Clearing the air
Professor Tim Larson helps uncover the hazards of aircraft air pollution.
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The CEE community is taking concrete actions toward creating a more diverse, inclusive and equitable environment. To do so, the work of the Justice, Equity, Diversity and Inclusion (JEDI) Committee has accelerated in recent months, resulting in the implementation of several new initiatives.

“it’s important that the culture of the department be welcoming to all people, that’s core to our mission,” says professor Julian Marshall, who leads the JEDI Committee with associate professor Jessica Kaminsky.

Supporting and encouraging a diverse community is important for the future of engineering, says Marshall, as more diverse engineering teams lead to new ideas and solutions. “It’s also important for engineers today to consider the impact of their designs on society, he says.

“While it used to be ok to stick to just the equations, there’s a broader recognition now that we are here to solve problems in society and we have to be aware of social contexts,” Marshall says.

With these overarching goals in mind, and with input from students, faculty and staff, the JEDI Committee has ushered through several initiatives, with more on the way. A few highlights are provided below.

Gathering input

In spring 2020, students petitioned the department for meaningful change, asking for immediate action to “ensure a safe and inclusive educational environment, particularly for Black students, students of color, LGBTQ+ students, students with disabilities and other represented groups.”

“The student petition triggered significant change in our department,” Kaminsky says. “I hope the students who led it and signed it are proud of the positive impact their activism has had!”

In response to the petition, chair Laura Lowes organized a department-wide listening session in June 2020 to hear from students, staff and faculty. This was followed by town halls in February and May 2021. Throughout the year, students have been able to share thoughts, concerns and suggestions through weekly drop-in sessions with the JEDI Committee and an anonymous feedback form.

Building a Foundation of Diversity and Equity

Student advisory boards

To ensure that student voices are represented in department matters, including diversity, equity and inclusion efforts, student advisory boards were formed in January 2021. Representatives from both the undergraduate and graduate student classes serve one-year terms, working as liaisons between students and CEE’s faculty and administrators.

New courses

In spring quarter, the department introduced new courses that focus on diversity and inclusion topics. A three-credit class, Engineering, Environment and Justice, was taught by Khalid Kadir, an instructor at University of California, Berkeley. A one-credit JEDI Seminar, taught by Marshall, focused on topics at the intersection of JEDI and CEE’s six research areas as well as other critical topics such as climate change. A five-credit Grand Challenges Impact Lab course, taught by associate professor Ibeca Neumann, provided an opportunity for students to design civil infrastructure to meet the needs of Seattle’s homeless population. There was a waitlist for all three classes and the department hopes to offer similar courses next autumn to meet student demand.

Faculty and staff trainings

Formal JEDI trainings were offered to faculty and staff throughout the academic year, including a three-part training session in March 2021 and a one-time workshop on inclusive teaching in April 2021. Additional training sessions are anticipated for the 2021-2022 academic year.

Equitable bathrooms

Construction is currently underway to provide more women’s and gender-neutral restrooms in More Hall, an older building that houses much of the department. The project is expected to be completed by autumn 2021, when the UW plans to reopen campus.

Stay informed!
The JEDI Committee provides frequent updates at www.ce.washington.edu/JEDI
From RESEARCH to REALITY

CEE structures research informs new Mukilteo Ferry Terminal

A bumpy journey turned to smoother sailing after engineers decided to utilize research from CEE’s Structural Research Laboratory when designing the wharf for the new Mukilteo Ferry Terminal, which opened to the public in December 2020.

The new $187 million ferry terminal is located in close proximity to the Whidbey Island Fault Zone on a site that is highly susceptible to liquefaction and lateral spreading. Liquefaction and lateral spreading occur when the soil beneath a structure loses strength and liquefies, which can trigger lateral ground movement and settlement.

“CFSTs were very suitable for this project,” says Professor Emeritus Charles Roeder, who has researched CFSTs together with professor Dawn Lehman for the past 20 years. “They have been used in building foundations.

A stronger system

As the name implies, CFSTs are steel tubes that are filled with concrete. A type of structural frame system, CFSTs offer considerably higher strength and stiffness when compared to other pile designs that are commonly used in building foundations.

“CFSTs were very suitable for this project,” says Professor Emeritus Charles Roeder, who has researched CFSTs together with professor Dawn Lehman for the past 20 years. “They have two to three times the shear strength of a reinforced concrete shaft of the same size.”

From concept to construction

The process to implement the research entailed taking ownership of the concept and performing due diligence, says Alire. This involved tailoring the research concept to the needs and constraints of the project and working through technical questions with WSDOT’s structural engineer, alumnus Geoff Swett (MSCE ’98).

“Taking something from research to practice, a translation has to happen. There are steps in between that relate to due diligence, risk, and identifying constructability and how a contractor will build it,” Alire says. “The research gave us a great solid start to find a suitable solution that was experimentally substantiated.”

A challenging building site

The new $187 million ferry terminal is located in close proximity to the Whidbey Island Fault Zone on a site that is highly susceptible to liquefaction and lateral spreading. Liquefaction and lateral spreading occur when the soil beneath a structure loses strength and liquefies, which can trigger lateral ground movement and settlement.

“One of the biggest challenges was the liquefiable soil,” says professor Emeritus Charles Roeder, who has researched CFSTs together with professor Dawn Lehman for the past 20 years. “The liquefied soils are fairly deep, and a non-liquefiable soil layer rests on top,” Alire says. “If an earthquake liquefied the deep soil, the non-liquefiable crust would push against the wharf and try to drive it into the water with immense force.”

Typical wharf construction relies on piles driven into the earth and a horizontal concrete slab structure resting on top, with a connection between the two acting like a hinge. However, the engineers’ analysis indicated that during a seismic event this solution would result in excessive movements of up to seven feet, which would impact the overall stability of the structure. The design team explored several other options, but they all presented unique challenges and costs.

After learning about research in CEE’s Structural Research Laboratory that sounded promising, Alire reached out to CEE researchers to explore using concrete-filled steel tubes (CFSTs). Although the Washington State Department of Transportation (WSDOT), which oversees WSF, has utilized CFSTs in a handful of construction projects during the past decade, this would be their first time using them for a wharf structure.

Although they are widely used in countries throughout Asia and Australia, CFSTs are not often utilized in the United States, says Roeder, which is largely due to issues related to connecting the CFSTs to the rest of the frame system.

Working together with the UW researchers, the Mukilteo Ferry Terminal engineering team developed a system that paired CFSTs with a connection called a fixed pile head, the stiffness of which is around four times greater than other more commonly used connections. The combination resulted in enough strength to control the anticipated movement of the wharf during a seismic event.

“We did some preliminary studies and the results were that the structure went from several feet of movement to about a foot or less,” Alire says.

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The impacts of air pollution on communities living near airports are no longer up in the air, thanks to breakthrough research that has not only identified the previously unmeasured footprint of aircraft-originating air pollution, but has started to unravel public health concerns and explore mitigation measures.

CEE professor Tim Larson has been involved in all of these efforts, in collaboration with researchers at the UW University of Southern California; Tufts University and University of California, Los Angeles. In recent years, there has been a flurry of activity after researchers discovered a way to distinguish air pollution originating from aircraft from other sources, such as freeway traffic. This enabled them to map the corresponding footprint of aircraft air pollution.

"A lot of air quality studies were done near airports, but what was not fully appreciated were the impacts further downwind and the ultrafine particle plume that encompassed a larger area," Larson says. "It's clearly an issue of concern for people living near the airport."

The research may have considerable public health impacts, as ultrafine particles are not monitored or regulated by the federal government, although they may negatively affect health more than larger air pollution particles. In the United States, 40 million people live near major airports — and the population tends to be lower income minority groups and people of color.

"There is a lot of ethnic and racial diversity in South King County that overlaps with where the airport is and where the flight paths are," says Environmental & Occupational Health Sciences (EOHS) associate professor Edmund Seto. "Roadway traffic has traditionally been the major source of ultrafine particles that people have been concerned with, but now there's increasing evidence of health effects from aircraft ultrafine particles."

EOHS assistant professor Elena Austin (center) demonstrates air sampling methods to Washington State Representative Tim Green Delfl and SeaTac Deputy Mayor Peter Moon during a visit to Highline Public Schools last September. Photo credit: Mark Stone / UW Photography

**CLEARING THE AIR**

**A healthy concern**

Researchers are now exploring health impacts on people who reside near airports and are exposed to ultrafine particles from aircraft emissions. A recent study found that women who live near the airport have a higher risk of preterm birth. For the study, birth certificates from the California Department of Health were used to identify all mothers who gave birth from 2008 to 2016 while living within 15 km of LAX. The researchers determined in utero exposures using a novel dispersion model developed at the UW that predicted air quality impacts downwind of the airport. The findings revealed that expectant mothers with the greatest levels of exposure were 14% more likely to experience preterm births.

Premature newborns are at risk for a number of health problems — from heart, lung and brain development to vision and hearing impairments, according to separate health studies. Although it is not known exactly how ultrafine particles lead to preterm birth, studies link exposure to inflammation and increased oxidative stress that can damage cells, proteins and DNA.

"Larger particles can get in the airway, but the body can filter them out," Larson says. "The ultrafine particles are small enough that the body's defenses don't recognize them, so they can go through the barriers between the blood and lungs. They can go to all sorts of organs and can even cross over into the placenta."

Prompted by the findings at SeaTac Airport, the Seattle & King County Public Health Department released a study in December 2020, investigating the health of individuals who live near the airport. The study found lower life expectancy and increased risk of various health problems, from stroke to heart disease to respiratory problems.

"It certainly highlights the need for continued research," Austin says. "We don't know whether it's the air pollution or other types of community exposures near SeaTac that may be contributing to these health disparities, but they certainly exist and are quite striking."

**What are ultrafine particles?**

Communities near airports are exposed to ultrafine particle air pollution, which is not routinely monitored or regulated by the federal government. At less than 0.1 micron in diameter, ultrafine particles are 700 times thinner than the width of a human hair. But some ultrafine particles are even smaller — to differentiate these smaller ultrafine particles, which are between 0.01 to 0.02 microns in diameter, the UW researchers coined a new term, "ultra ultrafine particles."

**UW researchers, including professor Tim Larson, uncover previously unknown hazards of aircraft pollution**

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PacTrans launches doctoral webinar series

To create a platform for students to present their research to peers, Pacific Northwest Transportation Consortium (PacTrans) launched a new doctoral webinar series this spring. A regional university transportation center that is administered by the U.S. Department of Transportation, PacTrans provides funding to support more than 20 doctoral students at the UW and 48 doctoral students total across five universities in Washington, Idaho, Oregon and Alaska.

“The new webinar series is a vehicle to disseminate and showcase the research done by the students, as well as to encourage exchanges between students within and across the participating universities,” says Anne Vernez Moudon, PacTrans’ associate director of education and UW Professor Emeritus of Urban Design, who is spearheading the effort. “PacTrans has a strong program of tech transfer to ensure that the work being supported is shared broadly.”

The inaugural webinar was presented by Oregon State University doctoral candidate Chen Chen in March. He discussed his research to improve safety in the Cascadia Subduction Zone by assessing evacuation decisions using a new type of modeling framework.

To oversee and promote upcoming student webinars, a student advisory committee is being established. In addition to students at the consortium universities, Moudon hopes to also feature students at universities who are collaborating on shared research. They plan to organize about six webinars per year, which will be available online at www.depts.washington.edu/pactrans.

Urban Freight Lab’s sustainable last-mile delivery project

In the Belltown neighborhood of Seattle, the Supply Chain Transportation & Logistics’ (SCTL) Urban Freight Lab has launched one of the nation’s first zero-emissions delivery pilots that focuses on the “last-mile” — when parcels are moved from a transportation hub to a final destination. The project is a collaboration between the City of Seattle and tech and delivery companies including AxleHire, Coaster Cycles, BrightDrop and REEF.

“In partnership with our members, and the City of Seattle, we are excited to help catalyze a transition to zero-emissions last-mile delivery,” says SCTL director and CEE professor Anne Goodchild. “We anticipate the pilot will reduce traffic in Belltown, provide access to safe and convenient goods and services, and allow our partners to test novel, zero-emissions delivery solutions.”

The pilot project builds on the center’s ongoing work to alleviate traffic congestion by addressing the last leg of urban deliveries, when delivery couriers must locate both parking and customers. In addition to reducing congestion, improving urban delivery positively impacts sustainability, livability, business efficiency and consumer demand. “The new zero-emissions last-mile delivery approach focuses on transporting goods from a transportation hub to a final destination utilizing new technology and green transportation options. At a staging location, pallets are loaded with packages before being connected to a three-wheeled electric bike. A driver then delivers packages to customers via the most efficient routes available.

By employing innovative technologies and solutions, the pilot project is designed to make the delivery of goods and services more sustainable, which is in alignment with the City of Seattle’s new Transportation Electrification Blueprint that includes the goal of transitioning 30% of goods delivery to zero emissions by 2030.

RAPID Center collects post-wildfire data

The megafires that turned more than 7 million acres of West Coast land into smoldering rubble last summer left behind something valuable for researchers: perishable data.

“There are long-term lingering effects of these wildfires that we don’t fully understand — and which can significantly impact affected communities,” says CEE professor Joe Wartman, who directs the Natural Hazards Reconnaissance Facility (known as RAPID), which supports data acquisition in the aftermath of natural disasters.

Following the 2020 megafires, RAPID partnered with researchers on the West Coast to gather perishable data at three wildfire sites in Oregon. The most immediate use of the data will be to better understand a type of landslide called post-fire debris-flow, which has resulted in numerous deaths. This hazard results from chemical changes to soil during extreme burning, which can form an organic coating on the soil that repels water, causing rain to run off rather than be absorbed into the ground. Collecting mud and debris, the runoff can be life-threatening as it rushes downhill.

To improve warning systems, researchers are updating the federal government’s models for post-fire slope stability hazards. To document the condition of post-fire hillsides in areas likely to experience debris flow, researchers collected high-resolution aerial imagery and lidar data, which will be used to generate 3D images that show detailed topographic information. This will be used to map post-fire sediment and debris loading of channels and to monitor erosion.

TRAC works on transit tech for underserved groups

Mobility applications focus on efficiency and finding the shortest paths, leaving out information critical to people with disabilities, older adults and anybody needing more support. Now, the UW is leading a team working toward a solution. Two UW centers, together with Microsoft, Google, Washington Department of Transportation and other public and private partners, are collaborating on the Transportation Data Equity Initiative.

The U.S. Department of Transportation awarded the project $11.45 million in January as part of a program focused on promoting independent mobility for all. The UW centers involved are the CEE-affiliated Washington State Transportation Center, directed by Mark Hallenbeck, and the Taskar Center for Accessible Technology, part of the Paul G. Allen School of Computer Science & Engineering at the UW.

Three demonstration applications will be built as part of the UW-led initiative, addressing the challenges of underserved populations and showing how the data can be used. The Taskar Center’s Multimodal AccessMap app will facilitate A-to-B trip planning for people with mobility limitations. The Soundscape app, developed by Microsoft, will enable spontaneous travel for people who are blind and visually impaired. 3-D Digital Twin, developed by San Francisco video game company Unity Technologies, will be a 3D virtual reality simulation tool that will allow older adults and multilingual travelers to explore, assess and visualize a trip. The applications will be deployed in 2022 in six counties in Washington, Maryland and Oregon.
REMEMBERING
Professor Emeritus David Stensel

With a lifelong passion for returning clean water to the environment through natural biological processes, Professor Emeritus David Stensel was truly a fount of knowledge. Over the years, he made notable research advancements, authored a textbook and was recognized with numerous awards.

“Dave was a generous colleague who freely shared his knowledge and skills, never holding back,” says Research Professor Emeritus Stuart Strand. “He was a fine mentor as evidenced by the success of his students in academia and many other doctorate and master's students who have gone on to success in wastewater and remediation engineering.”

Stensel passed away in March 2021 at the age of 76. He received his Ph.D. in environmental engineering from Cornell University and joined UW CEE in 1984 after teaching at the University of Utah for four years and working in industry for a decade. He retired in 2016 after 32 years of teaching and conducting research with the department.

As a colleague, Stensel was known as a good friend and research collaborator. He shared grants and lab space with numerous faculty over the years, in addition to sharing his knowledge and expertise.

“I frequently asked Dave to explain how some treatment process actually operated as opposed to the way it was described in textbooks, and he was invariably able to enlighten me,” says Professor Emeritus Mark Benjamin. “He did so not just willingly and thoughtfully, but with palpable excitement that came from a place of true love for his profession.”

Research highlights

Stensel is most well-known for his work to advance biological nutrient removal processes, which entails using microorganisms to break down organic substances in wastewater without the use of chemicals. Stensel focused on phosphorus recovery as well as the biodegradation of estrogen compounds in wastewater treatment. He worked closely with students designing and executing experiments that often led to breakthroughs.

“That was just like Dave, always reaching out to understand new techniques, to apply them to advance the scientific basis and the cutting edge of environmental engineering,” says Strand.

After retirement, Stensel remained involved in research and led a project to develop an innovative new wastewater treatment system with the goal of improving surface water quality at a lower cost than other options, while also saving space and energy. As part of the research, a pilot study was conducted at Seattle's West Point Treatment Plant. During retirement, Stensel was also in demand as a water treatment consultant throughout the country.

Publications and awards

Stensel is the co-author of a textbook on wastewater engineering that is widely used in the classroom and by practicing engineers. Titled “Wastewater Treatment Engineering,” the fifth edition was published in 2014. Stensel stood out for having expertise that spanned the latest tools and theories to long-established fundamentals, say colleagues.

“As a result, he was constantly in great demand to contribute chapters to textbooks, serve on advisory committees with practitioners, and collaborate on research projects with colleagues from other institutions,” says Benjamin.

Over the years, Stensel received numerous honors, including the ASCE Rudolf Hering Medal, the Water Environment Federation Harrison Prescott Eddy Medal, which he was awarded twice, the Water Environment Federation George Bradley Gascoigne Medal, and the Frederick George Pohland Medal from the American Academy of Environmental Engineers and Scientists.

One of his greatest honors was receiving the Water Environment Federation’s 2019 Camp Applied Research Award, the highest award bestowed by the society to a researcher who helped advance the development of wastewater collection or treatment systems.
Contaminated urban lakes pose consumption risk

After analyzing the human health risks of eating aquatic organisms from arsenic-contaminated urban lakes in the Puget Sound lowlands, UW researchers have a menu of concerns. Specifically, they found that consuming certain aquatic organisms in the lakes elevates cancer risk.

"The idea was to focus on organisms that people might eat, so we studied snails, crayfish and sunfish," says CEE associate professor Becca Neumann. "What we are seeing is elevated levels of arsenic in them."

Four small public access lakes with varying levels of arsenic contamination and depth were selected for the study: shallow lakes Bonney Lake, Steel Lake and Lake Killarney, and Angle Lake, which is deeper than the others. All are located downwind of the former Tacoma-area ASARCO copper smelter, which pumped waste byproducts that contained arsenic and lead into the air for 96 years before ceasing operation in 1985.

Overall, the researchers found the shallow lakes had proportionately more arsenic in the sediments near the shore when compared to the deeper lake and that near-shore sediment and shallow water arsenic concentrations controlled the amount of arsenic in tissues of the snails, crayfish and sunfish. Lake Killarney, a shallow lake with the highest concentrations of arsenic in near-shore sediments, posed the greatest human health risk. The study builds on research conducted two years ago, when the researchers discovered that the water of some shallow lakes contains surprising levels of arsenic, due to unique characteristics that facilitate the movement of arsenic from lakebed sediment up into the surface waters and near-shore areas where the aquatic food web resides.

Although it’s currently unknown how many people may be eating from the lakes, the researchers speculate that some populations may be fishing for subsistence reasons rather than sport. Many states, including Washington, don’t require a permit to harvest snails.

"The population we see out there fishing on a regular basis is more diverse than the nearby homeowner populations," says Jim Gawel, associate professor of Environmental Chemistry and Engineering at UW Tacoma. "There are fishermen who come out when they stock trout in the lakes, but there’s also a population that fishes throughout the year."

Supported by UW’s Superfund Research program, the research team includes scientists from UW Civil & Environmental Engineering, UW School of Aquatic & Fishery Sciences, UW Tacoma Environmental Sciences, and Dartmouth College Department of Earth Sciences.

Arsenic exposure and cancer risk

Arsenic enters the aquatic food chain primarily through diet. This occurs when plankton ingest arsenic, mistakenly thinking it is a nutrient, before being consumed by other organisms. Arsenic diminishes in organisms as it moves up the food chain; however, this means that eating lower on the food chain is especially problematic.

"Snails have a lot of arsenic in them, as they are crawling on the surface of the lakebed and are grazers," Neumann says. "With snails, we found that in all of the contaminated lakes there was increased cancer risk."

Snails on average contained the most arsenic of the three species investigated. Concentrations of arsenic in snails and crayfish from Lake Killarney were higher than all other lakes in the study. Arsenic concentrations in fish were also highest in Lake Killarney, followed by Steel Lake. The researchers calculated that consuming aquatic organisms from Lake Killarney resulted in four to ten times greater health risk compared to organisms from the deeper Angle Lake, which has similar arsenic concentrations in sediments from the deepest part of the lake.

According to the researchers, cancer risk is determined by the aquatic organisms’ concentration of inorganic arsenic, which is highly toxic compared to organic arsenic, and the quantity of organisms consumed by people. Based on their findings and Washington State Department of Health (DOH) guidelines, the researchers advise no consumption of snails or crayfish from the arsenic-contaminated lakes in this study (Steel, Killarney, and Angle lakes) and no more than one meal per month of sunfish from Lake Killarney.

Next steps

The researchers are in the early stages of working with the DOH to explore issuing a fish consumption advisory for the lakes.

"The risk is there, but the question is how many people are at risk?" Gawel says.

If additional funding is approved, the researchers plan to survey lake users about their food consumption. They also hope to create a screening tool to quickly determine if lakes have concerning levels of arsenic in the food web, explore remediation technologies to remove arsenic from lakebeds, and investigate the impact of arsenic on aquatic organisms.

Community collaborators

Community partners include Washington State Department of Ecology, Washington State Department of Fish & Wildlife, Environmental Protection Agency Region 10, Public Health Seattle/King County, King County Environmental Programs, City of Federal Way, Lake Killarney Improvement Association, Steel Lake Management District Advisory Committee and Angle Lake Shore Club.
interested in helping us out,” says Davidson, whose uncle a good excuse to reach out to her and ask if she’d be When the Lunar Loo contest came around, I saw it as one were aboard the 1993 Endeavour. Lieutenant General Susan Helms, the first U.S. military Upon learning about the contest, Davidson quickly enthusiasm using space plumbing: retired Air Force shuttle Endeavour in 1993. Davidson, whose fascination with space dates back to Being a fan of space, it was easy for me to get hooked "She said aiming is an on-the-job learning curve. Other notable problems, Helms said, were inconsistent vacuum suction, which didn’t fully keep waste away from the posterior, and difficulty aiming into the toilet. Space toilets have a 4-inch diameter, in comparison to about 10 inches for standard toilets. Space toilets separate solid waste from liquid waste, a suction hose with different attachments for women and men is employed for liquid waste. This poses one of the biggest challenges for women when using a space toilet, Helms shared, since it’s not possible for women to complete both bodily functions at once, due to their anatomy. Dynamic design Although the four-member team didn’t have any previous experience designing toilets, they completed their design in fewer than two months. “Our goal, to paraphrase the Navy’s KISS principle, was to Keep It Simple, Silly. We developed a straightforward design that adapted existing, proven products in a clear, logical way that is easily serviceable and avoids the pitfalls of the current space toilets,” says Vaswani, who is employed at Magnusson Klemencic Associates. The first challenge the team addressed was replacing suction, which has historically been used to pull waste into space toilets in the absence of gravity. As an alternative, the team decided to try pushing the waste down from the top of the toilet. To do so, they utilized one of the most powerful fans on the market, the bladeless Dyson Ring Fan, which they placed directly below the toilet seat and positioned to blow downward. To make the toilet easier for women to use, the team’s design allows liquid and solid waste to be collected in the same chamber. The design also makes aiming easier with a larger seat, which is crafted from memory foam to create a better seal. Another signature element of the team’s design was a new approach to waste collection. Modeled after the Diaper Genie, which seals babies’ diapers separately upon disposal, waste from the space toilet can be sealed automatically between uses. Ready to launch NASA engineers are now taking the top winning designs into consideration as they develop a space toilet that will be utilized specifically for NASA’s Artemis program, which intends to land the first woman and next man on the moon in 2024. “I do hope I can say something I put my fingerprint on the moon in 2024. "Making sure that project owners receive a good product and good value with taxpayer dollars is really important,” says Betty, who retired from KBA in 2019. “The way that taxpayer money is deployed and handled must comply with the community commitments that have been made.” Over the years, Betty grew the company from one person to more than 100 employees and oversaw the management of multi-million dollar construction projects for local and regional entities including the Washington State Department of Transportation, Sound Transit, King County, King County Housing Authority and City of Seattle. Enhancing trust and productivity between public agencies, construction managers and contractors, Betty says, relied on a new approach. “It’s deeper than communication, it’s the ability to spot potential problems and diligently pursue resolution,” Betty says. “Conflicting priorities often arise during the construction phase of a project, resulting in cost, schedule, technical or compliance issues. My team helped owners, contractors and designers reach a consensus on appropriate solutions.” Over the moon Alumni win NASA contest to design better space toilet It’s an out-of-this-world accomplishment: Two CEE alumni took first place in a NASA contest to design a better toilet for astronauts to use on the moon. With an innovative, yet straightforward design that also makes space toilets more accessible for women astronauts, alumni Byron “Boone” Davidson (BSCE ’11) and Kunal Vaswani (BSCE ’11) competed against more than 2,000 teams in NASA’s Lunar Loo Challenge. The contest crowdsourced designs for compact toilets that operate in lunar gravity, which is about one-sixth of the gravity on Earth. “Being a fan of space, it was easy for me to get hooked on this project. I was working on something that could end up on the moon — that was mind blowing,” says Davidson, whose fascination with space dates back to his childhood when he attended the launch of the space shuttle Endeavour in 1993. Upon learning about the contest, Davidson quickly assembled a team and also contacted someone with experience using space plumbing: retired Air Force Lieutenant General Susan Helms, the first U.S. military woman in space, who was aboard the 1993 Endeavour. “When the Lunar Loo contest came around, I saw it as a good excuse to reach out to her and ask if she’d be interested in helping us out,” says Davidson, whose uncle is a friend of Helms. Expert advice Interviewing a former astronaut was more insightful than the team could have imagined. Helms shared her struggles using toilets on various space shuttles, as well as the International Space Station, and explained that space toilets have historically been designed for men. Since space toilets separate solid waste from liquid waste, a suction hose with different attachments for women and men is employed for liquid waste. This poses one of the biggest challenges for women when using a space toilet, Helms shared, since it’s not possible for women to complete both bodily functions at once, due to their anatomy. Other notable problems, Helms said, were inconsistent vacuum suction, which didn’t fully keep waste away from the posterior, and difficulty aiming into the toilet. Space toilets have a 4-inch diameter, in comparison to about 10 inches for standard toilets. “She said aiming is an on-the-job learning curve. There is even a mock space toilet at the training facility for astronauts to try before they have to use a toilet in space,” says Davidson, who is employed by MacKay Sposito, an energy, public works and land development company. Second annual CEE Distinguished Alumnus Award Alumna Kris Betty (BS ‘83) dedicated her career to the advancement of public works in the region. To do so, she not only built large infrastructure projects — she also built trust. In recognition of Betty’s work to improve the civil engineering field by increasing public agencies’ confidence in the construction management process, she is the recipient of the second annual CEE Distinguished Alumnus Award. Founded by CEE chair Laura Lowes, the award acknowledges the achievements of alumni in industry and highlights how civil and environmental engineering degrees create meaningful impact. “Early on in my career, there was a fundamental lack of trust and mismatch between project owners and contractors, so there was an opportunity to bring professionalism, attention to detail and accountability to how designs get constructed,” says Betty. Having identified a need that wasn’t currently addressed in the profession, and which she felt passionate about, Betty founded KBA, Inc. in 1994. Based in Bellevue, Washington, the engineering firm specializes in construction management services for large-scale transportation, water and wastewater, port facility and land development projects. “Making sure that project owners receive a good product and good value with taxpayer dollars is really important,” says Betty, who retired from KBA in 2019. “The way that taxpayer money is deployed and handled must comply with the community commitments that have been made.” Over the years, Betty grew the company from one person to more than 100 employees and oversaw the management of multi-million dollar construction projects for local and regional entities including the Washington State Department of Transportation, Sound Transit, King County, King County Housing Authority and City of Seattle. 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People of color hardest hit by air pollution

A new study models peoples’ exposure to air pollution and shows that exposure disparities among people of color and white people are driven by nearly all emission source types, rather than just a few. A team of researchers, including CEE professor Julian Marshall, have found that white people are exposed to lower-than-average concentrations from emissions source types that, when combined, cause 60% of their total exposure. Conversely, people of color experience greater-than-average exposures from source types that, when combined, cause 75% of their total exposure.

Genetically engineered grass cleanses toxic soil

Large swaths of U.S. military land are covered with munitions components, including the explosive chemical RDX that doesn’t naturally break down and can contaminate groundwater. Designated as a priority pollutant by the Environmental Protection Agency, RDX is toxic and can cause cancer. Now, a team of researchers, including CEE Research Professor Emeritus Stuart Strand, has genetically engineered switchgrass to remove RDX from soil. This is the first time researchers have used a genetically engineered plant in the field to remove pollutants that are resistant to degradation.