

Honoring Air Quality Achievements



HAAGEN-SMIT **CLEAN AIR** AWARDS

October 24, 2024

California Environmental Protection Agency
Sacramento, California



CALIFORNIA
AIR RESOURCES BOARD



**The Haagen-Smit Clean Air Awards
are given annually to scientists, policy
makers, community leaders, and educators
from California and around the world
who have made significant lifetime
contributions to the advancement of
clean air and climate change science,
technology, and policy.**

"We should have learned by now that we cannot hope to change the laws of nature, but we can change human institutions. The road is not an easy one, but the reward ... is worth the effort."

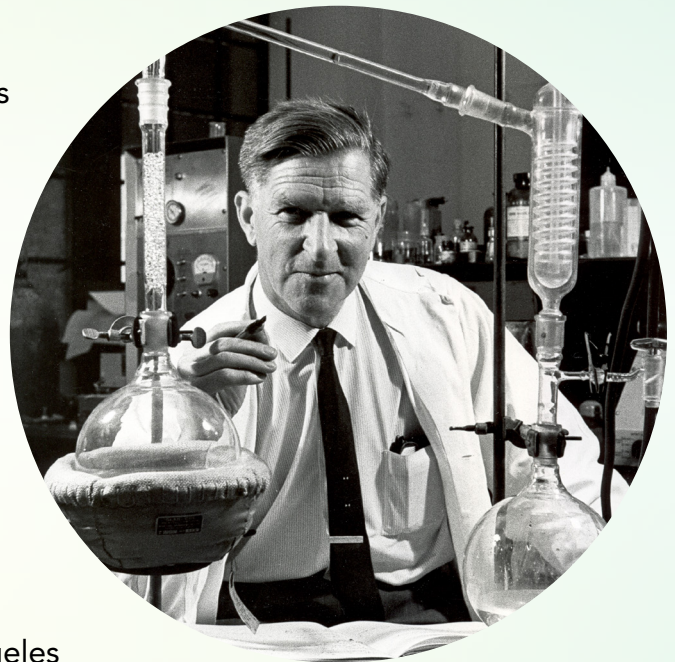
- Dr. Arie Haagen-Smit

Dr. Arie Haagen-Smit

Dr. Arie Haagen-Smit, a native of the Netherlands, was a leader in developing air quality standards based on his research efforts. Known by many as the "father of air pollution control," Dr. Haagen-Smit was a graduate of the University of Utrecht and a biochemistry professor at the California Institute of Technology (Caltech) in Pasadena for 16 years before beginning his air pollution research in 1948. At Caltech, Dr. Haagen-Smit studied the physiological aspects of natural products like rubber and pineapples. This work led to studies with his colleagues investigating the flavor components of wine, onions and garlic. His training and expertise in chemistry, along with his natural curiosity, brought him to the forefront of air pollution research when he was asked by the county of Los Angeles to investigate the chemical nature of what we now call smog. Noticeably different from earlier accounts of haze and dust in London, which was caused by coal, the eye-irritating haze in Los Angeles was brown and almost odorless. Dr. Haagen-Smit applied his technique of studying plant chemistry in enclosed clear chambers exposed to sunlight to figure out what caused smog in the Los Angeles air basin.

Through a series of experiments, he concluded that most of California's smog resulted from photochemistry – when substances in the exhaust from motor vehicles and the smokestacks of industrial facilities react with sunlight to create ozone. This breakthrough provided the scientific foundation for the development of both California's, and the nation's, air pollution control programs. In recognition of this contribution, Dr. Haagen-Smit received the National Medal of Science in 1973, the nation's highest scientific honor.

He became the California Air Resources Board's first chairman in 1968 after serving eight years as an original board member of Air Resources Board's predecessor, the Motor Vehicle Pollution Control Board. Dr. Haagen-Smit passed away in 1977, but his legacy lives on.



Since 2001, the California Air Resources Board has annually bestowed the distinguished Haagen-Smit Clean Air Awards. The awards are given to extraordinary individuals to recognize significant career accomplishments in at least one of these air quality categories: research, environmental policy, science and technology, public education and community service. Over the years, there have been 79 acclaimed recipients. In light of the global connection between air quality and climate change, the scope of the program has now expanded to include an international focus and a focus on climate change science and mitigation.

Past Winners

Daniel L. Albritton · 2022
Stephen O. Andersen · 2019
Janet Arey · 2011
Roger Atkinson · 2004
David Bates · 2004
Timothy Belian · 2005
Leon Billings · 2004
John Birks · 2019
Donald Blake · 2014
James Boyd · 2006
Tom Cackette · 2012
Junji Cao · 2019
William Carter · 2005
Judith Chow · 2011
Paul Crutzen · 2018
William B. DeMore · 2019
Joan Denton · 2010
Anne Douglass · 2018
Bradley Edgar · 2010
Alex Farrell · 2008
Barbara Finlayson-Pitts · 2013
Chet France · 2016
Axel Friedrich · 2006
John Froines · 2010
Prashant Gargava · 2022
Allen H. Goldstein · 2022
Daniel Greenbaum · 2016
Hal Harvey · 2018
James Hansen · 2007
Jiming Hao · 2015

David Hawkins · 2017*
John Holmes · 2001
Andrea Hricko · 2012
Timothy Johnson · 2009
David Kittelson · 2020-2021
James Lents · 2013
Kunsheng Li · 2020-2021
Alan Lloyd · 2007
Ron Loveridge · 2012
Bill Magavern · 2022
Gina McCarthy · 2017*
Mario Molina · 2017*
Curtis Moore · 2005
Mary Nichols · 2002
Janice E. Nolan · 2019
Margo Oge · 2009
Teruyuki Ohno · 2013
Paul M. Ong · 2020-2021
Fran Pavley · 2007
Joyce Penner · 2016
John Peters · 2009
James Pitts · 2002
Shankar Prasad · 2022
Kimberly Prather · 2015
Michael Prather · 2015
Veerabhadran Ramanathan · 2016
Juergen Resch · 2020-2021
Anumita Roychowdhury · 2016
Jonathan Samet · 2022
Robert Sawyer · 2008

Arnold Schwarzenegger · 2017*
Stephen E. Schwartz · 2020-2021
John Seinfeld · 2003
Jananne Sharpless · 2011
Peggy Shepard · 2022
Byron Sher · 2001
Kirk Smith · 2014
Richard C.J. Somerville · 2020-2021
Donald Stedman · 2015
Karl Taylor · 2019
John Wall · 2014
Barry Wallerstein · 2018
Michael Walsh · 2003
John Watson · 2018
Henry Waxman · 2017*
Henry Wedaa · 2008
V. John White · 2003
Joy Williams · 2019
Arthur Winer · 2006

* Legacy Award

** Posthumous Recognition

2023 Haagen-Smit Clean Air Award Recipients



Hofi A. Agyarko, M.Sc.
Director of Renewable Energy, Energy
Efficiency and Climate Change
Ghana Energy Commission
Environmental Justice



Richard C. Flagan, Ph.D.
McCollum-Corcoran Professor of
Chemical Engineering and Environmental
Science and Engineering
California Institute of Technology
Research



Prashant Kumar, Ph.D.
Professor & Chair of Air Quality & Health
University of Surrey, United Kingdom
International Education



Vickie Patton, J.D.
General Counsel
Environmental Defense Fund
Policy

Kofi A. Agyarko, M.Sc.

**Director of Renewable Energy, Energy Efficiency and Climate Change
Ghana Energy Commission**

Environmental Justice

Mr. Kofi Agyarko has been a leader in energy efficiency and energy conservation policies and programs in Ghana for decades, with expertise and impact that transcends international borders. With a Bachelor of Science in Finance and Banking from the University of Ghana and a Master of Science in Energy Management from BI Norwegian Business School, Mr. Agyarko has worked tirelessly to advance energy efficiency initiatives that benefit both people and the planet. This includes the fight against international trade practices of environmental dumping, where wealthy nations ship new and used consumer products, including outdated refrigerators and air conditioners with obsolete and high global warming potential refrigerants, to poor and developing countries that can ill afford the environmental, financial, and other burdens of such appliances. The environmentally harmful dumping of outdated cooling appliances in African countries is an environmental justice issue that directly affects millions of people, and also contributes to the global climate crisis.



As Director of Renewable Energy, Energy Efficiency and Climate Change at the Ghana Energy Commission, Mr. Agyarko led the Ghana delegation at the 35th Montreal Protocol Meeting of the Parties in Nairobi, Kenya in October 2023 and showed inspirational leadership in helping secure critical decisions. His expertise and negotiating skills, which included building an alliance of 54 African countries, led to a ground-breaking decision on environmental dumping. This decision recognizes that environmentally harmful product dumping problem requires a solution involving both exporting and importing countries, requests financing for developing countries from the Montreal Protocol's Multilateral Fund to help develop measures to prevent cooling appliance dumping and urges countries exporting such appliances to prohibit the export of cooling equipment that are not permitted in their countries. This decision ensures the accessibility of the best energy efficient technologies, using refrigerants more climate-friendly to Africa and other developing countries.

"His contributions to the game-changing decision of the Montreal Protocol to stop dumping is a masterpiece of modern multilateral diplomacy that sets an extraordinary example to ongoing crucial negotiations in the climate, chemicals, and biodiversity fora."

Hon Marco Gonzalez

Senior Expert Member, Montreal Protocol Technology and Economic Assessment Panel (TEAP)
and retired Executive Secretary of the Montreal Protocol Ozone Secretariat

Mr. Agyarko has also served as a member of the United Nations Environment Programme-Global Environment Facility lighting and refrigerating task force, a member of the Energy Efficiency Task Force of the Montreal Protocol Technical and Economic Assessment Panel and is currently the chairman of the Working Group on used products imported to Africa. Mr. Agyarko has been the focal person for the Economic Community of West African States Regional Center for Renewable Energy and Energy Efficiency since 2010. He is a passionate voice in Ghanaian media educating about energy conservation and defending energy conservation policies.

Mr. Agyarko's decades of leadership and expertise in energy conservation, combined with his drive to improve environmental stewardship and address the climate crisis, has repercussions beyond the borders of Ghana and Western Africa. For his steadfast work in advancing energy efficiency and energy conservation and opposing environmentally harmful product dumping, the positive impacts his work has had on improving air quality, mitigating the climate crisis, and addressing environmental justice inequities, as well as promise for future achievements, the California Air Resources Board is honored to bestow Mr. Kofi Agyarko with a 2023 Haagen-Smit Clean Air Award in the category of Environmental Justice.

Richard C. Flagan, Ph.D.

McCollum-Corcoran Professor of Chemical Engineering and
Environmental Science and Engineering
California Institute of Technology

Research

Professor Richard Flagan is a globally recognized and innovative experimentalist and researcher in aerosol science and instrumentation. In 1975, the Massachusetts Institute of Technology graduate joined the California Institute of Technology faculty to study aerosol science. Throughout his career, Professor Flagan has made transformative contributions to the field of aerosol science, developing innovative measurement techniques and advancing the understanding of aerosol dynamics and their environmental impacts.

One of Professor Flagan's most remarkable contributions to clean air was the development of novel aerosol measurement instruments that dramatically improved the accuracy and scope of atmospheric studies. These included developing the first low-pressure impactor for nanoparticle collection, and inventing scanning mobility particle sizers that enabled fast, size-resolved size distribution measurements in the submicron regime. Professor Flagan's perpetual innovation on aerosol instruments also enabled their airborne operation, both in the lower troposphere and polar stratospheric clouds, which played a critical role in providing in situ validation for satellite-based remote sensing of atmospheric aerosols. These pioneering efforts led to significant advancements in quantifying and analyzing aerosol particles, enabling more precise investigations into their roles in air quality and climate change.

By enabling measurements throughout the particle size range from molecular clusters through super micron particles, Professor Flagan's research provided critical insights into aerosol formation, composition, and behavior, at scales ranging from the very localized effects of near roadway exposures to that of the urban, regional, and global atmosphere. Through a combination of laboratory and field measurements, Professor Flagan's research provided the comprehensive data that is needed to probe the fundamental mechanisms of aerosol formation and growth and to assess their impacts on climate and health. Professor Flagan's work has been instrumental in shaping air quality policies at the national and international levels.



“Rick’s sustained innovations, excellence, and many accomplishments have radically advanced our knowledge in aerosol science in fundamental ways and guided related research around the world and improved our ability to understand and assess the impacts of aerosols on climate and health.”

Nga Lee (Sally) Ng

Love Family Professor,
School of Chemical and Biomolecular Engineering,
School of Earth and Atmospheric Sciences,
and School of Civil and Environmental Engineering,
Georgia Institute of Technology

Professor Flagan’s influence extends beyond his groundbreaking research. He has authored over 450 peer-reviewed publications, with an H-index of 114, and holds 28 patents, reflecting the far-reaching impact of his work on the scientific community. Professor Flagan managed to regain the copyright for his out-of-print textbook “Fundamentals of Air Pollution Engineering”, and made it freely available online, resulting in over 375,000 downloads and significantly expanding its impact, especially in developing countries and polluted mega-cities. Professor Flagan has also served on many professional societies such as the American Association for Aerosol Research and the California Council on Science and Technologies, where he provided important key guidance to policymakers addressing air quality and climate change.

In addition to his research, Professor Flagan is celebrated for his mentorship and leadership in the scientific community. He has guided numerous early-career scientists, fostering the next generation of leaders in aerosol science and environmental engineering. His commitment to education and research excellence has left an indelible mark on his students and colleagues alike.

For his pioneering contributions to the field of aerosol science, his leadership in environmental research, and his dedication to mentoring future scientists, CARB is honored to bestow Professor Richard Flagan with a 2023 Haagen-Smit Clean Air Award in the category of Research.

Prashant Kumar, Ph.D.

**Professor & Chair of Air Quality & Health
University of Surrey, United Kingdom**

International Education

Professor Prashant Kumar, a Professor of Air Quality & Health at the University of Surrey, UK, has been active in research and education across the globe, including in Brazil, China, Egypt, India, and the United Kingdom.

After earning degrees in civil and environmental engineering in India, Professor Kumar completed a doctorate in engineering at the University of Cambridge, UK, specializing in measurements and dispersion modelling of nanoparticles in the urban environment. Professor Kumar then joined the University of Surrey, where he rapidly advanced from Lecturer to Professor & Chair, and to Associate Dean. His widespread public outreach and education work has distinguished him as an uncommon academic who takes his research to the end users, from policy makers to the public.



Professor Kumar stands out for the “big picture” breadth plus very broad impacts of his air quality work. He is among the world’s most cited researchers, with contributions on indoor air, climate, health, and air quality mitigation solutions. Beyond transdisciplinary research, Professor Kumar has an exceptional commitment to both citizen science and public engagement for tackling air pollution and advancing sustainable practices. His exceptional and agenda-setting research on air pollution low-cost sensing, green infrastructure for air pollution abatement, and ultrafine particles is contributing to safer breathing in urban environments and leading future air quality research.

Professor Kumar has also demonstrated exceptional leadership by establishing air quality organizations such as Surrey’s Guildford Living Lab, Global Centre for Clean Air Research. The Guildford Living Lab, with over 150 collaborators across four continents, is a long-standing platform for cooperation between researchers, local communities, and other stakeholders, taking a citizen science approach to research and mitigation guidance. Professor Kumar is also a founding Co-Director of Surrey’s Institute for Sustainability. Moreover, Professor Kumar has worked tirelessly to translate complex science into practical lay-friendly resources, public-facing articles, educational videos, and engagement with media and policymakers. This includes notable work on resources for pollution exposure mitigation guidance that are used globally by schools, the transportation and land use sectors, indoor air quality measures, and urban greening policies. During the COVID-19 pandemic

“Professor Kumar’s exceptional commitment to public engagement in tackling the pressing issue of air pollution and advancing sustainable practices, makes him a unique academic who goes beyond his academic duties to take his research to the end users at the grassroot level.”

Ben McCallan

Senior Climate Officer, Greener Futures Team, Surrey County Council

he played a crucial role in prevention of airborne transmission through his work on masks, airborne virus sampling and building ventilation. Professor Kumar was a signatory of the influential letter to the World Health Organization, that called for greater acknowledgement of the role of airborne spread of COVID-19.

Professor Kumar also leads a large collaborative program, the RECLAIM Network Plus, on nature-based solutions for cities. He has also participated in and organized numerous award-winning community programs including citizen-lead sensor networks, car-free days, and learning initiatives on pollution exposures, urban overheating, and climate change literacy, such as Heat-Cool. For his impactful approach to academia and public engagement over the past 20 years, globally influential research, transdisciplinary leadership, pragmatic solutions, as well as promise for future achievements, the California Air Resources Board is honored to bestow Professor Prashant Kumar with a 2023 Haagen-Smit Clean Air Award in the category of International Education.

Vickie Patton, J.D.

General Counsel

Environmental Defense Fund

Policy

Ms. Vickie Patton has been integral in upholding numerous national and state climate change and air quality standards by utilizing science-based analysis, partnerships, public education, and strategic litigation. An environmental attorney and resolute clean air advocate, Ms. Patton has dedicated over 30 years to improving and protecting clean air regulations and promoting healthier air and a safer climate for all people and communities. She has been a powerful California ally when the state's waiver has been under attack. Her leadership and integrity have made her one of the most respected and accomplished leaders within the non-profit advocacy community.

Significant achievements of Ms. Patton's began early in her career with the Environmental Protection Agency (EPA). As a new hire tasked with implementing the Clean Air Act Amendments of 1990, she was awarded the Gold Medal for Exceptional Service for outstanding achievement and leadership in forging a landmark agreement on the control of air pollution from the largest coal plant in the western U.S.; she was also a lead in defeating the litigation to overturn these protections. EPA honored Ms. Patton for her work developing EPA's first policy supporting tribal air quality programs. Ms. Patton also was the principal author of the first EPA legal brief on the incorporation of environmental justice considerations into the Agency's air quality permitting decisions.

During her 26 years with the Environmental Defense Fund (EDF), where she currently serves as General Counsel, Ms. Patton has engaged in numerous, high-impact legal actions. Notably, Ms. Patton advocated to secure several landmark victories at the Supreme Court. In *EDF v. Duke*, the court's decision required coal plant pollution controls under the Clean Air Act. Despite opposition from the sitting administration and EDF having lost in the district court and the 4th Circuit, Ms. Patton pushed to appeal to the Supreme Court and EDF ultimately won in a unanimous ruling. Ms. Patton helped defend EPA's historic clean air standards limiting deadly soot and smog pollution by refuting sweeping constitutional attacks in the Supreme Court.



“Vickie, throughout her career, has made it her life’s mission to encourage government policy makers to enact laws and regulations that established feasible stretch goals that produce massive emission and health benefits.”

Chester J. France

Senior Strategic Advisor, Clean Transportation,
Environmental Defense Fund

She worked on Massachusetts v. EPA, the Supreme Court’s decision affirmed EPA’s authority and legal responsibility under the Clean Air Act to tackle greenhouse gas emissions. She has repeatedly defended in the U.S. Court of Appeals EPA’s resulting finding that greenhouse gases endanger public health and has extensively advocated for the EPA to carry out its responsibilities to address climate pollution from the largest and most pervasive sources including cars, trucks, power plants, and oil and gas. For decades, she has fought tirelessly to protect California’s authority to adopt world-leading tailpipe emission standards.

Ms. Patton has advocated on behalf of children and communities as a co-founder of Moms Clean Air Force, over 1.5 million moms, dads, and caregivers united against air pollution to protect children’s health. Ms. Patton’s impact, innovation, and leadership have left an incredible and lasting positive impact on clean air for people and communities. CARB is honored to award Ms. Vickie Patton the 2023 Haagen-Smit Clean Air Award in the category of Policy.



Carl Moyer Memorial Air Quality Standards Attainment Program

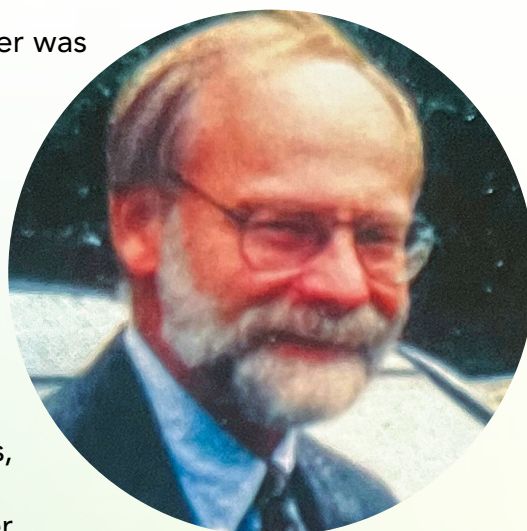
25th Anniversary Special Recognition Award

Born in Lafayette, Indiana, on February 13, 1936, Carl Moyer was an avid reader and had a gift for public speaking.

After receiving his Bachelors, Master's, and doctoral degrees in Mechanical Engineering, Dr. Carl Moyer was chief engineer for Acurex Corporation where he worked closely with CARB and made a deep impression.

Because of Dr. Moyer's visionary leadership and desire to improve California's air quality, CARB had the blueprint for its first incentive program, the Carl Moyer Memorial Air Quality Standards Attainment Program.

The Carl Moyer Program has replaced over 69,000 engines, allocated over \$1.5 billion dollars, spent over \$570 million dollars in Environmental Justice communities, reduced over 203,000 tons of NOx/ROG and over 8,000 tons of Particulate Matter from California's air since its creation 25 years ago after being named after the late legendary Dr. Carl Moyer whose children are here to accept a special recognition in his honor.



More Information

CARB Haagen-Smit Awards

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arb.ca.gov/hsawards