

UL Safety Science Challenge

An archive of experiences!



The UL Challenge is an annual university wide competition organized by the leading safety science organization Underwriters Laboratories in collaboration with IIT Gandhinagar.



UL Safety Science Challenge 2014-15

The UL Electrically Induced Fires Challenge was based on reviewing the electrical factors that have potential to cause fire and then designing of experiments to study these electrically induced fire.

Like Every year, the safety challenge by Underwriter's Laboratories for year 2014-15 was 'Investigation of Electrical Fire'. There are several phases of this challenge in which phase 1 requires some research and literature review of study of electrical fire. Groups of 4 students would submit a report of their literature review and 2 teams would be given a chance to carry this challenge forward. These teams had to work collaboratively in the summer break of 2015 staying in campus.

In phase 1, we did a literature analysis of types of electrical fire, statistical analysis of electrical fires in India, USA, UK, and China. We also did some major case studies of electrical fire accidents happened across India. We identified a root cause of these fires and supportive non-technical issues those put many lives in trouble at the same time.

These reports from several participating groups were sent to various experts in India and also USA, including Underwriter's Laboratories and Electrical Research and Development Association, Vadodara (ERDA). In phase 2, we were working as a group of 8 students during which we designed several experiments to support our study in phase 1. These experiments include overloading of wires, short circuit, heating due to loose connections, wet tracking in power plugs, heating due to excessive thermal insulation, some experiments related to harmonic distortion in the current waveform.

We continued harmonic distortion analysis in UL Chicago (mainly focussed on Ballast) there we also did the thermal analysis of the ballast to understand the causes. After coming back to India we did the experimentation on many samples repeatedly so as to get better results.



Mayank Khewaria

Internship at UL was an amazing learning experience with enormous exposure to my work field. I was one of the 8 members selected for UL Engineering challenge 2014. We worked on investigation of "Electrically Induced fires" in summers of 2014 and went to explore more at UL laboratories Chicago. The labs there were state of art, we did measure Total harmonic distortion by one of the best instruments with high precision and accuracy. We also did thermal analysis with the Infrared camera. UL also provided us the opportunity of a two day visit to NREL USA. We got to meet the experts in the field of renewable energy. The working culture there at UL was very different from the one in the usual corporate world, and it was very disciplined.

We also visited some famous destination in Chicago and Denver. I thank Prof. Chinmay Ghoroi, Prof. Naran Pindoriya, NREL and Underwriters Laboratories for this chance.



Pratham Goel

I feel truly privileged to have got the opportunity to visit Underwriters' Laboratories, Illinois. The efforts that went into the preparation of the Phase 1 report on Investigation of Electrically Induced Fires had paid off really well. At UL, we were exposed to testing and measurement equipment and also other technologies like infrared imaging and power analysers, which we used during our work there. I particularly enjoyed the tour of the fire safety testing at UL. One of the major take-aways from the experience at UL was the board-room discussions with Dr. Gandhi, where we were engaged in active brainstorming and finally converging to concrete ideas for our project. The support from all the staff at UL was also encouraging, and I think I learnt a lot from their work culture and gratitude towards simple things.

Another highlight of our trip was the visit to NREL where we got a first-person's-view of the latest technologies in the fabrication of solar cells during the tour of the PDIL there. Overall, the entire trip proved to be enjoyable and one to take important lessons from.



Suraj Bhosale

Working with the Underwriters laboratories is one of the most influential things happened to me. The fortnight spent in the environment of UL is a long lasting learning experience.

The visit to UL was well planned and promptly administered by the Dr. Pravinray Gandhi and Dr. Liang Ji. Every second spent in the companionship of these experts was enriching on so many levels.

The training at UL was a part of second phase of Electrical Fire Project. We presented our work to the experts at UL, including Paul Brazis and Fan He. We received some insightful feedback from them. Dr Gandhi took us through a whole new thought process for arriving at a technical plan (for Electronic ballasts and Resafetacle). For me, this was a wonderful lesson. We worked hard through-out the days and held meetings at night. There was so much to learn in such a limited period of time. We wanted to make most out of it. There, I realized the importance of teamwork and how it brings the best out of every one. While working in the labs, I couldn't resist to notice the gratitude and co-operation among Lab staff and research staff.

Their standard of the work ethics and discipline, is something we all should bring into practice. (Apart from safety standards :P)

And how this experience will go without a mention of NREL!

I consider myself extremely fortunate to have a chance to visit NREL at such a crucial time in my academic career. Everything, right from hosting to the presentations and site visits, was enlightening. I am grateful to Dr Larry Kazmerksi and team for it. I will cherish every moment spent there, for a long time. (Hopefully, till my destiny takes me there again).

Our mentors took us on the wonderful tour of Red Rocks museum in Denver. On weekends, we visited some attractions in the city of Chicago. We couldn't fill our hearts with the beauty of this city. But off course, it rejuvenated the bond of friendship between me and my friends. I thank Dr Sudhir K. Jain and UL for this wonderful opportunity.

Amit Yadav

UL Engineering Challenge 2014 was wonderful project to work on as well as challenging too. The project was in two phases. In phase-1 I had worked in a team of four members, making a thorough report on 'Investigation of Electrically Induced Fire'. It taught me a lot about safety aspects of electrical fires happened all over the world while collecting information. I came to know how advancement in technology has provided support in preventing electrical fire

incidents at large and vice versa. Phase -2 was much more challenging, as we designed experiments depicting the causes of electrically induced fires. The experience of working in lab has added much to my Research and experimentation background. I got opportunity to visit Underwriters Laboratories Inc. Northbrook. Exposure to one of the oldest and best Safety Testing Laboratory in the world was amazing. With my team I continued experimentation on performance, current harmonic analysis and safe design features of electronic ballast at UL laboratory equipped with world class instruments and facilities. Safety in each and every aspect related to lab was take away home message. Besides this I got best guidance and mentoring from senior researchers and engineers in sorting out the problems occurred during experiments. Dr Pravinray D. Gandhi and Mr Liang Ji guided us not even in our work but also taught us how to tackle any kind of task/challenge.



It was an enriching and inspiring experience working with Dr Gandhi and Mr Liang Ji, lessons got from Dr Gandhi through his stories are never forgetting. One of them is “Thinking is reality”. It was a great experience while going through the brainstorming sessions, which motivated us to think disruptively. It was a great

opportunity to visit the National Renewable Energy Laboratory, Department of Energy, US. Presentations on Photovoltaic Technology by Dr L.L. Kazmerski, Ex-Director National Centre for Photovoltaic, NREL and David S. Ginley, Research Fellow, NREL were important additions to my knowledge in the field of solar energy. I got to see the manufacturing of solar panels in Process Development and Integration Laboratory, NREL. It was encouraging to have the tour of ESIF (Energy Systems and Integration Facility), known as most energy efficient building in the campus. Visit to NWTC (National Wind Technology Centre) introduced me to the testing of wind turbine blades, their operations and maximum capacities. Familiarization with the US people, environment and culture is an exposure that may help me for pursuing higher studies in US in future. Interaction with professional world was not only encouraging but knowledgeable too. Overall this challenge has provided me a lot to grow as a good personality. I am very thankful to IIT GN and UL, providing me the opportunity to work on the challenge.

Kapil Pathak



I was a member of a team of UL Challenge for year 2014-15 and got a chance to explore this area more. In phase 1, we did a literature analysis of types of electrical fire, statistical analysis of electrical fires in India, USA, UK, and China. We also did some major case studies of electrical fire accidents happened across India. We identified a root cause of these fires and supportive non-technical issues those put many lives in trouble at the same time. We also proposed an analytical approach to design a safety equipment that can alarm upcoming incident to people.

These reports from several participating groups were sent to various experts in India and also USA, including Underwriter’s Laboratories and Electrical Research and Development Association, Vadodara (ERDA). Our report impressed many experts and we were selected to carry this challenge forward. In phase 2, we were working as a group of 8 students during which we designed several experiments to support our study in phase 1. These experiments include overloading of wires, short circuit, heating due to loose connections, wet tracking in power plugs, and heating due to excessive thermal insulation.

After completing 2 phases of the challenge, we presented our work to Dr. Pravinray Gandhi, Director of corporate research, Underwriter's Laboratories, Northbrook, Illinois, USA. He was quite impressed with our work and he suggested us to do thermal analysis of ballast samples to detect major hotspots during their working condition. We were quite happy with the research facility we were getting and the staff who was fully supportive to us. Along with this, brain storming sessions with Prof. Gandhi sir and Dr. Liang Ji sir provided us an enriching experience about the work that is being carried out in corporate research.

We also got a great opportunity to visit National Renewable Energy Laboratory, Department of Energy, USA. Talks on Photovoltaic Technology by Dr L.L. Kazmerski, Ex-Director National Centre for Photovoltaic, NREL and David S. Ginley, Research Fellow, NREL also contributed significantly to my knowledge in the field of solar energy. The tour of ESIF (Energy Systems and Integration Facility), known as most energy efficient building in the campus, encouraged me to think how we can make unthinkable routine exercises more and more energy efficient.

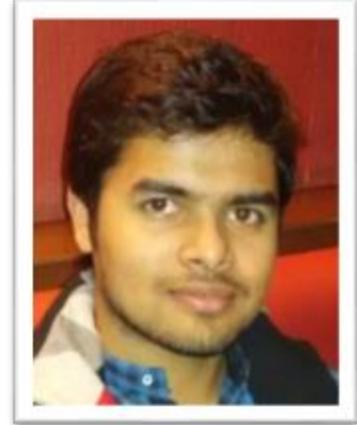
During this visit, an interaction with professionals gave me an enriching experience of a work culture, which will help me for pursuing higher studies in USA and a new dimension about safety aspects of various products. I thank IIT Gandhinagar and Underwriter's Laboratory for giving me such an amazing opportunity.

Akshay Verma



The Internship at Underwriters Laboratories was a wonderful experience of my life. The facilities at UL are indeed world class and we were privileged to work there. The internship started at our campus. The most interesting sessions were the ones with Dr. Gandhi. These sessions were based on brainstorm sessions and then finally coming on a some concrete ideas and also the making of a technical plan. I was also impressed by the corporation of the Lab staff and also thankful for the help that they provided by taking out some time from their busy schedule.

We also got the opportunity to visit National Renewable Energy Laboratory (NREL) which was provided to by UL. The visit to NREL was a fruitful one. It was an addition to the knowledge of solar energy and renewable energy. We were exposed to facilities and the research work which is been carried out of the NREL. Overall the trip proved to be delightful. I would like to thank Prof.Chinmay and Prof Naran for helping us to carry out the work at IIT Gandhinagar. I would also like to thank IITGN and UL for Providing me this opportunity.



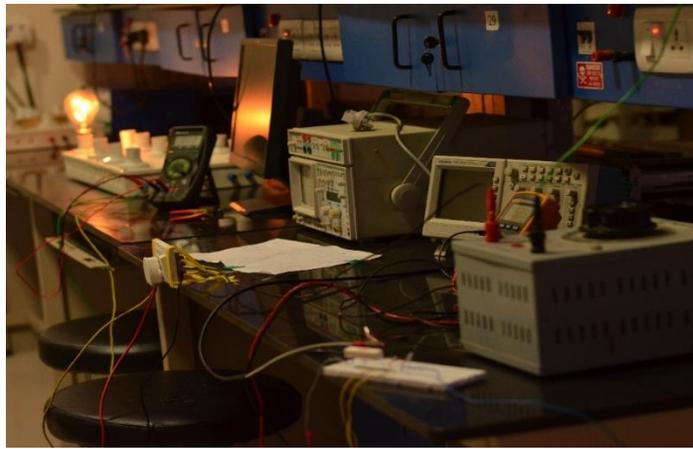
Suryakumar Mane

Those fifteen days of internship has contributed for enlightening the best part of me. The visit to the headquarters of Underwriters Laboratory was a worth of working for the UL Challenge 2014. The challenge was to investigate electrically induced fires. We presented our work about the designed experiments, related to how fire takes place. Apart from the technical work and the lab facility at UL, we had a chance to interact with the experts and learn a new insights from them. Session with Dr. P. Gandhi were really enriching and adding values for the future life. He did not just focus on the technicality but also talked about dealing with the project and how to come up with something best in a short time. The "technical plan" was something which is very important in every aspect of life, specially when, in working with a team. That informal discussion at the end of the internship really motivated me to have my future plans ready..

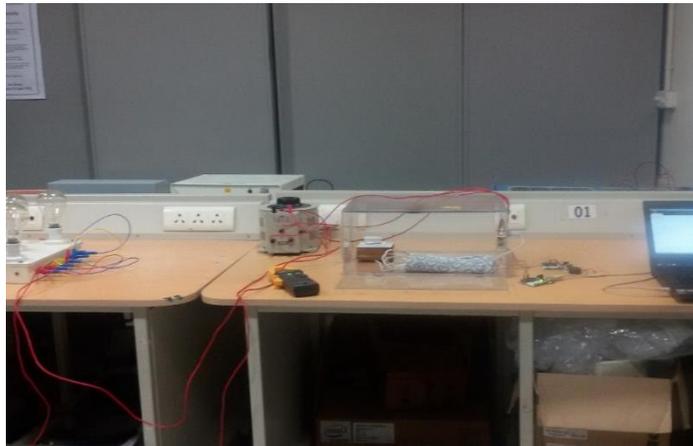
Apart from the work culture and the ethics, gratitude and respect for each being was present in every individual at UL.

Visit to NREL was a amazing, we got the chance to see the most efficient building in the world in terms of energy conservation and uses. We were given the exposure about the facilities and the research work being carried out in NREL.

I am thankful to Director and UL team for giving this opportunity in my second year to visit and take new insights through this internship.



Experimental Lab set-up for one of the experiments performed during Investigation.



Experimental Set-up to study effects of Excessive Insulation.

UL Safety Science Challenge 2013-14

The UL Water Challenge was based on reviewing the drinking water problem in India and designing and developing a drinking water station research platform for use by local population.

Clean drinking water is one of the most basic necessities of an Individual, yet we live in a country where 21 % of the diseases are waterborne diseases. In the summer of 2014, with the support of Underwriters Laboratories, The UL Water Team started building a research platform for community based water purification station suitable for rural India.

The team reviewed the existing water purification techniques used all over the world, and analysed upcoming research in this field. With reverse osmosis as the most economical and widely used purification technique, they decided to compare it with membrane based electrical deionisation techniques which exhibit promising results in literature. In order to understand the sophistication of the drinking water problem in India, the team visited villages of Haryana and Uttar Pradesh to identify the challenges faced by existing water purification plants there and receive adequate feedback from local people. They have now developed a research platform which can treat impure water using reverse osmosis. They are also manufacturing their own Capacitive Deionisation unit cell, and will install the final module in the research platform to test it parallel to the RO process, to develop a comparative analysis and choose an adequate model for Indian conditions.

Every team member was immensely benefited from this project. Some of them were motivated to pursue higher studies and choose research as their career, while others were motivated to work further for development of rural India.



Vidyanand Wagh

As a part of UL Engineering Challenge 2013, our team first reviewed, studied and worked on the drinking water problem in India (primarily rural India). Being a part of winning team of this challenge, I got an opportunity to visit the UL Research Lab, Chicago. It was indeed an enriching experience. We also visited National Renewable Energy Laboratory, Denver. For someone like me, who is otherwise very shy and introverted, an opportunity to interact with experts from UL and NREL was really overwhelming. I got to learn a lot in those two weeks. Even we grew stronger as a team, our brainstorming sessions started being more productive and efficient than before. If working on this project has helped me realize anything, it's the fact that only the existence of technology doesn't solve problems. The technology has to be made available for the masses, well within their reach, by making it affordable. This is what our current work focuses on.

I am immensely grateful towards IIT Gandhinagar and Underwriters' Laboratories for giving us this wonderful opportunity and unique experience.

Rakesh Ranjan

The experience of UL research lab at Chicago was very learning and wonderful. I got to know more about tackling problems and working as a group. After finalizing, a group discussion on what we can do to make the product better and what are the faults in the current one was the best experience. Also the visit to NREL was very educating. The research on increasing the efficiency of solar panels was very impressive. Their operations facility was spectacular. It was powered only by renewable energy. I am very thankful to IIT Gandhinagar, Dr. Pravin Gandhi, Dr. Larry Kazmerski, Mr. Liang Ji and everyone who was involved in making this trip successful and enjoyable.



Shubham Pachori



I had a memorable internship at Underwriters Laboratories. Added to it, I had an opportunity to work upon the problem of community water purification which is a major challenge in front of the whole world. Apart from having world class research facilities at UL, employees are warm-hearted and are always open to help. We had a few field visits to understand the problems related to water purification and what are the existing technologies in India which is being deployed for the purpose. Throughout the summer rigorous work was done by all of us to study and understand the latest technologies on which researchers across the world are working and has a great utility and application in future. Once found out we performed various simulations to understand the working mechanism in details and look into the possibilities of improving.

The best part that I liked about my internship was that I got a chance to meet with Dr. Pravin Ray Gandhi, Dr. Liang Ji and Dr. Larry Kazmerski. Dr. Pravin Ray Gandhi on the daily basis used to setup tasks for us. He gave us the tips to how to deal with an industrial problem and bring a product from the research level to the commercial level.

He once said to us that “One must look all possibilities for making a product better while doing research, regardless of the money spent in the research. The cost of the production of the product will be optimised during the final manufacturing”. This is one of the quotes that I will cherish throughout my life. Dr. Liang Ji was also open to explain the concepts behind the working of Solar Cells and about the latest technology existing in the world. We were also fortunate enough to visit NREL. People there highlighted the scope of renewable energy in future. They explained us how solar cells are exploited at large scale for the efficient production of energy and what kind of research is being done on them. That visit was life changing experience for it cleared my vision about my career options. They proved us that research is cool if done in healthy environment and together. I want to pursue PhD. in future.

I would like to thank my friends Ch. Suryavinay Koundinya, Vidyanand Wagh, Sanjit Jena, Rakesh Ranjan, Saurabh Vaichal, Manjot Saini, Vikram Alriya and Jithin Prabha for being supportive throughout the project. Apart from it, I also want to thank Prof. Chinmay Ghoroi and IITGN for providing me an opportunity to work on this exciting project.

Sanjit Jena



I was very excited on getting the internship opportunity at Underwriters Laboratories in the summer of 2014.

We had been working on the Community based water purification project – a UL-IIT Gandhinagar initiative. This involved many challenges we had to face, the foremost being setting an aim – an issue that we need to focus upon which our project of designing a drinking water station would target to achieve. Thus we had finalized a drinking water station that aims for serving the rural Indian population on the community scale, and would be low maintenance and designed for high TDS removal.

This led us to do comparative analysis of available technologies, brainstorm on new ideas for using the technologies in conjunction to minimize water wastage and reduce the cost per litre of drinking water obtained, and plan a control system.

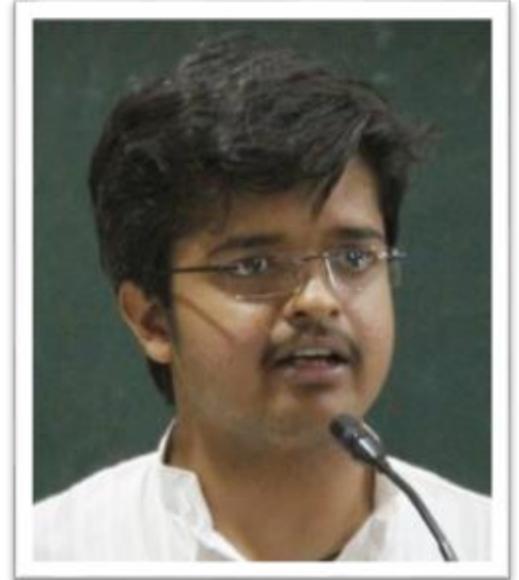
We designed and fabricated an initial prototype of the research platform during the summer of 2014 after a couple of field visits to places in Haryana, and UL Bangalore, before we visited UL, Chicago.

UL has always been a big name in the field of Product Safety. To visit their well-equipped fire-safety labs in Chicago, as well as receiving a short course on Hazard-Based Safety Training gave us an insight into the sheer importance of the safety aspects in any design.

We also visited National Renewable Energy Labs (NREL), Denver, where we got our first glimpse of large scale research being carried out in a well-equipped facility. Research which was aimed at rendering more efficient the available renewable energy sources. I was especially astounded by the solar energy research facility, and the staff working there were eager to get us a good idea of what work they are into, and also what their research actually aims at: “To try certain methodologies, collect the results, modify the methods or parameters, iterate, and do this until u obtain the desired results. Therefore, patience is indispensable for a researcher.”

I am thankful to both IIT Gandhinagar and Underwriters Laboratories for availing me this opportunity. It was a great learning experience working as a team and

getting useful inputs from Dr. Pravinray Gandhi ad Prof Chinmay Ghoroi, who played a major role in the project.



Saurabh Vaichal

The internship experience at UL was memorable and with my batchmates accompanying me on this trip, the fun was doubled. In the short span (15 days) of the internship, we learnt quite a few valuable lessons. It was overwhelming to visit the state-of-art labs at UL, Chicago as well as NREL, Denver. The experience was enriching on the academic level as well as at a personal level. Interacting with top-notch scientists at both UL and NREL was inspirational and is something which all curious engineers should be looking forward to. Suggestions and insights provided for our project especially by Dr. Pravinray Gandhi have shaped the progress of our project.

Manjot Singh



I was a part of UL Water team. Our project was to develop a research platform for community based water purification station suitable for rural India. This project was exciting as for the first time we had an opportunity to use our technical skills to build a product that could uplift the living standards of rural India. The project has a direct social impact.

We reviewed the existing water purification techniques used all over the world, and analysed upcoming research in this field. We also visited villages of Haryana and Uttar Pradesh to identify the challenges faced by existing water purification plants there and receive adequate feedback from local people. The project has motivated me to work further in social sector and I was also involved in teaching village students for their upliftment.

In summer of 2014, we visited UL Chicago, and National Renewable Energy Laboratory, Denver. At UL labs, I was exposed to the advanced research techniques and certification process used by UL. It was an inspiring experience. At NREL, I got an opportunity to understand most recent research carried in field of renewable energy. The research environment that we were exposed to at NREL motivated me to pursue further research at IIT Gandhinagar. We also have started manufacturing our own Capacitive Deionisation unit cell, and will install the final module in our research platform to develop a comparative analysis and choose an adequate model for Indian conditions.

In short I would like to say that the UL project was an incredible learning opportunity, and I along with my team mates will put all our efforts to work for the rural India, seeking motivation form UL.

After completing 2 phases of the challenge, we presented our work to Dr. Pravinray Gandhi, Director of corporate research, Underwriter's Laboratories, Northbrook, Illinois, USA. He was quite impressed with our work and he suggested us to do thermal analysis of ballast samples to detect major hotspots during their working condition. We were quite happy with the research facility we were getting and the staff who was fully supportive to us. Along with this, brain storming sessions with Prof. Gandhi sir and Dr. Liang Ji sir provided us an enriching experience about the work that is being carried out in corporate research.

We also got a great opportunity to visit National Renewable Energy Laboratory, Department of Energy, USA. Talks on Photovoltaic Technology by Dr L.L. Kazmerski, Ex-Director National Centre for Photovoltaic, NREL and David S. Ginley, Research Fellow, NREL also contributed significantly to my knowledge in the field of solar energy. The tour of ESIF (Energy Systems and Integration Facility), known as most energy efficient building in the campus, encouraged me to think how we can make unthinkable routine exercises more and more energy efficient.

During this visit, an interaction with professionals gave me an enriching experience of a work culture, which will help me for pursuing higher studies in USA and a new dimension about safety aspects of various products. I thank IIT Gandhinagar and Underwriter's Laboratory for giving me such an amazing opportunity.



**Research platform for
community water
purification station**



**Working prototype of
Capacitive De-Ionization
unit**

