

THE YEAR IN REVIEW

ULSE International Standards 2023



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Letter to Our Stakeholders



Dear Stakeholders,

In 2023, we celebrated the 120th anniversary of our first standard, UL 10A – Standard for Tin-Clad Fire Doors. Today, we carry on that legacy by translating scientific discoveries into standards and policies that have the power to make a systemic impact on public safety.

As UL Standards & Engagement continues to grow and evolve, our commitment to safety science and standardization remains steadfast. We convene experts from around the world to develop practical, action-oriented safety standards, and we also serve as a vital resource for regulators and policymakers as they help advance standards and promote safety science. In 2023, we made further strides in deepening our collaborative work and initiatives with our international partners, demonstrating that we could amplify safety science conversations via partnerships that are equally committed to our safety mission.

Electrification has been a top priority area for ULSE International, and we have been relentless in advocating for standards and supporting initiatives that enable economies to have a smooth transition from fossil fuels to renewable energy, battery energy storage systems, and electric vehicles. We want to support economies in meeting their net-zero commitments; as such, we develop standards to mitigate safety risks that come with electrification while accelerating the acceptance of innovation and trust-building among international stakeholders. At the same time, fire safety has been the heart of our organization since its inception. We continue to maintain our extensive suite of fire safety standards and provide technical assistance on how they can be implemented and leveraged by our partners to enhance safety.

Through our working partnerships with other international standards organizations such as the International Electrotechnical Commission and the International Organization for Standardization, we remain committed in ensuring that UL standards can be adopted, harmonized, and used internationally. Apart from partnering with international stakeholders to address safety challenges, our regional teams are ever ready to ascertain international participation in ULSE's standards development process is fruitful. We thank all stakeholders for contributing your valuable time and expertise, to advance the UL mission of working for a safer, more secure, and sustainable world.

In the year ahead, I look forward to what we can achieve together, as we continue to translate safety science into action.

Sonya M. Bird

Vice President, International Standards
UL Standards & Engagement



Battery Safety

With increasing global demand for batteries to power clean energy technologies, opportunities and risks are multiplying in equal measure. Lithium-ion batteries are needed to power a growing fleet of electric vehicles, provide electricity storage for power grids, and harness energy generated by solar and wind technology. Innovative circular economy solutions are also needed for end-of-life processes to prevent e-waste. But if damaged, malfunctioning, modified, counterfeit, or otherwise substandard, these batteries can enter thermal runaway, an uncontrollable, self-heating state that can lead to smoke, fire, toxic off-gassing, or explosion. Our standards offer solutions that help mitigate these risks.

Through our international activities in 2023, we advanced greater global safety and understanding of these risks:

India

Throughout 2023, we led a webinar series with the India Energy Storage Alliance. The series covered standards including UL 2271 and UL 2580. More than 350 participants attended and participated in robust discussions on opportunities for the adoption and adaptation of these standards in India and other markets around the world. In August, we kicked off a three-year collaborative program between ULSE and the U.S. Commercial Services with the Building Robust Safety Ecosystem for EVs in India Conference. Through our partnership, we aim to develop common standards and conformity assessment framework



Standards for Electric Vehicles and Charging Systems

UL 2202, DC Charging Equipment for Electric Vehicles

UL 2251, Plugs, Receptacles, and Couplers for Electric Vehicles

UL 2271, Batteries for Use In Light Electric Vehicle (LEV) Applications

UL 2580, Batteries for Use in Electric Vehicles

Standards for energy storage systems:

UL 1973, Batteries for Use in Stationary and Motive Auxiliary Power Applications

UL 1974, Evaluation for Repurposing Batteries

UL 9540, Energy Storage Systems and Equipment

UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems



for the safe deployment of EVs in India. The conference featured a host of expert speakers and government leaders, including ULSE Executive Director Dr. David Steel, U.S. Ambassador to India Eric Garcetti, and India Minister of Road Transport and Highways Nitin Gadkari.

In the same month, we also served as the knowledge partner for the sixth Fire & Security India Expo, hosted by the Fire & Security Association of India. The expo featured a live demonstration of a lithium-ion battery fire and mitigation from the Maharashtra Fire Services, with support from FSAI and the Electrochemical Safety Research Institute. It also featured presentations on the risks and mitigation best practices for fire and explosion from EV batteries and charging systems. Presenters included Dr. David Steel; ESRI Executive Director Dr. Judy Jeevarajan; and ULSE VP of International Standards Sonya Bird, among others.

We also participated in several BESS-related events hosted by partners including the Bureau of Indian Standards, the Indian Institute of Technology-Delhi, and the India Energy Storage Alliance. In these events, we discussed the need for thermal runaway testing standards and codes in India and presented UL 9540 and UL 9540A as solutions to advance safety in BESS deployment.

Vietnam

In April, we joined with the Directorate of Standards, Metrology and Quality of Vietnam to host the Supporting Clean Energy Goals and Industry Development Through Standards conference in Hanoi. The conference featured more than 120 speakers and participants, including standards leaders and industry experts, with discussions on the role of electrification standards in accelerating the country's clean energy transition. The workshop also addressed various aspects relating to EV batteries and charging systems including cost, interoperability, safe implementation, and end-of-life management. Participants included representatives from ULSE, UL Solutions, VinFast, Toyota, the Institute of Energy Vietnam, the Singapore Battery Consortium, the Vietnam Certification Centre, and the Vietnam Standards & Quality Institute, among others.

Latin America

In August, we collaborated with UL Research Institutes to launch the Latin America Battery Safety Summit in Mexico City. Speakers from the UL organizations and other experts from local standards associations, fire departments, and research bodies discussed various aspects of electric mobility – from safe manufacturing and usage, to challenges with safety, battery fires, and emergency response – and shared how standards and certification could address associated risks.

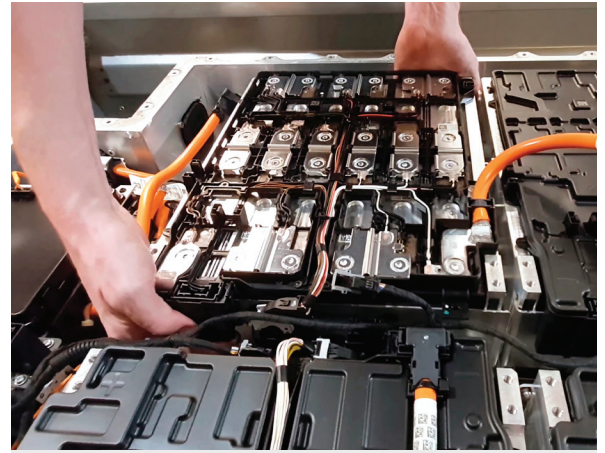
China

Our BESS standards, UL 9540 and UL 9540A, are a major topic in China, where Regional Managers Eric Zhang and Jessie Guo have spoken at several industry events on the benefits these standards bring toward ensuring safer operationalization of BESS. Some of these events include the World New Energy Storage – Conference and Cable Technology Forum and the 11th Energy Storage International Conference and Expo in Beijing. We also co-hosted an Energy Storage Conference with the Shanghai Electrical Apparatus Research Institute, as well as an energy storage workshop with the Dongguan Standard Association, where we talked with stakeholders on the benefits our standards could bring to the city's energy storage industry.

Acknowledging the role academia plays in driving knowledge through research, we jointly hosted a technical workshop on our BESS-related standards with the Shenzhen Institute of Standards and Technology to approximately 90 local stakeholders from the clean energy industry. Speakers explained how UL 9540 and UL 9540A could be applied for Chinese stakeholder needs.

Middle East

In November 2023, ULSE attended the Gulf Standards Forum, hosted by our partner, the GCC Standards Organization, to introduce and promote the role of standards between member states and representatives of the Gulf and Gulf industries. We shared how standards are currently supporting the global clean energy transition while also enhancing countries' economies. Guided by the MOU signed in 2021, ULSE and GSO are working together to promote safety, security, and sustainability through standardization in the Middle East.



UL 1974, Evaluation for Repurposing Batteries

As EV batteries near the end of their initial service life, they still retain close to 70-80% of usable energy capacity. To help prevent usable batteries from adding to the accumulation of e-waste, UL 1974 provides requirements for sorting and grading processes that allow batteries to be repurposed in other applications, such as stationary energy storage systems. Stakeholders around the world have expressed enthusiasm at the potential of UL 1974 to bolster their domestic battery economies.





Circular Economy and Sustainability

Many of our standards incorporate sustainability and sustainable practices into various products and industries. Our circular economy standard, UL 3600, is the first standard that could assist companies in evaluating circular economy efforts and quantifying corporate sustainability at the site, product, and company levels. Our international stakeholders have shown much interest in the standard and its impact on driving circular economy efforts.

Vietnam

In July, we coordinated with STAMEQ to organize a technical workshop for Vietnamese stakeholders on the scope and impact of UL 3600. Bill Hoffman, business manager at UL Solutions and member of TC 3600, shared how the standard enables companies to determine and measure the overall efficacy of their sustainability efforts.

APEC

In August, Dr. David Steel and Dr. George A. Borlase presented on our sustainability standards at the battery energy storage system workshop held as part of the third Asia-Pacific Economic Cooperation Senior Officials' Meeting, SOM3, in Seattle. Steel noted that the need for renewable energy in the APEC region is underscored by the threat of climate change, the depletion of conventional fossil fuels, and challenges of global supply chain disruption, and he outlined the role of BESS in helping to overcome intermittency of weather-dependent renewable energy sources such as wind and solar energy, while explaining how ULSE is helping lithium-ion battery technology develop safely to address these issues. In another presentation, Borlase provided further details on

ULSE's extensive range of energy standards, and highlighted how they can provide effective solutions to the challenges of BESS while increasing public acceptance and contributing to an economy of scale.

India

In December, Senior Regional Standards Project Manager Richie Stephen participated in a panel discussion at Times of India Right to Excellence – Energy Summit 2023, where he presented our sustainability standards as possible solutions to issues faced by India's circular economy and waste management industries.

Standards for Circular Economy and Sustainability

UL 3600, Measuring and Reporting Circular Economy Aspects of Products, Sites and Organizations

UL 746S, Evaluation of Sustainable Polymeric Materials for Use in Electrical Equipment

UL 3420, Formulated Plastics Packaging

UL 110, Sustainability for Mobile Phones



Autonomous Vehicles

In 2023, ULSE published the third edition of UL 4600, the Standard for Safety for the Evaluation of Autonomous Products. This latest edition expands the scope to cover autonomous trucking, with trucking-specific examples incorporated into the safety cases of the standard. The standard remains technology-neutral and non-prescriptive, while expanding coverage of all aspects of autonomous technologies and functions.

Webinars and roundtable discussions were held throughout 2023 to educate stakeholders across East Asia, the Middle East, and India, on the expanded scope of UL 4600 and its ability to support the adoption of autonomous technology in these regions.



Standard for Autonomous Vehicles

UL 4600, Safety for the Evaluation of Autonomous Products



Fire Safety



Fire safety science has been a critical pillar of our organization since its inception more than 120 years ago, and we continue to support industry and regulatory bodies in developing standards that cover fire prevention, detection, and suppression. Our portfolio of fire-related standards has grown to include more than 1,500 standards, and we continue to address the world's most pressing fire safety risks and dangers through standards development, research, and advocacy to empower communities with the knowledge and tools to prevent and manage fire hazards.

LATAM

In 2023 we hosted and presented at several events to share our expertise in fire safety management through standards. These include webinars, in-person events, and meetings with organizations including the Society of Fire Protection Engineers Mexico, the Costa Rica College of Electrical, Mechanical and Industrial Engineers, the Peru Institute of Occupational Health and Environment Safety, and the Colombian National Fire Protection Association.

The 2023 LATAM Fire Expo in September was a key fire protection event in the Latin American region to bring together experts to drive optimal impact. ULSE engineers Wil Fletcher and Jonathan Lopez spoke on the collaborative initiatives between ULSE and external stakeholders to drive enhanced understanding of the scale and nature of fire situations and incidents in the region's economies. They also highlighted the wide range of UL standards that support both active and passive areas of fire protection. Participants included fire agencies and regulatory authorities.

In October, we organized the 2023 LATAM Fire Safety Congress in Costa Rica, which gathered more than 100 fire safety experts from standardization and fire protection organizations including the Argentine Institute of Standardization and Certification and the National Fire Protection Association, among others. Participants



explored the fire safety challenges and opportunities Latin American economies faced, and discussed how organizations like ULSE can strengthen their fire protection systems through the expanded use of safety standards, education, and heightened risk awareness.

As the first foreign standards development organization authorized by the Dirección General de Normas to develop standards for Mexico, ULSE collaborates with industry experts in Mexico on the development of standards for fire safety products, systems, and installations, as well as life-saving devices such as life jackets and personal flotation devices through its Technical Committee for National Standardization of Fire Safety and Lifesaving Devices. Through the CTNNNSCIDS, we have worked to incorporate the following UL standards to the Mexican National Standardization Plan across two categories:

1. Ready for Publication in the Official Gazette

- a. NMX-S-448-UL-2021, Standard for Pumps for Fire Protection Service
- b. NMX-S-10C-UL-2021, Standard for Positive Pressure Fire Tests of Door Assemblies

2. In Development

- a. Joint Standard with the Association for Standardization and Certification on Test Methods for Fire Pump Motors
- b. Standard on Visible Signaling Devices for Fire Alarm and Signaling Systems, including Accessories

Middle East

Through our partnership with the Saudi Standards, Metrology and Quality Organization, we organized a workshop series throughout 2023 on fire doors, fire door Hardware, Curtain Assemblies, and Cladding. Regional Manager Zahi Daher and UL Solutions Engineering Manager Jonathan Gonzalez presented to local stakeholders on standards for fire protection safety, including UL 10, UL 305, and UL 723. The robust participation by SASO members and stakeholders is an affirmation of the value of transferring knowledge and experiences, that could empower local authorities and communities to make local landscapes safer and more secure.

Standards for Fire Safety

UL 10, Fire Doors

UL 305, Panic Hardware

UL 723, Test for Surface Burning Characteristics of Building Materials

ASEAN

In September 2023, we hosted a joint conference with the Bureau of Philippine Standards, which featured discussions on how fire safety standards can enhance the resilience of solar energy systems, including photovoltaic panels and batteries, wires and cables, the battery economy, and energy storage systems. Presenters explained how fire safety standards can support fire detection, resistance, and suppression – mitigating risks of implementing sustainable energy applications such as solar panels and battery energy storage systems.

India

In August, ULSE organized the National Conference on Fire Risk Reduction and Mitigation, with support from the Directorate-General of Fire Services, Civil Defence & Home Guards, the Bureau of Indian Standards, the Maharashtra Fire Services, and the Fire & Security Association of India. With more than 125 delegates and subject matter experts in attendance from government bodies, industry, academia, and research institutions, stakeholders explored strategies for building a safer India. Discussions spanned various technical tracks, such as operational challenges, emerging technologies, and the effective implementation of National Building Codes and standards within the fire safety landscape.





Wires, Cables, and Electrical Products

Our portfolio includes more than 40 wire and cable consensus standards and it continues to grow as we address safety issues that arise with the introduction of new technologies. Current topics include charging cables for portable electronics, and connection cables for rapid-charging stations for electric vehicles. While some standards are developed for voluntary compliance, the majority are organized to match the corresponding requirements in the U.S. National Electrical Code, NFPA 70, and are identified as applicable to the relevant installation types in that code.

Stakeholders in countries outside of the U.S. have adopted or applied some of the standards in their jurisdictions, and we continue to support ongoing engagement with current and future overseas users. Recent examples are below:

The Philippines

In May 2023, we met with the Bureau of Philippine Standards to explore how UL standards can make electrical products safer, particularly those used to decorate homes during the holidays. The meeting follows the country's adoption of UL 588, the Standard for Safety for Seasonal and Holiday Decorative Products and more than 20 other UL standards related to wires and cables.

In November, we presented at the Annual National Convention of the Philippines' Institute of Integrated Electrical Engineers, and shared how standards like UL 3741, Standard for Photovoltaic Hazard Control and UL 174, Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources, can support the Philippine Electrical Code. Our participation at the convention follows several roundtable discussions with IIEE in 2023, which were held to understand the country's electrical safety challenges, and identify areas where UL standards could address these challenges.

Mexico

A webinar on UL 810, Standard for Capacitors, was also organized in May for the Federation of Colleges of Mechanical, Electricians, Electronics Engineers, and Related Branches of the Mexican Republic, a follow-up from our recently signed MOU to improve facilities, equipment, and public safety through standardization.

China

In May, we worked with the Shanghai Electrical Apparatus Research Institute in China to hold a workshop on our UL 1004 series of standards for motors.



Data Science & Engineering

ULSE's International team works closely with the Data Science & Engineering team to support the research and data needs of our international stakeholder partners in various regions around the world. The DS&E team applies data analytics, engineering, and scientific knowledge to drive safety in standardization and identify opportunities for standards development or adoption.

Engaging with International Stakeholders

In 2023, the DS&E team participated in many presentations and discussions with international stakeholders, and shared how data and scientific inputs can drive standards and policy. These include virtual and in-person events with partners in Latin America, India, ASEAN, and Asia.

In June, DS&E Director Dr. Denice Durrant and Lead Project Engineer Wil Fletcher participated in a webinar with Colombia's Asociación Nacional de Protección Contra Incendios. During the session, they presented statistics regarding fire safety in Colombia and shared how stakeholders can get involved in the UL standards development process. In another June webinar with ANRACI, Standards Specialist Nicolette Weeks presented on issues regarding fire extinguishers in Colombia and reviewed requirements in UL fire extinguisher standards that address these issues.

In August, Project Engineer Alec Krabbe presented safety incident data on EV fires at the 2023 Latin America Battery Safety Summit in Mexico City, and discussed the importance of standardization in mitigating these issues.

TRIP

Through our Thermal Runaway Incident Program, we collaborate with airline industry dangerous goods and hazardous materials professionals to track lithium-ion battery fire incidents on airplanes and better understand the scale and complexity of this growing aviation safety issue.

TRIP is a secure, voluntary surveillance system developed with, and for, airline industry dangerous goods professionals. It is designed to provide the most accurate and timely accounting of lithium battery incidents.

In 2023, we held the inaugural TRIP Summit in Herndon, VA, with participants from ULSE, ULRI, and UL Solutions, as well as the lithium-ion battery and aviation industries, exploring opportunities to prevent thermal runaway in lithium-ion batteries transported via aircraft.

There is no cost to participate in TRIP. Stakeholders interested in helping shape future safety research, standards development, and consumer safety education can contact TRIP@ul.org to learn more about the program.



incorporating lasers or intense pulsed light for hair growth, hair removal, and reducing the visibility of fine lines and wrinkles. And in January, ULSE adopted the standard as ANSI/UL 60335-2-113. Through its adoption and harmonization, the international standard now applies to beauty care appliances in the United States, due to ULSE's authorization by ANSI as an Audited Designator.

Currently, there are more than 20 IEC standards and 4 ISO standards containing texts, tables, and figures from UL standards.

Representation via National Standardization Systems

We are also proud to have ULSE staff represented within various national standardization systems. Sonya Bird currently serves on the Board of Directors of ANSI and the IEC Council Board Task Forces on Diversity and Sustainable Development Goals. Joergen Bruus-Jensen, ULSE's Standards Engineering Manager based in Europe, is involved in European standards development at the European Committee for Electrotechnical Standardization – one of three recognized organizations for developing and defining voluntary standards at the European level.

US-ASEAN Business Council Subcommittee on Standards

Early in 2023, ULSE supported the US-ASEAN Business Council's cybersecurity study tour in Washington, in collaboration with the U.S. Department of State and the Arizona State University. The tour saw a delegation made up of key personnel from cybersecurity government agencies in ASEAN exploring key sites of interest in the U.S. advancing the cybersecurity landscape. ULSE also hosted the delegates in our offices at Washington D.C., where there were lively discussions on possible collaboration areas between industry, government, and public-private intermediaries of the U.S. and ASEAN region.

Later in May 2023, ULSE Vice President for Global Standards Phil Piqueira provided keynote remarks as the Chair of the USABC Standards Subcommittee, and participated on a panel discussion at a cybersecurity standards workshop with more than 140 participants in attendance from ASEAN member states, the ASEAN secretariat, and industry players. ULSE is proud to support the USABC in its advocacy of the solutions standards offer to the policy gaps and safety issues in the region, including the strengthening of cybersecurity and cyber resiliency.



New UL Standards



Standards Highlights: UL 4200A, Products Incorporating Button or Coin Cell Batteries

We published an updated version of UL 4200A on 30 August, 2023. The updates strengthened protections against accidental ingestion of these batteries among young children. And in September of 2023, the U.S. Consumer Product Safety Commission made UL 4200A mandatory for consumer products that contain such batteries.

The standard requires that battery compartments for these products must be secured and accessible only by use of a tool or at least two independent and simultaneous hand movements. These compartments must remain closed after tests that simulate normal use and abuse, such as a drop onto a hardwood surface or pressure under a crushing force. The standard also requires warnings on the product packaging, instructions, manuals, and on the product itself, if space allows.

We organized two global webinars to educate participants and stakeholders on the requirements of the standard, its impact on child safety, as well as its potential for protecting children around the world from accidental battery ingestion. With more than 150 attendees across the two sessions, attendees learned how UL 4200A could be adopted internationally to help protect children around the globe.

New Standards Published

Standard Number	Standard Description
UL 2750	Wireless Power Transfer Equipment for Electrical Vehicles
UL 2700	Sustainability for Cleaning Supplies
UL 3600	Measure and Reporting Circular Economy Aspects of Products, Sites, and Organizations
UL 4248-14	Supplemental Fuseholders
UL 4400-3	Safety of Premises, Buildings and Equipment Utilized for Cultivation, Processing and Production of Cannabis – Part 3: Security
UL 7466	Sustainable Polymeric Materials in Electrical Equipment
UL 8400	Virtual Reality, Augmented Reality and Mixed Reality Technology Equipment
UL 8802	Ultraviolet (UV) Germicidal Equipment
UL 8803	Portable UV Germicidal Equipment
UL 9741	Bidirectional Electric Vehicle Charging System Equipment
UL 9990	Information and Communication (ICT) Power Cables
UL 60335-2-113	Household and Similar Electrical Appliances – Safety – Part 2-113: Particular Requirements for Cosmetic and Beauty Care Appliances Incorporating Lasers and Intense Light Sources
UL 62817	Photovoltaic Systems – Design Qualification of Solar Trackers

Standards Revisions Published

Standard Number	Standard Description
UL 48	Electric Signs
UL 296A	Waste Oil-Burning Heating Appliances
UL 796	Printed Wiring Boards
UL 879A	LED Signs Retrofit Kits
UL 979	Water Treatment Appliances
UL 1063	Machine-Tool Wires and Cables
UL 1180	Fully Inflatable Flotation Devices
UL 1738	Venting Systems for Gas-Burning Appliances
UL 1974	Evaluation for Repurposing or Remanufacturing of Batteries
UL 2034	Single and Multiple Station Carbon Monoxide Alarms
UL 2158	Electric Clothes Dryers
UL 2271	Batteries for Use in Light Electric Vehicle (LEV) Applications
UL 2351	Spray Nozzles for Fire-Protection Service
UL 4200A	Products Incorporating Button or Coin Cell Batteries



Making a Global Impact Everyday

In 2023 there were:



444

Technical Committees



38

Total Countries with MOUs



160

Employees at UL Standards & Engagement Across 8 Countries



16

New Documents Including Standards, Outlines of Investigations, and Design Guidelines



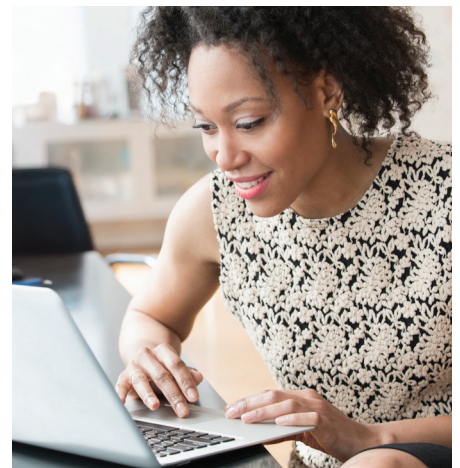
80

Total Memoranda of Understanding



1,137

Unique International TC Members 2023



Our entire library of UL standards documents can be accessed through our free Digital View feature (with site registration) on ShopULStandards.com.

Registration is open to any interested individual or organization globally.

