PPPL PRINCETON PLASMA PHYSICS LABORATORY
A Collaborative National Center for Fusion & Plasma Research
U.S. DEPARTMENT OF ENERGY
WEEKLY
DECEMBER 9, 2013

At PPPL THIS WEEK

MONDAY, DEC. 9

Group Photo for Holiday Card
9:45 a.m. ◆ Meet in LSB Lobby
All Employees

TUESDAY, DEC. 10

PPPL Colloquium
11 a.m. ◆ MBG Auditorium
DIII-D Explorations of Fusion Science to Prepare for ITER and FNSF
R. Buttery, General Atomics, DIII-D

FRIDAY, DEC. 13

Lisa Calabrese, My Health Coach at PPPL
8:30 a.m. - 12:30 p.m.
Call 866-237-0973 for appointment

UPCOMING EVENTS

December 16
Gerry Pierre, My Health Coach at PPPL
8:30 a.m. - 12:30 p.m.
Call 866-237-0972 for appointment

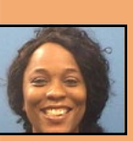
December 18
PPPL Colloquium
4:15 p.m. ◆ MBG Auditorium
Lithium Tokamak Experiment (LTX)
Richard Majeski, Princeton University

December 20
PPPL Holiday Luncheon
Noon ◆ LSB Lobby and Café

Dec. 23 - Jan. 1
Lab Closed - Holidays

January 11
Science on Saturday Lecture Series begins
9:30 a.m. ◆ MBG Auditorium

INSIDE...



Celebrating the 20th anniversary of the tritium shot heard around the world

By John Greenwald

Tensions rose at PPPL as the seconds counted down. At stake was the first crucial test of a high-powered mixture of fuel for producing fusion energy. As the control room clock reached "zero," a flash of light on a closed-circuit television monitor marked a historic achievement: A world-record burst of more than 3 million watts of fusion energy — enough to momentarily light some 3,000 homes — fueled by the new high-powered mixture. The time was 11:08 p.m. on Thursday, Dec. 9, 1993.

"There was a tremendous amount of cheering and clapping," recalled PPPL physicist Rich Hawryluk, who headed the Tokamak Fusion Test Reactor (TFTR), the huge magnetic fusion facility — or tokamak — that produced the historic power. "People had been on pins and needles for a long time and finally it all came together." It did so again the very next day when TFTR shattered the mark by creating more than six million watts of fusion energy.

Headlines around the world

The achievements generated headlines around the world and laid the foundation for the development of fusion energy in facilities such as ITER, the vast international experiment being built in France to demonstrate the feasibility of fusion power. The results delivered "important scientific confirmation of the path we are taking toward ITER," said physicist Ed Synakowski, a PPPL diagnostics expert during the experiments and now associate director of the Office of Science for Fusion Energy Sciences at DOE. "I felt an important shift in the understanding of fusion's likely reality with those experiments."

The breakthroughs proved the practicality of combining equal amounts of the hydrogen isotopes deuterium and its radioactive cousin tritium — the same combination that will be used in ITER and future fusion power plants — to form the superhot, charged plasma gas that fuels fusion reactions. The deuterium-tritium (D-T) mix produced some 150 times more power than a reaction fueled solely by deuterium, long the stand-alone ingredient in tokamak experiments, or "shots."

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PPPL's world-record burst of fusion energy on Dec. 9, 1993, made headlines around the world.

A Front Page Evening

BY KITTA MACPHERSON

The fascinating science that is at the heart of everything at the PPPL keeps hundreds of staff members busy. For the past week or so, though, with the approach of a major anniversary, Lab matters have seemed especially charged.

On Dec. 9, 1993, a team of researchers at PPPL produced world record-breaking levels of fusion energy in a one-of-a-kind experimental device called the Tokamak Fusion Test Reactor (TFTR). I was on site, too, not as a member of the Lab staff, but as a science reporter for The Star-Ledger of Newark, New Jersey's largest newspaper.

On that long ago evening at PPPL, I had serious competition. I was one of a handful of reporters who had shown an interest in PPPL for some time who was invited to cover the event. Others in the general press would be drawn by our stories and a public television video to cram into a news conference the next day for this world-class story. I stood in the main lobby of the Lab's main administration building and met two other reporters, and we moved to the auditorium to wait for news from the TFTR control room. A monitor in the auditorium displayed images of activity from the packed control room via a camera located there. Ron Davidson, PPPL's director at the time, and Dale Meade, then the Lab's deputy director, gave animated play-by-plays to the auditorium audience of what could be seen on the television interspersed with viewgraphs on fusion. In addition to the press, staff members of PPPL – some of whom brought their children – perched there, taking it in.

The late Malcolm Browne of the New York Times was covering the experiment. He had earned a Pulitzer Prize in 1964 for his bulletins from the Vietnam War. When I met him that evening, he was enjoying a grand second act as a front-page science writer. He was quiet and nice. I also spoke as we worked with Boyce Rensberger of the Washington Post. His book, "How the World Works," with its deft explanations of formidable concepts such as Einstein's theories of relativity and the field of quantum mechanics, made it a go-to source for science writers. He was outgoing and nice.

Any story from this event loomed as a wonderful capper for my year – one already loaded with stories of worldwide interest. In June 1993, eight years into my stint as my newspaper's science editor, I wrote about Princeton Professor Andrew Wiles' wondrous announcement that he proved a 300-year-old math problem known as Fermat's Last Theorem. And, on Oct. 13, 1993, only two months before the fusion experiment, I trailed Princeton Professor Joseph Taylor the day the Royal Swedish Academy of Sciences awarded the Nobel Prize in physics to Taylor and Russell Hulse. Hulse was a former graduate student of Taylor's who had risen to be a physicist at PPPL. They were honored for their 1974 discovery of a new type of pulsar, a find that opened up new possibilities for the study of gravitation.

On that night at PPPL, I was on edge. I knew I could report and write the story. The problem rested with my computer. The newspaper was experimenting with portable computers in those days and my model was a doozy. Static electricity brought about by a movement as slight as a shuffle on an office carpet provoked tremors in the casing and blackouts on the screen. Even if you managed to write a story and hold on to it, the device's manual phone hook-up — a black plastic molded doodad that fit very imperfectly on the end of the handset of a standard rotary telephone — worked erratically.

I also stewed over the fact that I knew and liked many of the scientists involved in this experiment. Journalists are supposed to be emotionally removed so they can fully represent the public interest and report objectively. In my heart, I realized, I was rooting for the PPPL team.

The reporters covering the event had editors waiting at other ends of the phone line who expected a full-fledged news story as soon as a breakthrough was achieved. We all worked for morning newspapers with tight evening deadlines. As the hours wore on, my colleagues remained calm. In my case, jubilation and tension battled for control of my emotions. I looked forward to the possibility that the researchers would pull it off and worried about the opposite outcome. I dreaded using my computer. We wondered aloud whether the results would be announced in time for us to report them.

To pull off writing such a complex story at the verge of the newspaper's print deadline, each of us had composed "A matter" — the background material that gives the story context — ahead of time. From time to time, we scurried to different corners of the lobby and worked so that when the news came, all we would need would be the lede (the first sentence or, sometimes, paragraph) and a quote. I, for one, did not want to have to explain the intricacies of a fusion reaction on the fly!

Twice I watched the A-matter I had written on my computer disappear as if the words had been written in smoke. The third version held. Just in time for deadline, as if the research team had been prompted, the scientists achieved their record.

It took me two attempts to successfully send my story over a telephone. The transmission hissed and twanged, my words transferred in stages to bits, electronic pulses and sound waves. The story relayed a remarkable scientific achievement. I knew I had spread the word to hundreds of thousands of readers. Now they would know.

I was exhausted from the cliffhanger evening. I was happy for the scientists.

We made our deadlines. And we all made the front page. ■

20 years

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"This was the first test with equal parts D-T and it was technically quite challenging," said Michael Zarnstorff, a task-force leader during the experiments and now deputy director for research at PPPL. "What we did marked a huge advance in integrating tritium into fusion facilities."

Gained insights included precise measurement of the confinement and loss of alpha particles that fusion reactions release along with energetic neutrons. Good confinement of the alpha particles is critically important since they are to serve as the primary means of heating the plasma in ITER, and thereby producing a self-sustaining fusion reaction, or "burning plasma."

The historic shots capped years of intense preparation for tritium operations, which ran until TFTR was decommissioned in 1997 after setting more records and producing reams of new knowledge. "The journey to tritium was

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(Left to right) Jim Strachan and Rich Hawryluk examine data after the pulse.

An important shift in understanding

BY ED SYNAKOWSKI, ASSOCIATE DIRECTOR OF THE OFFICE OF SCIENCE, FOR FUSION ENERGY SCIENCES AT THE U.S. DEPARTMENT OF ENERGY

Ed Synakowski, the associate director of the Office of Science, for Fusion Energy Sciences at the U.S. Department of Energy, was a PPPL researcher for 17 years, and was in the control room when the Laboratory's Tokamak Fusion Test Reactor produced world record-breaking levels of fusion energy. Here, he shares his recollections on seeing the photo of himself and his colleagues (he is pictured in a red striped shirt in the photo on page 4) on that momentous day.

In concert with JET, the TFTR experience overall, as initiated that night, took us a step further not only to fusion being scientifically closer, but also experientially so.

Now, I was pretty young in that photo - only five years out of grad school - and so others closer to the earlier years of the Lab can speak with a different kind of authority. Still, my experience was one of having crossed a long overdue threshold by operating with the "high octane" mix that yielded megawatts of fusion power. It is hard to describe except to say that I felt an important shift in understanding of fusion's likely reality with those experiments of the first night. I don't mean to sound sappy, but after that long night of running, I did take the time to look starward while walking to my car in the parking lot, and saying to myself that we too were in the game.

I can also speak of a high sense of camaraderie that is captured in that photo. Pictured there is part of a very dedicated, talented group that felt the pressure of the times and was willing to do whatever it took to rise to the occasion.

The excitement, though, was not unbridled, because we all had a sense that fundamental questions about the Lab's future were in the balance. We were finally on the DT mission that TFTR was built for. Even on this first day, the fact that TFTR's best was yet to come was mingled with an awareness that this was the likely beginning of its final mission. We did not know what was ahead, although we had hopes for the future.

As a physicist, one item that was important during DT was realizing that the tritium operation need not be onerous. Experimentalists all benefited from the tremendous work done to establish the safe handling and delivery of tritium to the experiments. I know that behind what we saw in the control room was a well-orchestrated set of processes that made DT operations easy for the physicist.

I think there was an extended period of anxious waiting to see what limits using tritium would put on how we did scientific business. In the end, physicists experienced it as a great research tool, with the choice to use tritium being yet another knob to turn to help understand fusion physics.

The sense that operating with DT could add to our scientific flexibility without excessive burden came as a welcome surprise to me, and I think it did to others as well. The absence of any sense of burden in carrying out the experiments is a tribute to the quality of the work done that many of the physicists did not directly see.

Looking forward, the experience girds my own belief that ITER can and should be regarded as a flexible scientific instrument. ■

20 years

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at least as exciting as the first experiments," said former PPPL Director Ronald Davidson, who led the Laboratory during the tritium years. "It was an enormous technical undertaking and one of my greatest elements of pride in the PPPL staff was that the preparations were so good and so thorough that the tritium shots were successful early on in the D-T campaign."

The preparations mobilized physicists, engineers and staffers throughout the Laboratory. "The absolute top priority was to demonstrate that one could carry out the tritium experiments safely," said former Deputy Director Dale Meade. "Everyone focused on this mission as we went through a step-by-step construction and checkout of the tritium systems with rigorous adherence to procedures and strong oversight by DOE."

(Left to right) John Willis of the Office of Fusion Energy Sciences and former PPPL director Harold Furth talk fusion as events unfold.

Scientists in the control room. Seated front to rear: Eric Fredrickson, unidentified, Helmar Adler, Ken Hill, back to camera unidentified, seated is Joe Bartolik; Standing from front: Phil Efthimion, George Renda, Stephen Paul, unidentified, and Forrest Jobes.

Leaders of this effort included Jerry Levine, now head of the Environment, Safety, Health & Security Department at PPPL, and John DeLooper, who heads the Best Practices and Outreach Department. Levine's team launched an environmental assessment under the National Environmental Policy Act in 1989 and received DOE and state approval in 1992. "The purpose was to show that there would be no significant environmental impact as a result of tritium operations," Levine noted. DeLooper's team double-checked everything from operator training to preparations for storing and moving the tritium gas, which subsequently arrived in stainless steel containers from the Savannah River National Laboratory in South Carolina.

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Then...

Front row, left to right: Marilee Thompson (PPPL, retired), Murakami Masanori, Alan Janos, Bob Budny (PPPL), Mike Zarnstorff (PPPL) Behind Thompson: Helmar Adler (in red) behind Murakami; Steve Sabbagh (in white, PPPL). Third row: From left: Schwick von Goeler (in black), Steve Batha (in white), Charles Bush (in blue), Eric Fredrickson (in white, PPPL), Ed Synakowski (striped shirt, then PPPL, now DOE's Office of Fusion Energy Sciences), Phil Efthimion (blue sweater, PPPL), Brent Stratton (green plaid shirt, PPPL), George McKee. Back row: The late Stephen Paul (black sweater, PPPL), Ken Hill (PPPL), Dave Johnson (white shirt, khaki slacks, PPPL), Charles Skinner (arms folded, PPPL), Boris Grek (tan shirt), Joe Bartolik (striped shirt), Lane Roquemore, far right, tan shirt, PPPL).

And Now

Some of the original group who were on hand for the world-record DT shot posed in the control room in honor of the 20th anniversary in the same spots as the original photo. From left to right: Marilee Thompson, Ken Hill, Steve Sabbagh, Dave Johnson, Eric Fredrickson, Charles Skinner, PPPL Deputy Director for Research Michael Zarnstorff, Brent Stratton, who is wearing the shirt he wore in the original photo, and Lane Roquemore. Some of the scientists are wearing the original red TFTR badges they wore that night.

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In the towering TFTR test cell, engineers readied the three-story high, 695-ton tokamak to operate with tritium. Key tasks included adding more shielding, checking all major systems against possible failures and ensuring that every diagnostic device worked. "The major challenge was to bring everything on line so that failures didn't happen," said Mike Williams, the head of engineering at PPPL and also deputy head of TFTR at the time.

Nothing was certain

Yet nothing could be certain until the experiment began. "The whole world was going to show up and we had lots of opportunity to fall on our faces," said engineer Tim Stevenson, who headed the neutral beam operations that heated the plasma to temperatures of more than 100 million degrees centigrade during the shots. "All the instruments were tuned up," Stevenson said, "but we still had to play the symphony."

Keeping the local community informed was another high-priority. PPPL leaders held open houses, met with local executives and government officials and conducted two public hearings before the arrival of tritium. Attendees at one hearing included a local college class that arrived at the urging of its professor.

By the day of Dec. 9, press coverage and Laboratory outreach had made PPPL a focus of attention. "Scientists from around the world flew in to witness the experiment," recalled Rich Hawryluk. More than 100 local visitors flocked to the PPPL auditorium, where a closed-circuit TV feed displayed the control room and Ron Davidson and Dale Meade briefed the audience on unfolding developments. PPPL staffers and their families crowded around the viewing area that overlooked the control room.

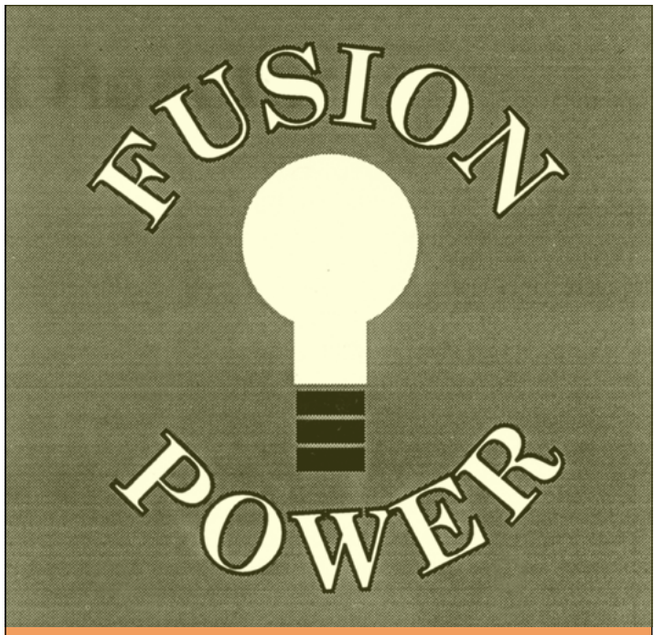
Reporters from several major newspapers covered the event. Also there was Mark Levenson, a reporter from New Jersey public TV station NJN, whom the Lab hired to produce a video that subsequently received worldwide exposure.

The source of all this excitement was surprisingly small: Just six-millionths of a gram of tritium was consumed that night in the shot that made global news. "Such tiny amounts generate huge energy because of the formula $E = mc^2$" explained Charles Gentile, the head of tritium systems at PPPL. The celebrated Einstein equation states that the amount of energy in a body equals the mass of that body times the speed of light squared — an enormous number since light travels at 186,000 miles per second.

Excitement among the press

The media seemed as eager as the scientists to watch the famed formula work. "The press people were enormously excited," said now-retired physicist Ken Young, who headed the PPPL diagnostics department and led efforts to measure the confinement and loss of alpha particles during the experiments. "These reporters were seeing science as it happens and kept waiting for the shot."

Also anxiously waiting were more than 100 scientists, engineers and invited guests inside the control room, which normally held about 40 people. All sported red passes that the Laboratory gave to PPPL staffers and guests from DOE and institutions that collaborated on TFTR. "Everybody who could be in there was in there," recalled Forrest Jobes, a now-retired physicist who kept those in the rear of the L-shaped room abreast of what was happening.



This poster with cutouts shaped like a light bulb and letters spelling "Fusion Power" was used to signal successful D-T shots.

Up front, physicist Jim Strachan was too intent on his job to be caught up in the exuberance. His task was literally to call the shots — to decide how much heating power to use, for example, and when to start the countdown. "Everyone in the group was out to get the most D-T power from reproducible shots," the now-retired Strachan recalled. "I felt a lot of responsibility and didn't want to foul up."

"Fusion Power"

All eyes followed a closed-circuit TV monitor that displayed a neutron-sensitive scintillator screen in the TFTR test cell that glowed when struck by the neutrons that a D-T shot produced. Artfully covering this test-cell screen was a cardboard poster — designed by PPPL graphic artist Gregory Czechowicz at the behest of Dale Meade — with holes cut into the shape of a light bulb and letters spelling "Fusion Power." Engineer George Renda designed the scintillator itself. A flash of light from the bulb and the letters in the 3-foot-by-3-foot poster that covered the screen signaled a successful shot. "We came to really count on that image," said Ed Synakowski. "No need to wait for the computer system to process the data."

But there still was plenty of waiting while a series of hardware glitches dragged out the schedule. "Many people in the audience thought we were doing this intentionally to increase the suspense," Meade recalled.

Jubilation

By 11 p.m. the problems were solved — setting the stage for the record-breaking shot at 11:08 signaled by the brightly lit light bulb and "Fusion Power" sign on the TV monitor. The control room erupted in jubilation over the shot, which produced 3.8 million watts of power. The excitement reached even the staid control-room log, where an operator noted the historic event with the exclamation, "EEYAH"!

On that high note the experiments ended and the control room opened for press interviews. NJN reporter Levenson returned to his studio to assemble a video news release that he uploaded to a satellite for worldwide distribution, sending the piece off at about 4 a.m. Key parts of the footage — including the control-room jubilation — were shown on nationwide newscasts the following evening.

Looking back at these events, Hawryluk reflected on the sense of excitement, anticipation and relief that came with them. "We had worked so hard to finally get to that stage and we had done it," he said. "That night on December 9 established a research capability that has enabled us to pursue a whole host of opportunities to advance the development of fusion energy."

Material Services Celebrates 20-year Clean Safety Record

The Material Services group celebrated the fact that they have maintained a clean safety record for the past 20 years with a cake and plaque and invited the entire Laboratory to celebrate with them.

Fran Cargill, material services branch head, said the group was able to maintain that record despite working with heavy machinery.

"They all really look at safety whenever they do any type of work here," she said. "They look out for each other and they really just work as a team. I think what makes me proud is that they continue safe practices on a daily basis and in addition, recognize the STOP program as a tool that is beneficial to all."

The Material Services group shows off their plaque: From left to right: Front row: Christine Canal, Jim Conover, Marisol Ovalles. Middle row: Matt Lawson, Kyron Jones, Tanisha Harris, Fran Cargill. Back row: Mike Viola, Spence Holcombe, John Luckie, Jerry Siminoff.

Mark Your Calendars

Upcoming Science Education Events & Scholarships

Young Women's Conference:
Registration is open for the Young Women's Conference in Science, Mathematics, Technology & Engineering! The conference will be held in early spring and is now open to the daughters of PPPL employees. To register and for more information, go to https://pppl.princeton.edu/www.pppl.gov-YWC.

High School Internship Program Deadlines:
The spring semester high school internship application is open until Dec. 14. The summer high school internship application is also open and the deadline is Feb. 21. Go to http://www.pppl.gov/education/science-education/programs/high-school-internship/ for more information.

National Undergraduate Fellowship Program:
Applications are now open for the National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Science with applications due Feb. 14. Go to http://www.pppl.gov/education/science-education/programs/nuf for applications and information.

Community College Internship:
This program through the Department of Energy Office of Science has an application deadline of Jan. 10. Go to http://science.energy.gov/wdts/cci/ for applications and information.

Science on Saturday:
The always popular Science on Saturday program will start on Jan. 11 with a lecture by PPPL's Walter Guttenfelder on "Containing a Star on Earth: Understanding Turbulence at 100 Million Degrees." Seats fill up fast so plan to get to PPPL by 8:30 a.m.! https://pppl.princeton.edu/education/science-education.

The New Jersey Regional Science Bowl:
The middle school competition will be held at PPPL on Friday, Feb. 21 and the high school competition will be on Saturday, Feb. 22. Registration closes Jan. 21. https://pppl.princeton.edu/education/science-education/programs/new-jersey-regional-science-bowl.

The Science Undergraduate Laboratory Internship (SULI) program:

This is a Department of Energy program that offers 16-week research internships at DOE labs during the spring and fall semesters and 10-week summer internships. Go to http://science.energy.gov/wdts/suli/ for applications and information.

PPPL welcomes new employees!

JOHN B. ADAMS
NB Cryogenics Technician
Engineering & Infrastructure

TANISHA HARRIS
Property Mgmt. Coordinator
Engineering & Infrastructure

ALEXIS D. SANCHEZ
Electrical Technician
Engineering & Infrastructure

COLLOQUIUM

DIII-D Explorations of Fusion Science to Prepare for ITER and FNSF

RICHARD BUTTERY
General Atomics, DIII-D

SPECIAL DAY•Tuesday, Dec. 10•SPECIAL TIME

11 a.m. (Coffee/Tea at 10:45 a.m.) • MBG Auditorium

PPPL'ers contribute to United Way

Thank you to all the PPPL'ers who contributed $ $22,523.37 to the PPPL and Princeton University United Way as of Dec. 6. We also raised $448 from the two bake sales held at PPPL. Your contributions will help numerous organizations in Mercer county, including groups that mentor at-risk high school students in Trenton, provide housing for homeless people and help seniors and a group that helps people with disabilities stay in their homes. The deadline was Friday but donations are still being accepted!

My Health Coach comes to PPPL Dec. 13 and 16

My Health Coach, offered in partnership with TrestleTree, an accredited health transformation organization, provides you and your eligible dependents with free confidential assistance to achieve your health goals. For your convenience, the Health Coaches will be at PPPL to meet with employees. Lisa Calabrese, a registered nurse, will be at PPPL on Friday, Dec. 13 from 8:30 a.m. to 12:30 p.m. and Gerry Pierre, a registered dietician and certified diabetes educator, will be at PPPL on Monday, Dec. 16 from 1 p.m. to 5 p.m.

To make a first-time appointment, please call (866) 237-0973. Be sure to identify yourself as a PPPL employee and make an appointment for either Dec. 13 or 16.

Food Contributions Needed for Local Food Bank

Please help people in our community who do not have enough to eat this holiday season by bringing your donations to the LSB lobby from now through Dec. 18.

The donations will be sent to the Mercer Street Friends Food Bank, which provides food to more than 25,000 people through 50 pantries, shelters and soup kitchens.

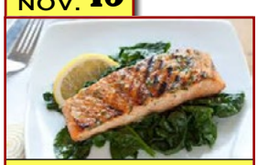
The most needed items are canned protein such as tuna fish or chicken, Parmalat, cereals, and peanut butter and jelly. The Food Bank also needs personal care products such as soap, shampoo, deodorizer, feminine products and laundry soap.

Items needed for the Send Hunger Packing Program, which provides food to school-aged children to get them through the weekend, include: single servings of Parmalat, individual servings of cereal and individual servings of microwaveable food, granola bars and pudding cups.

Café at PPPL Menu

BREAKFAST ..... 7 a.m. • 10 a.m.
CONTINENTAL BREAKFAST ..... 10 a.m. • 11:30 a.m.
LUNCH ..... 11:30 a.m. • 1:30 p.m.
SNACK SERVICE ..... until 2:30 p.m.

— MARK GAZO, Chef Manager

	MON. 9 DEC.	TUE. 10 DEC.	WED. 11 DEC.	THU. 12 DEC.	FRI. 13 NOV.
COMMAND PERFORMANCE CHEF'S FEATURE	 Herb-Crusted Chicken Breast served over Pasta	 Grilled Vegetable Burrito	 London Broil au Jus	 Roast Pork Lo Mein	 Grilled Lemon Basil Salmon
EARLY RISER	Corn Flake-Crusted French Toast with Strawberry Honey Butter	Mediterranean Egg White Omelet	Scrambled Egg Wrap with Turkey Sausage	Fresh-Baked Biscuits with Sausage Gravy & Scrambled Eggs	Pumpkin Pancakes with Apple Cider Syrup
COUNTRY KETTLE	Straciatella with Parmesan Cheese	Cabbage Potato Soup with Egg Noodles & Sour Cream	Pumpkin Turkey Chili	Shrimp & Corn Chowder	Beef Barley
GRILLE SPECIAL	Pepperoni Pizza Steak Sandwich with French Fries	Grilled Italian Sweet Sausage Sub served with Pasta Salad	Pub Style Fish & Chips	Cajun-Rubbed Turkey Breast with Seasoned Potato Wedges	Create Your Own Portobello Mushroom Stacker
DELI SPECIAL	Veggie Wrap with Hummus, Spinach, Tomato, Portobello	Corned Beef and Swiss Cheese on Pumpernickel with Coleslaw	Baked Ham with Pears, Cranberry Relish & Cheddar on French Bread	Creamy Dilled Seafood Salad with Cucumber on a Croissant	Turkey Ranchero Hoagie Melt served with Baked Beans
PANINI	The Cubano	Tuna Fish Nicoise	Montana Smokehouse on Ciabatta Bread	Grilled Apple with Cheddar Cheese & Arugula on Ciabatta Bread	Hot Roast Beef with Caramelized Onions & Horseradish on Ciabatta
VALUE MEAL $5	BLT with Housemade Potato Chips & 12 oz. Beverage	Crispy Chicken Tenders with French Fries & 12 oz. Beverage	Cheese Omelet with Home Fries & 12 oz. Beverage	2 Slices Pizza with Garden Salad & 12 oz. Beverage	Italian Meatball Sub with French Fries & 12 oz. Beverage

MENU SUBJECT TO CHANGE WITHOUT NOTICE

VEGETARIAN OPTION

CLICK HERE FOR A PRINTABLE WEEKLY MENU

WEEKLY

Editor: **Jeanne Jackson DeVoe** ◆ Layout and graphic design: **Gregory J. Czechowicz**
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