American Nuclear Society



Purdue University Student Section

Samuel Glasstone Report 2012



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INTRODUCTION

The Purdue American Nuclear Society Student Section took an aggressive stance towards being the highest achieving student section in the country this academic year. Over the past few years, Purdue ANS has been in a stage of rapid expansion. The elected ANS officers and all of its members took a stance towards success and worked harder than ever before to move Purdue ANS into great standing.

Beginning the semester, Purdue ANS kicked off with a brand new event, the Nuclear Engineering Opportunity Nights (NEON). This two evening career fair event was the first Nuclear Engineering oriented career fair of its kind on campus. Soon after NEON was successfully concluded, Purdue ANS conducted a campus-wide event, titled Nuke Week, which was aimed at educating students at Purdue on the benefits of nuclear technologies. These two major events effectively set the scene for the Purdue ANS vision for the rest of the year. Following this, there was not only a focus on public outreach, but also on bringing professional development benefits to members.

This report includes all of our most notable events, in addition to information about our student section. A short list of reasons why we are set apart from other student sections is included below:

- **Corporate involvement** from the National Nuclear Security Agency, Nuclear Regulatory Commission, Idaho National Laboratory, Fermi National Laboratory, Donald C. Cook Power Plant, Duke Energy, First Energy, and Dominion.
- **Public outreach and education** at 5 different education institutions, 4 different public events, and through teaching 12 high school educators.
- **Member professional development** from a nuclear engineering oriented career fair, sending 12 members to the ANS student conference, and interfacing with corporations.
- **Nationally recognized section** through ANS newsletters, a visit and presentation from Dr. Eric Loewen, a member being accepted into the ANS WISE internship, and receiving 3 awards at the ANS student conference.

I sincerely hope that you choose our student section as the recipient of the Samuel Glasstone award. Through hard work and dedication this past year, we have succeeded in bringing professional development to our members, nuclear education to the public, and brought novel research to the nuclear community.

with thowles

Justin Knowles Purdue ANS President





OFFICERS AND COMMITTEE CHAIRS



(top row, left to right): Anthony Wurl, Paul Branham, Kara Luitjohan, Weston Cundiff (bottom row, left to right): Tony Alberti, Nam Phan, Zach Schriver, Justin Knowles

President: Justin Knowles, Junior

Responsibilities included organizing section meetings, communicating with potential speakers, and organizing major events. In addition he acted as a liaison between the student section and the Purdue nuclear engineering department. As President, Justin took an active role in being a co-chair of all committees and assisting in project leadership and project execution.

Vice President: Zachary Shriver, Senior

Responsibilities include budget validation, project planning and approval, social event organization, and overall logistics. He enjoys his post, and hopes to one day retire in the West where he can settle down. He has also applied and was accepted to the WISE (Washington Internships for Students of Engineering) Program where he will be investigating technology policy and its application to the nuclear industry this summer.

Treasurer: Kara Luitjohan, Senior

Responsibilities include providing financial advice to the executive committee, keeping record of all the transactions, collection of money, and the financial paperwork, including check requests and reimbursement forms.





Secretary: Paul Branham, Senior

Responsibilities as secretary included keeping minutes for officer meetings, managing the club mailing list, and helping with event and travel plans for various activities.

Outreach Chair: Nam Phan, Junior

Responsibilities include planning, organizing, and executing outreach events that sought to inform the general public on nuclear science and technology. Outreach focused on educating the next generation through classroom visits and educating the local public plus the student body through participation in campus events, like Engineering Week, National Nuclear Science Week, and Introduce a Girl to Engineering Day.

Special Events Chair: Weston Cundiff, Senior

Responsibilities include planning large events for public outreach and professional development of our members. Events this year included Nuke Week 2011, Nuclear Science Teacher Workshop, tour of Fermi Lab and D.C. Cook Nuclear Power Plant and some smaller campus events and tours.

Corporate Relations Chair: Tony Alberti, Junior

Responsibilities include that of establishing and maintaining relationships with industry officials of both commercial and government institutions. Furthermore, he held a committee of underclassmen that helped him in his goals for the year. Those goals included that of hosting the Nuclear Engineering Opportunity Night (NEON) for the fall of 2011, organizing NEON for the fall of 2012, hosting company nights here on campus, and calling industry officials to try and spread the work about what Purdue ANS is all about.





SPECIAL EVENTS COMMITTEE

Fukushima Dai-ichi Discussion Panel (April 21st, 2011)

Purdue's American Nuclear Society teamed up with two other student organizations: PUGWASH, an organization that focuses on education about science and technology that sponsors a weekly lecture, and Energy Club, an organization that researches solutions to various energy problems. Together, the two organizations put together a multi-disciplinary discussion about the Fukushima Dai-ichi nuclear disaster.

Professor Andy Freed from the earth and atmospheric sciences department spoke about the nature of the natural disaster, especially concerning its magnitude and damages. Professor Freed explained the formation and propagation of the earthquake and the resulting tsunami and how large it was compared to modern records.

Professor Martin Lopez-De-Bertodano from Purdue's nuclear engineering department spoke about the reactor safety systems and the responses to the natural disasters, especially being concerned with a timeline from the first signs of trouble to the present-day. Professor Bertodano focused on the nature and quantity of the radiation released from the nuclear power plants as well as how the reactor's design coped in reaction to the disaster.

Professor Daniel Aldrich from the political science department spoke about the event's political consequences in Japan and began with the differences in Japanese education about nuclear power versus American education. Professor Aldrich then shifted his talk to understanding how the politics of the Japanese power companies and government played a hand in determining that the reactor safety systems were adequate.

After these three speakers gave their lectures, the floor was opened to public Q&A where any audience member could ask a question to any of the three speakers. The audience was very perceptive and the general feeling was that the speakers were able to answer many general questions through their talks. The good news was that very few of the attendees remained in fear from the radiation reaching the United States and everybody now knew the facts behind the incident instead of what the attention-seeking titles of the news was telling the public.

Overall, there were about 75 attendees for the event, all of whom had come to be educated and were concerned about knowing about Fukushima. The professors who spoke were glad to help out and were pleased with the turnout of the event as well as the receptiveness of the audience.





Purdue ANS Nuke Week (September 26th to 30th, 2011)

Every year Purdue ANS throws a Nuke Week event. This year's event took place September 26th through 30th. The purpose of this event is to get the word out about ANS, network with the school, and educate the public about nuclear applications. Nuke Week was an all-week event that had several different activities, including a grill out, bowling, sophomore orientation, and a radiation information session. All members of ANS helping with the event were provided with a free t-shirt. This event was made possible with money provided by SOGA (Student Organization Grant Allocation).

Grill Out (September 26th, 2011)

The first event of the week was the grill out. Several grills were set up with an information board in the engineering mall at Purdue.

The engineering mall at Purdue is centrally located to many of the educational buildings at Purdue. This makes it an ideal location as many students walk through to and from class. Grill outs are a relatively common event for groups at Purdue to raise awareness and funds. Purdue's ANS grill out differed from other clubs as all of the food was free but students had to ask a question about ANS, or anything nuclear related in order to get food

Several members of ANS with industry or research experience went along the line answering questions and talking about nuclear topics with students. This turned out to be a great way to get people interested in ANS and nuclear topics in general, by having everyone to ask a question. Many students felt comfortable about asking questions and as a result many stayed after the food to continue discussing the nuclear field.



Purdue ANS volunteers grill burgers and hot dogs for the hungry Purdue students



Nicholas Wilson speaks with a student interested in nuclear technology while she waits in line for food





Nuclear Bowling (September 27th, 2011)

Another event for Nuke Week was Nuclear Bowling night. This event was ANS funded for members and friends to come out and relax and get to know each other better while having fun.

Sophomore Orientation (September 28th, 2011)



Numerous upperclassmen also participated in the nuclear trivia game to test their knowledge versus the sophomore class

At Purdue, engineering majors declare their major after their freshman year. This means that incoming sophomores are beginning their first semester of nuclear classes and may not be fully aware of everything that is a part of the School of Nuclear Engineering. For this reason, a Sophomore Orientation night was held by the upper classman for the sophomores. The orientation allowed the sophomores to meet the upperclassman, and ask any questions they had

about classes or about the program. A tour of the Nuclear Engineering building was also given, with information about how to get a key to the building

as well as set up their printing accounts to access the printers in the nuke building. After the tour, the upper classmen and sophomores got to know each other with a grilled cheese social provided by ANS members.

After this a presentation about the nuclear engineering program was presented followed up with a game of nuclear trivia.

Radiation Information Session (September 30th, 2011)

On the final day of Nuke week a Radiation Information Session was held in the atrium of Armstrong Hall. This session had an information board about radiation as well as a Geiger counter demonstration.

The Armstrong atrium proved to be a good location as many students walk through there after class, and several would stop for a cookie and to read



Purdue ANS set up its displays and demonstrations in a high-traffic area to attract a large number of people





about radiation. Students who stopped were able to have a postcard with a picture of Purdue's reactor (PUR-1) on it, as well as bookmarks displaying nuclear facts, and sheets that explained how to calculate their radiation dose. One of the biggest hits at the session was showing students how to use the Geiger counter. Several sources, including fiesta ware, uranium ore, and a smoke detector were there to use the Geiger counter on. Shielding was also included to show what materials can stop different kinds of

radiation. Many students were surprised that the fiesta ware was more radioactive than the



Passing students were drawn to the display with the promise of free cookies and the sounds of a Geiger counter

uranium ore. Students were also encouraged to try the Geiger counter out themselves and measure whatever they wanted. Many students tried the Geiger counter out on their electronic devices, such as their IPods and phones, and were surprised that their phones were not giving off any radiation. This event also took place on the day before the Purdue v. Notre Dame Game which meant there were many families with younger children touring Armstrong Hall. This was great as the young children and adults were very impressed and curious about the radiation demonstration.



Weston Cundiff shows off the Purdue nuclear engineering display

Homecoming Booth

(October 21st-23rd, 2011)

During the 2011 Homecoming weekend October 21st -23rd this past fall, four Purdue American Nuclear Society Student Section members held an information booth to showcase the School of Nuclear Engineering. Many alumni and their families were in attendance including alum of the first nuclear engineering graduating class from Purdue University as well as a woman whom currently holds a high level position in the IAEA.





Purdue ANS Nuclear Science Teacher Workshop (February 11th, 2012)

This year, Purdue ANS put on their annual teacher workshop event. Twelve science teachers from around the state of Indiana came to Purdue's award winning building, Armstrong Hall, to attend the educator workshop with presentations from ANS members. This workshop helped science and physics teachers develop their understanding of nuclear sciences and the ability to share that knowledge with their students. Awareness and comprehension of nuclear technologies in the community was raised and information on careers in science, engineering, technology, and mathematics was provided in hope of encouraging students to achieve those career goals.

The workshop consisted of a series of interactive lectures on nuclear technology and physics. Presentations were given on several topics selected to reflect the Indiana's State Science Standards:

- Physics: P.1.29-P.1.35, P.2.8-P.2.10
- Chemistry: C.1.24, C.1.42, C.1.43
- Integrated Chemistry and Physics: CP.1.8, CP.2.10-12
- Environmental Science: ENV.1.16, ENV.1.24, ENV.1.32
- Earth and Space Science: ES.1.9

Presentations were designed to reflect these standards.



Lenka Kollar giving a presentation on nuclear non-proliferation

"Excellent knowledge base of presenters, who were good public speakers. Extremely well organized." – Workshop Attendee





Atomic Physics History

"In youth we learn, in age we understand." – Marie Von Ebner-Eschenbach. Major discoveries of the elementary particles were discussed, starting with the discovery of fission and the first chain reaction in 1942 at Chicago Pile-1 at the University of Chicago. The theoretical development preceding experimental results was discussed in nuclear atomic physics, using Dirac's postulation of the existence of the positron in 1928, when it was not discovered until 1932. Democritus's vision of the atomos was described as well as the early models of atoms. Rutherford's backscattering experiment was explained in detail and Niels Bohr's work with electrons and his planetary model were analyzed. Important discoveries in radiation including those of Henri Becquerel and Marie Curie were also discussed.

Radiation, Radioactivity and Detection

In this presentation, the basic building blocks of the elements were discussed. Teachers learned about different types of radiation and how to be safe with them. ALARA (As Low As Reasonably Achievable) was discussed with the teachers as well the main ways to reduce exposure, time, distance, shielding and amount. Isotopes of atoms were explained and how they play a role in radioactive decay. An M&M half-life activity was done to demonstrate the concept of half-life and how radioactivity decreases over time. Exposure to radiation was discussed with relevant units as well as differences between absorbed dose and equivalent dose. Radiation effects on biological materials were explained as well as health effects from acute doses of radiation. Calculating yearly dose of activity was done with the teachers, and the concept that radiation is everywhere was stressed. Various radiation detectors were described including Geiger-Mueller, scintillator, and solid state detectors.

Nuclear Physics

The nuclear physics presentation was one of the more technical presentations. Fundamental forces in nature such as strong, electromagnetic, weak, and gravity were explained in depth. Einstein's mass-energy equivalence and its meanings were also presented. Other important effects of particles that were discussed included: wave-particle duality, Young's double slit experiment, the photoelectric effect, Heisenberg's uncertainty principle and the implications of quantum mechanics.

Fission and Fusion

Explanations of the difference between fission and fusion were presented. The binding energy per nucleon vs. atomic mass was shown to illustrate the energy changes for both fission and fusion. Comparisons were made between the kinetic energy from fission and that of coal combustion. The fission chain reaction was explained as with what criticality is and how it is used in reactor analysis. Fusion was explained using stars as examples. Current research of fusion was explained and examples of the Tokamak and ITER reactors were provided.





Nuclear Energy

Nuclear fission reactors were discussed in this presentation including the discovery of the natural nuclear fission reactor discovered in Gabon, Africa. A time line of nuclear power was presented showing the advancements made in nuclear energy from the first reactor to generate electricity in Idaho, to the Generation-III plants like the ABWR, as well as projections into the future for the Generation IV plants. A map of the nuclear power plants in the United States and their locations was shown and information on the Nuclear Regulatory Commission and their role was discussed. In particular the environment, safety, security, and barriers to prevent fission product released were touched on. Several other topics discussed included the differences between pressurized water reactors and boiling reactors as well as advantages for both, energy density and the future of nuclear power in the United States, and differing aspects of the nuclear fuel cycle from the mining and milling, to the long term storage or recycling of fuel.

Another focus was on major accidents. Three Mile Island, Chernobyl, and Fukushima were presented with what went wrong, what effects did it have, and how the industry has responded to each one of these accidents. Most of the attention was spent on the Fukushima accident. The teachers were very interested in learning more about how Fukushima would affect the people and environment of Japan. The teachers were very interested in this part of the presentation and asked many questions.

Medical Nuclear Science

Based on teacher feedback during registration, a presentation on nuclear technology in medicine was included. Uses of radiation for medical imaging both internal and external were described as well as varying techniques for them and their differing uses in the fields. X-rays, MRI's and CAT scans were discussed in relation to external imaging. This presentation related to the nuclear physics presentation which laid the ground work for the teachers to get a better idea of how imaging is performed. Radionuclides and their uses in internal imaging were discussed including PET, and SPECT scans. Specific examples of advantages in nuclear medicine were shown I.E. Myocardial Perfusion instead of EKG's for cardiac stress tests. External and internal uses of radiation in treatment were also discussed. This included an example of how radiation can treat cancer from external radiation beams to Brachytherapy.

"This was great! Thank you so much for your efforts." – Workshop Attendee

Nuclear Technology Applications

Everyday applications of nuclear technology from smoke detectors to gemstone coloring were covered. Many teachers were surprised to learn how vast the nuclear field is in terms of everyday applications. Several applications were nuclear RTG's and their applications in pacemakers and space exploration were also looked at, radiation hardening and how it can be used on hardwood floors to make them dent and scratch resistant, carbon dating and how it is





done, including examples from Purdue's own PRIME lab was presented, food irradiation and how it can be used to kill bacteria on food, even on food that is already packaged, sanitation of medical supplies and imaging for oil and cracks in pipes.

Non-Proliferation and Policy

Non-Proliferation issues in the United States were presented as well as how policy has affected the nuclear industry. The Nuclear Waste Policy Act of 1982 was discussed as well as the withdrawal of the NRC license application for Yucca Mountain. Additional topics discussed were The Blue Ribbon Commission's final report findings, how nuclear material from the nuclear fuel cycle could be diverted to nuclear weapons and the Non-Proliferation of Nuclear Weapons Treaty of 1970 with its regards to the International Atomic Energy Agency. This presentation also went into homeland security and how it monitors for atomic weapons.

Careers in Nuclear Engineering

This presentation went over areas where nuclear professionals are needed as well as the education requirements for them. Career opportunities discussed including national labs, the military, the power industry, medical fields, nuclear science and research, and fusion research.

Purdue Nuclear Engineering

The school of Nuclear Engineering at Purdue was explained to the teachers, giving them a better understanding of what nuclear engineers do here. Purdue's curriculum was described as well as the vast amount of research areas conducted by Purdue professors.

Rutherford Activity:

The Rutherford activity was done to show the teachers the findings from Rutherford's gold foil experiment. Teachers broke up into groups and were given marbles and a small experiment set up. The marbles (Alpha particles) were thrown at a target (atom). Most of the marbles were found to go straight through the target with no interaction, while those that hit the 'nucleus' bounced back. The goal of this experiment was to demonstrate how compact the nucleus is in an atom, and how much of it is essentially 'empty space'. The teachers all found this experiment to be a practical, fun application for their own classrooms.

Radiation Demonstration:

After the radiation, radioactivity and detection presentation, a radiation demonstration was performed. All teachers were provided with a Geiger-Mueller counter that they got to keep and where able to learn how to use them by detecting radiation from an alpha, beta, and gamma sources. Other radiation sources were also looked at, including natural uranium ore, fiesta-ware, and a smoke detector. Teachers were also able to see that distance had a large impact on the amount of radioactivity, especially with the alpha source. Shielding effectiveness was compared





between paper, steel and lead. Many teachers were surprised to see that the fiesta-ware was the most radioactive object that we brought.

PUR-1 Reactor Tour:



Promotional postcard displaying PUR-1's glow during operation

Possibly the most anticipated activity was the tour of Purdue's very own reactor, PUR-1. PUR-1 is located on Purdue's campus below the Electrical Engineering building; it is a 1kW pool type reactor. A tour of this was given by Purdue's Radiation Lab director, Jere Jenkins.

After the tour of the reactor teachers had a question and answer session with Jere on topics ranging from electrical generation to Chernobyl.



Attendees of the Teacher Workshop looking down into the reactor pool during the PUR-1 tour



Jere Jenkins giving a short introduction to some of the background and history of PUR-1

PRIME Lab Tour (March 7th, 2012)

Teachers were also given the opportunity to tour the PRIME lab on Purdue's campus. The PRIME lab contains a linear particle accelerator; it is one of five particle accelerators in the world capable of doing carbon dating.



Thomas Clifton, a PRIME lab assistant, giving a tour of the particle accelerator facility located underneath Purdue's engineering campus





Reflection

The teacher workshop was an overwhelming success. The feedback from teachers was overwhelmingly positive. Teachers were provided with the presentations on a flash drive to bring back to their classrooms, details on all of the activities performed, and Geiger counters courtesy of ANS Nationals' PIA Grant. This project is scheduled to occur again next year. One teacher even wrote to our school with additional feedback shown below:

"I just want to let all in the Nuclear Engineering College know how impressed I was with the presenters and their presentations on Saturday. I left feeling very good about the future nuclear advocates and energy managers. The power points were some of the best I have ever sat through. The speakers were confident and professional. The arrangement of activities and time to share with other educators was wonderful. I just want everyone in the whole department to know. Thanks for the motivation to keep on teaching Physics and Energy to the high school students I encounter.

-Email to the Purdue School of Nuclear Engineering from a Workshop Attendee





CMUXE Tour (February 1st, 2012)

A group of thirty ANS members visited the laboratory of current head of the School of Nuclear Engineering, Dr. Ahmed Hassanein. The tour included three rooms; each with a different laser apparatus for the multitudes of experiments covered there. Brandon Verhoff, current ANS member and graduate student under Dr. Hassanein, was the guide during the event.



Brandon Verhoff, a graduate student at CMUXE, explaining to Purdue ANS members how the laser arrangement is setup and how the orange boundary contains the green laser emitted





Trip to Fermi National Accelerator Laboratory (February 24th, 2012)



Group photo of the three ANS sections' members who toured Fermilab together



A multi-section ANS tour group views a manufacturing facility for spare parts needed for an accelerator

On Friday, February 24th the Purdue American Nuclear Society took a trip to the Fermi National Accelerator Laboratory, located out of Batavia, Illinois. This trip consisted of touring several accelerator production/operation facilities, the main Wilson Hall, and learning about some experimentation being conducted at the lab. Joining Purdue ANS were students from the University of Illinois and University of Wisconsin ANS Student Sections. Along with being a great educational opportunity, this trip was also used to enhance student relations between our universities.

Visit to DC Cook Nuclear Plant (March 2nd, 2012)



Group photo of the Purdue ANS members who visited DC Cook Nuclear Plant, outside of their facility

A group of students from Purdue's School of Nuclear Engineering visited the DC Cook Nuclear Plant in Bridgman, Michigan on Friday March 2nd. In attendance were nine students (4 sophomores, 2 juniors, and 3 seniors) from Purdue's American Nuclear Society Student Section. The tour began with a trip around the turbine building to see the condensers, heat exchangers, turbines, and generators for each unit. The group was able to step inside the radiological health monitor room to view live feed of the spent fuel pool and even saw a man suiting up to enter it for





maintenance, something rarely done. They also attended lunch with several alumni from Purdue. The trip concluded with a look inside the control room training facility which included the nation's only dual-reactor simulator. Several of the students were given the opportunity to attempt to manage plant failure situations, including those in Fukushima. The trip was a wonderful experience for all the students in attendance and we look forward to future visits!



Purdue ANS members posing in DC Cook's reactor simulator that is an exact setup of the actual control room in the plant



Purdue ANS PRIME Lab Tour (March 7th, 2012)

Twenty ANS members, consisting mainly of sophomores and juniors, toured the PRIME lab on March 7th 2012. PRIME is located a couple stories beneath the physics building at Purdue. PRIME has a large research particle accelerator that is used for a variety of things including university research, people using it for their PhD research or their post doc. PRIME is also paid by outside groups to run experiments. The particles are accelerated down a tube and can be split off into separate analysis sections depending on what specifically wants to be looked at. This lab can also do carbon dating and



View of the main accelerator of PRIME, facing in the direction the particles travel to be accelerated

research for medical isotopes; their current project has to do with studying the effects of Al-26 on patients with Alzheimer's.



Purdue ANS students touring the particle accelerator with Thomas Clifton, a PRIME lab assistant, explaining to them how the particles are generated

Much like the reactor, it was interesting that the vast majority of campus did not realize this lab exists right beneath where we walk every day. Purdue ANS students were very excited to see this and learn more about their campus. A lot of students got a better idea of some of the theoretical research that engineers and scientists can do.



CORPORATE RELATIONS

Dominion Company Night (February 14th, 2012)

Dominion Nuclear came to Purdue to host an event in order to interact with students interested in future co-op opportunities at their company. The two representatives present were also Purdue graduates. The event was held at an ANS Student Section general meeting to allow for the maximum number of students possible to be present. During the event, the Dominion representatives spoke in regards to their company mission, how they like to include co-ops in their business, and certain technical projects that went on during the past few months. After the presentation a game of "*Nuclear Pictionary*" was hosted by the representatives. This game was invented by Dominion in order to connect with the students on an intellectual and social scale as well as to judge potential interns and co-ops. During this meeting it was decided that Dominion would help fund students in attending the ANS Nationals Student Conference and other possible ANS needs. Furthermore, Dominion established their interest in future recruitment beyond this calendar year. Through their efforts to work with the Purdue ANS student organization, Dominion will be seen in positive light by the students at Purdue for many years to come.

Nuclear Engineering Opportunity Nights (NEON)

(September 12th and 13th, 2011)

In an effort to increase industry recruitment at Purdue University's Nuclear Engineering Undergraduate and Graduate student body, the American Nuclear Society (ANS) student section has created an annual event, *Nuclear Engineering Opportunity Nights (NEON)*. At NEON, all nuclear engineering undergraduate and graduate students were welcome to talk to company representatives in a typical career fair setting.



Lenka Kollar presenting as part of the representation for the National Nuclear Security Administration







In Stewart Center the room was full of Purdue nuclear engineers in attendance to learn more about the various companies

The first annual NEON event was hosted by the Purdue ANS Student Section on September 12th and 13th 2011. The event was held over two nights and allowed for students to come to nuclear job/intern specific presentations and learn about the opportunities that are available to them through companies and organizations. Approximately 60 students majoring in nuclear engineering were in attendance for both of the nights. Six companies were hosted including The National Nuclear Security Administration, First Energy, The United States Nuclear Regulatory Commission, Idaho National Laboratory, Duke Energy, and DC Cook Power

Plant. The layout of the event allowed companies to give up to a forty-five minute presentation and then intermingle with interested students, answering student specific questions and even collecting the resume of some qualified students. The foundation of this event was the motivation of the students in ANS.

The students were the driving force behind the numerous calls and emails trying to spark the interest of the invited companies; without them the event would not have been possible.





New Website for the 2011-2012 Academic Year

The opportunity presented itself this summer to give our student section's website a complete makeover. In years previous, the website had been more or less unmaintained. After officer elections in the spring of 2011, during the executive board meeting, the newly elected officers made it a priority to get a working website that would address a few priorities such as an updated calendar, newsletters/ pictures from events, and contact information for the section. Overall, the website was designed to be user friendly and provide resources for our members and the general public. Throughout its development, which consisted of approximately 2 months, features were added to enhance the mission of the website. This includes links to social media sites like Facebook and Linked-In.

Leadership

Anthony Wurl – Website and Media Chairman Jamie Marangoni – Website Project Leader Christopher Chaplin – Social Media Correspondent

Home Page

The home page was essential for the initial presentation and most current news of our section at Purdue. Flyers such as teacher's workshop, Samuel Glasstone report announcement, and campaign flyer for one of our members who ran for Homecoming King were displaced this year.

Events, Calendar, Newsletter

An updated site is a useful site. The website development team worked to maintain current news and events on our sire through newsletters and the calendar. Events were summarized and expressed through photography in the newsletters and on thumbnails on the website. Newsletters have produced 8 issues this year.







ANS

Members

Officers and representatives had an entire page to display their picture, contact information and basic information about their education and interests. This is to motivate members to seek higher office as well as let them know who represents each committee.

Education Depot

This section on the website includes slides/ other useful information for presentations and high school teacher's use in the classroom. It was made to create an easy interface for high school outreach and promote use of our site for academic use.

Monthly Showcase

Purdue ANS wanted to make a point to encourage members to seek internships, co-ops, and research opportunities. A good way to promote this was through a showcase of other successful members. Both undergrads and graduate students were highlighted through Q&A interviews about their experience.



Google Analytics is a wonderful, free service offered to help websites track traffic from around the planet. This year, this service was implemented on our site to see where our visitors are coming from, i.e. direct traffic, search engines, etc. It was extremely useful in advertising our site.









OUTREACH ACTIVITIES

Educate. Educate. Educate. These are the goals of the Purdue American Nuclear Society Outreach. ANS is dedicated to educating the public through presentations and demonstrations. Through the Outreach Committee, ANS has achieved that by participating in Engineering Week, National Nuclear Science Week, visiting high schools and welcoming groups to campus. The main goal is to encourage participants to ask questions about anything related to nuclear power, careers in nuclear engineering, radiation, classes related to nuclear engineering and more. The Outreach Committee has two main posters that are set up to use at various events on campus and a Goodie Box demonstration which is taken on our high school visits. The Goodie Box demonstration consists of a Geiger Muller detector, alpha, beta and gamma sources, a fiesta ware plate, a small piece of uranium oxide and shielding material such as lead and aluminum. Members explain a little about each of the three types of radiation, alpha, beta and gamma, and demonstrate how the Geiger counter will pick up that radiation and emit a sound. After the brief explanation different types of shielding are used on the sources and objects to show how the different types of radiation are blocked by different substances. It is a great visual tool that participants enjoy and it is beneficial for when talking about radiation safety.

What follows in this section are descriptions of the various events the ANS Outreach Committee have been a part of to fulfill the goal of educating the student body and the public about nuclear engineering.

Purdue ANS Visits Local High Schools (October 19th, 2011)

Purdue American Nuclear Society visited Hobart High School to join the Purdue Engineering Expo. This event aimed to allow high school students from northwestern Indiana to explore careers in engineering available at Purdue University. Various student organizations related to engineering were represented, with at least one organization from every subset of engineering offered at Purdue.

Purdue ANS sent four members to help inform the public about applications of nuclear technology and to discuss our undergraduate Nuclear Engineering program. Over the two hours, ANS talked to dozens of students who were curious about nuclear applications, including parents and siblings who were attending the event with the high school students as well as a few science teachers who wanted to know some of our methods for teaching nuclear science so they could apply these lessons to the classroom.

This turned out to be a successful event with nearly one hundred high school students attending the event, not counting their family members and teachers. A favorite query that was asked by





many curious students was how much radiation the Geiger-Mueller Detector was picking up from the background, as it was used for demonstrations counting the radioactivity of various sources. Many were surprised that the Fiesta ware, not the Uranium ore, was the most radioactive material that we brought.

Harrison: Thursday, October 27th Central Catholic: Thursday, November 3rd Lafayette Jefferson: Monday, November 7th

Purdue ANS continued its annual tradition of visiting local high school science classes to teach students about nuclear engineering concepts. Presentations by three to four ANS members per class were given for the entirety of the class period. The presentations were split into four parts: an introduction to radiation, shielding demonstration with a Geiger-Mueller Detector, facts about nuclear energy, and a brief discussion of the recent Fukushima Dai-ichi event.



(left to right): Kara Luitjohan, Kevin Fischer, and Alex Hagen at Lafayette Jefferson High School, teaching students about the atom

This year Lafayette Jefferson High School requested a brief primer on fusion in stars to align the material with what they would be talking about in their earth science class the following week, so a new star-focused fusion section replaced the Fukushima discussion for Lafayette Jefferson.



Anthony Wurl handling the Geiger counter demonstration after Weston Cundiff gave the lecture component of the presentation at Lafayette Jefferson High School

For most students, these talks about nuclear technology were the first mention of nuclear science in their schooling so Purdue ANS helped give these high school students a good visual experiment with the detectors that their science teachers would not have had the ability to demonstrate. Students were also challenged on their understanding of the scientific method through the shielding experiment performed, where some sources of unknown types of radiation (like Fiesta ware and Uranium ore) were presented. Then, they had to help figure out how to discern the type of radiation being emitted through a combination of the radiation detected at certain

distances as well as the amount of radiation detected through various shields (paper, aluminum and lead). Through these visits, Purdue ANS inspired some interest in nuclear science in students and was able to teach everyone about nuclear engineering in a hands-on manner.



College Mentoring for Kids

(November 3rd, 2011)

Purdue ANS hosted College Mentoring for Kids (CMFK), an organization that pairs atrisk elementary school children with a personal college student as a mentor to help improve these kids' lives by meeting with them once a week after school to participate in various activities, especially with Purdue organizations.

Last semester, Purdue ANS hosted CMFK and taught them the very basics of radiation and where radiation can be found. This semester the same batch of kids and mentors returned to talk



Nam Phan and Cassandra Lanceri prompt the CMFK kids to recall some knowledge that they taught last semester

more about nuclear science. Many of the children requested to see the Nuclear Engineering Building, so ANS hosted them within the Nuclear Engineering Library.

Purdue Student Section continues outreach on campus



Internet. Knowing what shielding material stopped the different types of radiation, the students were prompted to determine what sort of radiation was coming from unknown sources, based on the changes in detected radiation after shields were applied. Each student and mentor was given an ANS worksheet to calculate his or her personal annual radiation dose based on several factors. "These were given as an activity to perform with parents and/or timelar science routside of the event and to allow the kids to alwo others the sort of cost attiff they are statistical to the science routside

This event was very successful and was featured in the November/December ANS News to accentuate Purdue's outreach efforts

The event began with a brief review of the components atom as well as of the different types of ionizing radiation (alpha, beta and gamma) and where they originated from in terms of the atom. It turns out that the kids remembered a quite a bit last semester and even the mentors remembered some things and helped out in answering questions!

Next, the Geiger-Mueller Detector was taken out to refresh everyone on what kind of things emitted radiation. A visual demonstration of shielding of pure alpha, beta, and gamma emitters was held and then this information was

used to perform a miniature experiment. Knowing how what kind of material stopped what kind of radiation, the kids were prompted to figure out what sort of radiation was coming from a few unknown sources based on the changes in detection after various shielding was applied.

Last, every kid and mentor was given a worksheet from ANS nationals that enables a person to calculate the annual dose of radiation based on several factors like elevation and surrounding power plants. These were given as an activity to perform with parents and/or friends at home to talk a little about nuclear science outside of the event and to allow the kids to show others the sort of cool stuff they learned from Purdue ANS.





National Nuclear Science Week - Girl Scout Poster Session (January 25th, 2012)

Purdue ANS had the opportunity to participate in a poster session when several Girl Scout troops were visiting campus. Five ANS representatives participated and began by explaining the basics of nuclear engineering, radiation, and careers in nuclear engineering. A Geiger-Muller detector was used to test a piece of uranium oxide, an orange fiesta ware plate, and small beta, gamma and alpha sources. Different types of shielding were shown to only block some types of radiation versus others. The girls liked the demonstration because they could hear the detector go off if the shielding was not thick enough. After the presentation the girls asked question mainly on radiation and nuclear energy.

This was a great opportunity to reach an audience that Purdue ANS normally does not reach. Several of the girls had never heard of nuclear engineering and we were able to answer their questions as well as a few questions posed by some parents with regards to nuclear power in the US and what happened at the Fukushima Daiichi power plant.

On January 25, five members of the Purdue University Student Section attended Girl Scout Day, sponsored by the Society of Women Engineers, on the Purdue University campus in West Lafayette, Ind., where they provided information on careers in nuclear engineering and demonstrated the use of a Geiger counter. Savannah Marstall, a member of the section's Special Events Committee, said, "Several of the girls had never heard of nuclear engineering, and we were able to answer their questions, as well as a few questions posed by some parents with regard to nuclear power in the United States and

what happened at the Fukushima Daiichi power plant."

The event was featured in the March/April 2012 ANS News, showcasing Purdue's participation in National Nuclear Science Week

Engineering Week (February 20th-24th, 2012)

Every year, Purdue University puts on Engineering Week were various engineering organizations sponsor activities related to showcase the different majors. Purdue ANS participated in two ways. We had several representatives who were at the Engineering Extravaganza where they answered questions concerning ANS and nuclear engineering. On Tuesday, we put on an event focused on radiation safety. We had the Geiger-Mueller demonstration with the various sources, uranium ore and Fiesta ware plate. It was great to see how surprised people were when it was the Fiesta ware that had the higher radiation. With our alpha, beta and gamma sources, we showed how different types of shielding can block certain types of radiation. Many people were unaware of the fact that they themselves were naturally giving off radiation. We also debuted our mock hot cell and were able to explain how fuel rods are handled in industry. We had several questions about taking nuclear courses and careers in nuclear engineering and we were happy to answer their questions. A big hit was students taking the postcards with our PUR-1 reactor on the front and the information sheet with the mock uranium pellet on it.





Student Organization Fair

(February 20th, 2012)



Justin Knowles demonstrates the radioactivity of Fiesta ware to future Purdue students interested in nuclear engineering

Purdue ANS participated in Purdue's Engineering Extravaganza, which brings high school student to Purdue to learn about what it means to be an engineer. Engineering Extravaganza itself marked the beginning of Purdue's Engineering Week celebrations, where all of the engineering student organizations come together to represent Purdue engineering and enjoy the engineering collective.

Specifically, Purdue ANS represented our student section at the Student Organization Fair. After the high school students and their parents listened to a brief presentation introducing the diverse types of student organizations that Purdue possesses, they began to explore the different booths set up at the Fair.

Many student organizations from all engineering disciplines at Purdue were represented, and Purdue ANS informed students not only about our organization, but also about our Nuclear Engineering Department.

Nam Phan, Justin Knowles, and Anthony Wurl were the representatives for Purdue ANS. Most high school students were curious as to what kind of careers a nuclear engineer might have, and they were astonished to learn that working at a nuclear power plant was not the only option! By informing the students that careers in medicine, military, space and more were all other career paths a nuclear engineer might take, they became more interested in pursuing the field.

For those who may not have been specifically interested in becoming a nuclear engineer, Purdue ANS continued its mission of educating the public on radiation. Surprisingly, numerous parents of the students who stopped by our booth had worked with nuclear engineers or radiation in the past, and so both the parents and students were engaged in discovering the various sources of radiation as well as the useful applications of radiation.





Radiation Safety Demonstration

(February 21st, 2012)



Nam Phan and Joe Carabetta set up the mock-up hot cell while Phil Forsberg watches the new display in action and Stephen Taller gets ready to greet the passing public

As another event for Engineering Week, Purdue ANS showcased its new project, the hot cell, for the first time. The Radiation Safety Demonstration took place in a high-profile location and time, where many students came for coffee and lunch while the booth was set up. By choosing the event based on these factors, Purdue ANS experienced a lot more exposure with the general student body than usual.

The response to the hot cell was very positive, with many students complimenting Purdue ANS on the audacity of the project. Short of clubs that were geared to creating things for competitions, few other clubs have taken on big projects to make physical products. Additionally, students were excited to play with the claw as well as interested in why nuclear engineers would need to create and utilize such a device. Purdue ANS was glad to educate students on the necessity of handling radioactive materials in a safe manner.

Other than the hot cell, Purdue ANS entertained students with our standard Goodie Box with radioactive sources and the Geiger counter, our poster board with numerous applications of nuclear technology, and various promotional materials that we handed out to students, such as Purdue ANS stickers, postcards of the Purdue reactor, and fuel pellet energy equivalence cards.



Introduce a Girl to Engineering

(February 25th, 2012)



The Women in Engineering Program approached ANS about creating a nuclear engineering activity to present to interested high school students. We included our normal Geiger-Mueller demonstration and a hands-on activity. Our Geiger-Mueller demonstration consisted of an alpha, beta and gamma source and we use different types of shielding such as aluminum and lead. We also use a piece of uranium oxide and an orange fiesta ware plate to show the effects of the shielding. The hands-on activity created was called Radioactive Golf balls and

Purdue ANS members beginning the event with a brief introduction to nuclear engineering

focused on radiation safety. Each group received two brown paper bags which contained a golf ball, sticky notes, push pins, rubber bands, paper clips, skewers, drinking straws, various lengths of string and a piece of duct tape. The group must move the golf ball from one paper bag to the other using a mechanism they create with only the supplies given. This activity focused on teamwork and safely handling nuclear material.

There were 16 girls signed up for the nuclear engineering session and we had 17 girls in attendance. The event started with brief overview about what is nuclear engineering, potential career paths, and ANS at Purdue University. During the presentation, the Geiger-Mueller was performed to give a concrete representation of radiation.

Afterwards, the girls split into 5 groups and completed the Radioactive Golf ball activity. They really enjoyed the hands on building aspect of the activity and many of the groups finished fairly quickly. Following the activity, we answered questions about classes at Purdue and several of the participants had questions about nuclear



A participant tests out her mechanism for moving the "radioactive" golf ball

power plants. One of the ANS volunteers had had an internship at a power plant and was able to answer those.

Overall, it was a great experience and we were very excited when two girls came up to us at the end and told us they were now planning on looking into nuclear engineering. We were also glad with the positive feedback we received with our Radioactive Golf balls activity as this was the first time it was attempted. It was a positive experience with the girls asking many questions and the volunteers had a good time facilitating the activities. We look forward to doing this activity again in the future.





ANS Hot Cell Construction



The finished mock-up Hot Cell debuting in its first public appearance

Purdue ANS has been unofficially undertaking an annual project for three years now. The goal of each ANS project has been to create a useful and long-lasting product that could be used for future outreach events that aim to educate the public on radiation and/or nuclear engineering. Previous projects were: a Goodie Box containing various radioactive materials and a Geiger counter, an easily assembled and transported cloud chamber, and an informative display board.

This year, the Purdue ANS project was to create a mock hot cell to help emphasize safety as well as to engage younger audiences in a hands-on activity. By using the claw to manipulate objects instead of their hands, participants would learn some of the principles of ALARA, which was observed by using shielding and distance as the main deterrents of radiation. We feel that the Hot Cell was a beneficial tool to continue to educate the public about radiation and the steps the nuclear industry takes to ensure that radioactive material is properly handled and disposed of.

However, the completion of the Hot Cell saw several problems. The large size and heavy materials made it difficult to store and transport. Additionally, the claw mechanism that was constructed required a high amount of coordination and a decent amount of strength. Because of these flaws, the Hot Cell was scrapped after using it for the Radiation Safety Demonstration. However, Purdue ANS is committed to trying novel ideas to enhance Outreach and will continue to explore future projects despite this particular not meeting our high expectations.



Happy Hallow Elementary School (April 3rd, 2012)



Kiah Griffith (green) discussing the effectiveness of certain types of shielding from certain types of radiation

A Purdue education major who was an assistant teacher at the nearby Happy Hallow Elementary School, Grant Henry, approached Justin Knowles with the idea of putting on a nuclear science event for the 6th grade class, and ANS obliged. Justin Knowles, Nam Phan, Season Wyatt, and Kiah Griffith went to their school to give the presentation shortly after recess.

About 80 students, or three classes with their teachers and assistant teachers, gathered in their media room to hear Purdue ANS. The

students were all very excited to learn about nuclear science, having recently learned about the atom. Many of them had heard about radiation, but initially they believed that it was only a bad thing that got people sick. The first third of the presentation helped to explain to them for the first time what radiation really was, as well as its useful applications for medicine, power, lighting, and the like. All of them were surprised that they had personal experience with radiation for things like smoke detectors and x-rays! By learning about how radiation is used safely and effectively, most students were much less afraid of radiation.

However, everyone's favorite part was seeing the Geiger counter. Our demonstration of the background radiation astounded the students as we showed them how radiation is always around us. Afterwards, they were allowed to test any items they wished to see if they were radioactive. Despite their best efforts, nobody came up with anything that registered above background. Two students even ran back to their classroom and carried the class's potted pineapple plant to test it!

The teachers gave us some especially good remarks. They really enjoyed having us show the students some real-world applications of what they learned in science class, and they planned on using our presentation to relate their lectures to our interesting demonstrations. Numerous teachers also expressed interest in taking more advantage of the close proximity of Purdue, planning on taking field trips to the reactor and attending campus events in the future.





Spring Fest (April 14th, 2012)

Every year, Purdue University's Agricultural Department hosts an annual event in the spring semester called Spring Fest. Many student organizations have booths and activities set up for local families to participate in. Purdue ANS had a booth set up with a Geiger-Muller counter demonstration to help visualize radiation. Additionally, there were many giveaways, including: postcards with a picture of the PUR-1 research reactor, "I'm naturally radioactive and you are too!" stickers, and bookmarks with fun facts about nuclear science. Several families stopped by and many were curious about the future of nuclear power in the United States, the location nearest power plant, and the operation and location of the PUR-1 reactor.

This was a successful event due to ANS being able to reach out to local citizens in the surrounding area along with being able to educate very young children on radiation.



Jamie Marangoni, Jeffrey Klimes, and Savannah Marstall help curious kids calculate their annual dosage from natural radiation

Our goal in Outreach is to educate others in a fun way about the benefits and possibilities of nuclear engineering. Through our presentations, demonstrations and visits, we feel we have had a positive impact and even influenced some students to take a second look at engineering, specifically, nuclear engineering.





Purdue ANS Student Section General Meeting With ANS President Dr. Eric Loewen

(March 28th, 2012)

Doctor Eric Loewen, the current American nuclear society President, was invited to speak at the general meeting of the Purdue ANS student section. The visit was part of Dr. Loewen's "March Madness" where he visited multiple ANS sections at universities across the country.



Before the meeting, people mingled with Dr. Loewen, giving Purdue ANS members a chance speak with him. The meeting began with a presentation describing the activities of the student section over the past year. Each officer presented what they had organized and accomplished over the year and shared pictures of each event. The meeting also discussed the upcoming officer election for Purdue ANS. Each officer presented a description of exactly what their job requires and examples of what their work requires throughout the year.

Dr. Eric Loewen, the ANS President

After section business was handled, Dr. Loewen gave a presentation on his personal and professional experiences. He began by describing his undergraduate work and moved onto his experiences in the Navy. Then, he

discussed his graduate work and the academic and professional experiences that have led him to where he is now. The American Nuclear Society interaction with the Blue Ribbon Commission was discussed as well as the recently released report on Fukushima. Advice and insights were offered into how graduate and professional choices affect family and he gave personal examples when asked by students about how his family handled the experience. Dr. Loewen also spoke about his experience being elected as president of the American Nuclear Society, and encouraged us all to have a more active role in the national organization. The entire meeting was scheduled to last about an hour; however the discussion with Dr. Loewen went on almost an hour past the scheduled time due to the many questions and interactions with the students.





2012 ANS Student Conference (April 11th-15th, 2012)



The twelve Purdue ANS students who attended the 2012 ANS student conference, at the closing dinner

The 2012 ANS Student Conference was held at the University of Nevada, Las Vegas campus. The event was an overwhelming success for students attending from Purdue University. Three awards were given to Purdue researchers, making Purdue one of the most recognized schools in attendance. There were a total of nine presenters from Purdue: five of graduate students and three undergraduates. In addition, there was one undergraduate poster presentation. The awards were given to Purdue in the fields of detectors, materials, and the



Aaron Fancher explains his poster to a judge



poster presentation category.

(from left to right) Brandon Verhoff, winner in the materials category; Nicholas Wilson, winner in the detectors category; Aaron Fancher, winner in the poster presentations

In addition to the research presented at conference, Purdue students also attended multiple workshops and tour events. Two attendees from Purdue participated in the MCNPx Dice workshop and five Purdue students attended the Nevada National Security Test Site tour. The conference was great for Purdue ANS students to develop professionally, network with professionals, meet peers from other universities, and have great experiences along the way.





CONCLUSION

This year was an adventure for all the members and officers of the Purdue American Nuclear Society. Great challenges were posed in designing everything that the student section accomplished, but it proved that success cannot be had without some struggle. It is clear that the members of Purdue ANS became galvanized towards making the Purdue ANS the best it could be.

Efforts were made to preserve newfound practices and pass on lessons learned to the next group of officers. Every step of the planning process for our events was compiled over the year to streamline next year's preparations. The newly elected officers were mentored by their predecessors for the last three weeks of the semester. In addition, a large number of officers will be will remain at Purdue next year and assist in an advisory capacity. With these steps taken, the Purdue ANS student section will maintain its current practices with the opportunity to venture further into greater accomplishments.

I hope that this report has given the reader a clear overview of the Purdue American Nuclear Society's achievements over the last academic year. Purdue ANS is a passionate group of students who have enormous drive and desire to accomplish ambitious projects. Without the dedication of the officers and members of Purdue ANS, none of this would have been possible. I sincerely hope that you consider this student section for the Samuel Glasstone award.

Thank you.

Justin Knowles

Justin Knowles Purdue ANS President

