban, mother-child cohort in Tamil Nadu, India. Environmental Research 2018, doi: 10.1016/j.envres.2017.11.050
3. Saraswathy Manivannan, Vidhya Venugopal, Anupma Jyothi Kindo1, Rajarajeswari Kuppuswamy Method for assessment of indoor household dampness for its use in epidemiological studies in tropical settings, 2017. Annals of Tropical Medicine and Public Health, ISSN 1755-6783.
4. Rajarajeswari K1*, Venugopal V2 and Saraswathy M3Challenges and Opportunities in Dietary Assessment of Pregnant Women in Tamil Nadu,2017, Indian Journal of Nutrition,2017 ISSN: 2395-2326
5. Kalpana Balakrishnan,Sankar Sambandam,Padmavathi Ramaswamy,Santu Ghosh,Vettriselvi Venkatesan,Gurusamy Thangavel,Krishnendu Mukhopadhyay, Priscilla Johnson,Solomon Paul, Naveen Puttaswamy,Rupinder S Dhaliwal, D K Shukla, SRU-CAR Team1Establishing integrated rural-urban cohorts to assess air pollution-related health effects in pregnant women, children and adults in Southern

India: an overview of objectives, design and methods in the Tamil Nadu Air Pollution and Health Effects (TAPHE) study. BMJ Open 2015, ISSN 2044-6055

Invited Presentations at Major Conferences, Workshops and Meetings

- *Plenary Speaker* at Indo-US (ICMR-CDC) meeting on Air Quality and Health, February 24-26, 2016, New Delhi. Talk entitled "Assessing health effects of air pollution in India: A summary of recent progress in research evidence".
- *Invited Speaker* at Tufts University Global Health Symposium organized on the occasion of World Health Day. Talk entitled" Integrating air pollution in chronic disease cohorts: Opportunities within the TAPHE and PURSE-HIS cohorts in Chennai, Tamil Nadu", April 7, Boston, USA
- *Invited Speaker* at Inter-Ministerial Round Table at the International Conference on Climate and Health at World Health Organisation, Geneva, Switzerland. Talk entitled "Interfacing Climate and Air Quality Actions in India, August 2014.
- *Invited Speaker* at Environmental Health Seminar Series at Duke University, USA. Talk entitled "Examining health effects of air pollution in longitudinal cohorts in India: Opportunities for International collaboration", North Carolina, USA, March 2014

Member:

- Member, Scientific Advisory Committee, National Institute of Occupational Health, ICMR, Govt. of India.
- Member, Scientific Advisory Committee, National Institute for Research on Environmental Health, ICMR, Govt. of India.
- Member, Steering Committee on Health Related Issues in Air Pollution, Ministry of Health and Family Welfare, Govt. Of India
- Member, Expert Group on Uniform Air Quality Indices for Indian Cities, Central Pollution Control Board, Govt. Of India

The SRIHER-Safety Engineers Association, SEA-India Collaboration

Safety Engineers Association (SEA – INDIA) was started in the year 2000. It is a registered body under the Societies Act 1975. This is a non-governmental organization (N.G.O) working for enhancement of safety professionalism. Initially, about 50 safety professionals joined the association. But, now in 2017 the association has grown to have more than 700 members from different parts of the Country. Apart from industrial safety professional, other Para safety professionals such as those working in the field of safety education, safety law enforcement, safety consultancy and other safety service providers have become members under different category of this SEA India. Safety Engineers Association is publishing Quarterly journals and Monthly Safety Alerts and provide to all members free of cost. Also SEA is organizing various professional development programs such as industrial visits, Technical Meets etc., for the benefit of members.

The Safety Engineers Association (SEA) will be applying for accreditation from DGFASLI, Govt. of India, for conducting statutory courses under Factories Act 1948. They have approached Department of Environmental Health Engineering of Sri Ramachandra University (EHE- SRIHER(DU)) for collaboration in conducting various programmes in India.

SEA-India and EHE – SRIHER(DU) are the organizations dedicated to promote Occupational Health and Safety and they conduct several professional development programs on safety, occupational health and industrial hygiene. In addition to their individual programs, they collaborate among themselves to conduct Certificate Courses and other short term training programs on topics of common interest to the health and safety professionals.

- Library facility of the EHE department will be made available for the students of this course and borrowing of books will not be allowed. Access to the main library of the college will be subject to the approval of the management.
- Occupational Safety, Hygiene and Health laboratory facility available at EHE department will be used for the practical course during the program and faculty for teaching will be from EHE-SRU.
- Faculty support for preparation of modules or course materials etc., will be extended by the EHE – SRU and financial liabilities for the same will be collected separately on a mutually accepted amount.
- Certificate will be issued to successful students by DGFASLI.
- SEA-India will be responsible for collection and issue of Mark lists and the certificates to the students.
- Organizing Committee from SEA and EHE-SRU will work out technical details for conducting collaborative programs.

Technical programs:

- Guest of Honour at SEA-India Annual meeting celebration on 24th June,2017
- Professional Development Programme conducted at SRIHER(DU) in collaboration with SEA ,India on March 23rd,2019
- Workshop on “Technical Aspects of Noise & its Health Effects” conducted at SRIHER (DU) on 22.09.2018.

Conducting joint programs with SEA-India had built a strong network of industries across all type of sectors. Through this network connection, several industries recognized EHE-SRIHER a potential expertise in OSH, and thus are provided with occupational safety and health advisory services using the state of facility.

The SRIHER-Tamil Nadu Pollution Control Board, TNPCB Collaboration

The Tamilnadu Pollution Control Board and SRIHER have collaborated on numerous research projects and training programs with a common interest to reduce the impact of pollution on quality of life of the public. With the increased industrial and commercial activities in the vicinity of major cities, the quality of the ambient air is being affected by emissions from the industries and from the ever increasing vehicular population. We have had the opportunity of working with them in many air pollution related research ventures. We have shared without reservations, knowledge and technical expertise with each other to help us better the environment.

SRIHER has recently been awarded a national project of importance titled 'National Environmental Health Profile' study. This study is simultaneously being conducted in 20 cities of the country and SRIHER is the nodal center for Chennai. This study has been initiated by the Ministry of Environment, Forest and Climate Change, Government of India that aims to assess human health effects associated with environmental exposure, especially air pollution. The TNPCB has plays a vital role in data sharing related to air pollution in numerous such occasions. The TNPCB-SRIHER alliance is the rock solid foundation of many such research ventures in the future.

TNPCB –SRIHER Research Projects:

- Collaborative Research Project entitled "National Environmental Health Profile: 20 cities study " funded by the Ministry of Environment , Forest and Climate Change, Government of India.

Consultative meetings:

- Interactive Session on "Air Quality & Health Issues" conducted at Tamil Nadu Pollution Control Board and organized by US Consulate, Chennai on 05.11.2015
- Participation of investigators in National Health Mission-Tamil Nadu meeting conducted at Directorate of Medical Services on 16.08.2019
- Participation of investigators in Consultative meeting on Air Pollution and Its Impacts on Human Health (National Environmental Health Profile and National Clean Air Program), Conducted at Directorate of Medical and Rural Health Services, Chennai on 27.06.2019.

Guest Lectures:

- "Implementation of E-Waste (Management) Rules 2016", organized by Tamil Nadu Pollution Control Board at The Hotel Checkers on 07.03.2017.
- "Biomedical Waste Management Rules 2016" conducted at Environmental Training Institute, Tamil Nadu Pollution Control Board on

Expert Committee:

- Member on Committee to study the accident occurred on 27.09.2015 in the unit of JSW Steel Limited, M Kallipatti village, Metur Taluk, Salem District on 27.09.2015.
- Member on Committee to study the accident occurred on 17.11.2015 in the unit of M/S Shasun Pharmaceuticals Limited, SPICOT Industrial Complex, Kudikadu Village, Cuddalore District.

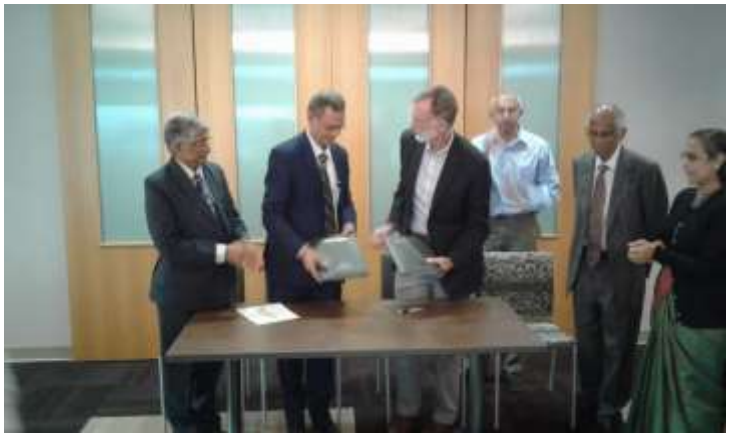
The SRIHER-EMORY UNIVERSITY Collaboration

Memorandum of understanding between SRIHER & Rollins School of Public Health, Emory University, Atlanta, Georgia, USA

This Memorandum of understanding between Sri Ramachandra Institute of Higher Education and Research (SRIHER), Porur, Chennai and Rollins School of Public Health, Emory University, 1518 Clifton Road, NE, Atlanta, GA, USA was executed on 22nd October 2018.

This MoU aims to enhance quality of research and extension of services to the society at large and whereas both SRIHER and Emory are convinced about the mutual benefit of forging formal linkage to develop collaborative research and training programmes in the areas of their core competence with a special focus on Public Health.

As part of the MoU, a large scale environmental trial is being executed by SRIHER and Emory with the funding from National Institutes of Health (NIH), USA. It is a multi-country randomized controlled field trial to demonstrate the benefits of LPG intervention on the health outcomes of women. The project entitled "Household Air Pollution and Health: A multi-country LPG Stove intervention trial (HAPIN)" is being conducted across rural sites in India (Villupuram & Nagapattinam District), Peru, Rwanda and Guatemala to assess the health benefits of transitioning to LPG as primary cook-fuel. The primary objective of our research trial includes data collection on birth weight (for HAPIN study participants) & pneumonia for child < 1 year for HAPIN study children.



SRIHER's faculty investigators are;

Dr. Kalapana Balakrishnan –Principal Investigator, Department of EHE, Faculty of Public Health
Dr. G. Thangavel – Co Prinicipal Investigator, Department of EHE, Faculty of Public Health
Dr. S. Sankar – Co Investigator, Department of EHE, Faculty of Public Health
Dr. Krishnendu Mukhopadhyay – Co Investigator, Department of EHE, Faculty of Public Health
Dr. Naveen Chand V P, Department of EHE, Faculty of Public Health

As part of the project MoU, we have conducted three continued medical education programs and two guest lectures at our field sites viz., Villupuram and Nagapattinam districts and in SRIHER. There were two publications (numerous others are in the pipe line) so far from this MoU. There were seven annual and bi annual review workshops and numerous training programs in SRIHER and field sites conducted so far. They are described below;

Publications:

- Quinn AK, Williams K, Thompson LM, Rosa G, Díaz-Artiga A, Thangavel G, Balakrishnan K, Miranda JJ, Rosenthal JP, Clasen TF, Harvey SA. Compensating control participants when the intervention is of significant value: experience in Guatemala, India, Peru and Rwanda. BMJ Glob Health. 2019 Aug 21;4(4):e001567. doi: 10.1136/bmjgh-2019-001567.
- Goodman D, Crocker ME, Pervaiz F, McCollum ED, Steenland K, Simkovich SM, Miele CH, Hammitt LL, Herrera P, Zar HJ, Campbell H, Lanata CF, McCracken JP, Thompson LM, Rosa G, Kirby MA, Garg S,

Thangavel G, Thanasekaraan V, Balakrishnan K, King C, Clasen T, Checkley W; HAPIN Investigators. Challenges in the diagnosis of paediatric pneumonia in intervention field trials: recommendations from a pneumonia field trial working group. Lancet Respir Med. 2019 Oct 4. pii: S2213-2600(19)30249-8. doi: 10.1016/S2213-2600(19)30249-8.

Conference presentations:

- Thangavel G, Balakrishnan K et al. Development of behavioural message strategy for participants who get LPG stove in an environmental trial – experience from the Indian arm of Household Air pollution Intervention Network (HAPIN) multi country trial. Poster presentation at ISEE 2019, 25-28 August, Utrecht, Netherlands.
- Cathryn Tonne, Margaux Sanchez, Carles Mila, V Sreekanth, Sankar Sambandam, Kalpana Balakrishnan, Julian Marshall Particle Exposure Assessment in Peri-Urban India: Lessons Learned from the CHAI Project, at ISEE Conference Abstracts 2018
- Sankar Sambandam, Kalpana Balakrishnan, Thangavel Gurusamy, Durairaj Natesan, Rengaraj Ramasami, Amudha Natarajan, Saritha Sendhil, Saraswathy Manivannan, Srinivasan Nargunanathan, Sathish Madhav, Uma Maheswari, Vigneswari Aravindalochanan, Krishnendu Mukhopadhyay, Naveen Puttaswamy, Santu Ghosh, Michael Johnson, Ricardo Piedrahita, Charity Garland, Ajay Pillarisetti, Jennifer L Peel, Maggie L Clark, William Checkley, Luke Naeher, Kyle Steenland, Tom Clasen . Establishing Potential Exposure Contrasts Associated with an LPG Gas Intervention in Biomass Using Homes: Results from Pilot Phase Activities for the HAPIN Trial in Tamil Nadu. at ISEE Conference Abstracts 2018
- Matthew Shupler , William Godwin , Joseph Frostad , Kalpana Balakrishnan , Paul Gustafson , Santu Ghosh , Raph Arku , Michael Brauer Global Estimation of Exposure to PM2.5 from Household Air Pollution, at ISEE Conference Abstracts 2018
- Vanessa Jean Burrowes , Michael Johnson , Ricardo Piedrahita , Charity Garland , Ajay Pillarisetti , Sankar Sambandam , Kalpana Balakrishnan , John P McCracken , Erick Mollinedo , Oscar Fernando de León , Jiawen Liao , Ghislaine Rosa , Miles A Kirby , Fiona Majorin , Kyle Steenland , Luke Naeher , Jennifer L Peel , Maggie L Clark , Tom Clasen , William Checkley. Pilot Study of the Enhanced Children's Micropem Compared to the Standard Gravimetric Methods to Measure Personal Exposure and Kitchen Concentrations to Fine Particulate Matter from Household Air Pollution: HAPIN Trial Investigators. at ISEE Conference Abstracts 2018
- Vanessa Jean Burrowes , Michael Johnson , Ricardo Piedrahita , Charity Garland , Ajay Pillarisetti , Sankar Sambandam , Kalpana Balakrishnan , John P McCracken , Erick Mollinedo , Oscar Fernando de León , Jiawen Liao , Ghislaine Rosa , Miles A Kirby , Fiona Majorin , Kyle Steenland , Luke Naeher , Jennifer L Peel , Maggie L Clark , Tom Clasen , William Checkley. Pilot Study of the Enhanced Children's Micropem Compared to the Standard Gravimetric Methods to Measure Personal Exposure and Kitchen Concentrations to Fine Particulate Matter from Household Air Pollution: HAPIN Trial Investigators. at ISEE Conference Abstracts 2018
- Kevin J Lane , Ketch Cowan , Jahnavi Sunderarajan , Kalpana Balakrishnan , Sadagopan Thanikachalam , Mohan Thanikachalam, Associations between Ambient Fine Particulate and Systolic Blood Pressure in Relation to Greenness in the PURSE-HIS Cohort, at ISEE Conference Abstracts 2018
- Naveen Puttaswamy , Srinivasan Natarajan , Sudhakar Saidam , Krishnendu Mukhopadhyay , Sankar Sambandam , Gurusamy Thangavel , Kalpana Balakrishnan, Exposures to Volatile Organic Compounds (VOCs) among Rural and Urban Households in Southern India in Relation to Primary Cooking Fuels at ISEE Conference Abstracts 2018
- Savannah Dawn Gupton , Maggie L Clark , Sarah Rajkumar , Carmen Lucia Contreras , Gary Malpartida Guzmán , Fiona Majorin , Erin W Williams , Damien Swearing , Naveen Puttaswamy , Kalpana Balakrishnan , Ghislaine Rosa , John P McCracken , Lisa M Thompson , Tom Clasen , Jennifer L Peel , William Checkley , Dana Barr. Cardiovascular Biomarker Validation in Dried Blood Spots and Plasma for the Household Air Pollution Intervention Network Trial, at ISEE Conference Abstracts 2018
- Devashri Salvi , Kevin J Lane , Kalpana Balakrishnan , Sadagopan Thanikachalam , Mohan Thanikachalam. Associations between Ambient and Indoor PM2.5 Exposure and Cooking Fuel on Insulin Resistance in the PURSE-HIS Cohort. at ISEE Conference Abstracts 2018

Continuing medical education programs

- Respiratory Illness in Children a CME conducted by HAPIN project team along with Indian Medical Association, Kallakurichi branch on 28th January 2018 at IMA Hall, Kallakurichi, Villupuram district – There

were 40 paediatricians from Kallakurchi and sourrounding areas participated. Dr. Kalpana Balakrishnan (SRIHER) gave a talk on introduction to HAPIN project; Prof. Dr. Vijayalakshmi Thanasekaran gave a talk on approach to community acquired pneumonia and Dr. Venkatesh, Associate professor, JIPMER, Pondicherry gave a talk on approach to respiratory distress in a child.

- Respiratory Illness in Children a CME conducted by HAPIN project team along with Indian Medical Association Delta branches on 31st January 2018 at IMA Hall, Vijila Nursing Home, Thiruthuraipoondi – There were 50 paediatricians from various places of Thiruvarur and Nagapattinam districts participated. Dr. G. Thangavel (SRIHER) gavea talk on introduction to HAPIN project; Prof. Dr. P. Ramachandran gave a talk on approach to ARI in children and Dr. S. Lakshminarayanan of Thiruvarur gave a talk on Overview of lung ultrasound in diagnosis of pneumonia.
- CME conducted at Thiruvarur Medical College on 28th June 2018. Dr. G. Thangavel, SRHER introduced HAPIN project to the faculties of Thiruvarur Medical College. Dr. William checkley one of the HAPIN principal investigators and also an associate professor at pulmonary and critical care medicine, Johns Hopkins School of Medicine gave a lecture on "Challenges in diagnosing paediatric pneumonia in field intervention trials: The HAPIN approach". About 100 faculties and internes participated in the event.

Guest lecturers

- Dr. Antonello Punturieri, Program director, National Institutes of health, USA gave a guest lecture on Recent clinical trials in chronic lung diseases to the faculty and students of Thiruvarur Medical College on 20th February 2019.
- Dr. Eric D McCollum, MD, Department of Paediatrics, Eudowood Division of Paediatric Respiratory Sciences, Johns Hopkins School of Medicine gave a guest lecture on Current protocol in the diagnosis of childhood pneumonia at department of paediatrics, SRIHER on 26th August 2019. This lecture was jointly organised by Department of EHE and Department of paediatrics. About 25 people participated. Among them were paediatricians, PG students in paediatrics and faculty from EHE.

Invited Presentations at Major Conferences, Workshops and Meetings

- *Invited Speaker* at I Meeting of the Global Implementation Science Network for Clean Household Energy held at the Fogarty International Center, National Institutes of Health. Talk entitled "Making the argument for clean fuels : consolidating the evidence base for actions on household air pollution in India , April 20, 2015 Bethesda, MD, USA.

Annual and bi annual workshops conducted

- Household Air Pollution and Health: A Multi-Country LPG Intervention Trial (HAPIN) Inaugural Workshop. 30/10/2016 at Emory University, Atlanta, GA, USA. Dr. Kalpana Balakrishnan participated.
- HAPIN Pneumonia protocol workshop June 2017, Seattle, Washington, USA – To develop protocol for HAPIN pneumonia definition and surveillance. Dr. Vijayalakshmi Thanasekaraan and Dr. Sarada Garg participated.
- HAPIN India site selection review workshop, June 8, 2017, National Heart, Lung, and Blood Institute, Bethesda, MD 20892. Dr. Kalpana Balakrishnan and Dr.G. Thangavel participated.
- HAPIN Second annual workshop. September 11 – 15, 2017 at Emory University, Atlanta, GA, USA. Dr. Kalpana Balakrishnan, Dr. G. Thangavel and Dr. S. Sankar participated.
- HAPIN Third annual workshop. October 22nd – 26th, 2018 at Emory University, Atlanta, GA, USA. Dr. Kalpana Balakrishnan, Dr. G. Thangavel, Dr. S. Sankar, Dr. Krishnendu Mukhopadhyay, Dr. Naveen and Dr. Vigneswari participated.
- HAPIN Year 3 Steering Committee Interim Workshop. March 31st –April 4th, 2019 at Hotel Camino Real, Antigua Guatemala. Dr. Kalpana Balakrishnan, Dr. G. Thangavel and Dr. Sarada Garg participated.
- HAPIN Fourth annual workshop. October 21th – 25th, 2019 at Emory University, Atlanta, GA, USA. Dr. Kalpana Balakrishnan and Dr. Vigneswari participated.