

## BNL, Carnegie Scientists Report First 'Morphing' in Plant Enzyme Function



Ed Whittle (left) and John Shanklin, Biology Department, in their lab.

For the first time, biochemists have succeeded in "morphing" a plant enzyme — using genetic manipulation to change a plant enzyme into another enzyme with a different function.

The achievement advances the prospects of "designer" plants for renewable industrial raw materials, fuel and food. It also sheds new light on how plant enzymes evolved to perform different functions.

This biochemical breakthrough, published in *Science* last November 12, was the topic of the Plenary Lecture at the First Annual Plant Biochemistry & Molecular Biology Conference at Iowa State University last Saturday, April 24.

Giving the lecture was John Shanklin of BNL's Biology Department, one of the leaders of the BNL-Carnegie Institution of Washington's Stanford, California, team who did the research. Also on the team are BNL Biology's Ed Whittle, and, from Carnegie, co-leader Chris Somerville and team member Pierre Broun.

"We have shown that it is possible to change an enzyme's function dramatically by tweaking its structure just slightly," said Shanklin. "Nature has been doing this for eons through mutation; our experiment shows how such changes might come about and what their end result is."

The research was funded by DOE's Office of Science (SC). SC Director Martha Krebs commented, "This is not only a discovery of fundamental scientific significance, but it clearly demonstrates a pathway to develop an alternative, biologically-based source for many oils used in industry which currently depend upon petroleum for their production."

### Working the Enzymes

Enzymes are made of chains of amino acids, strung together in a certain order to create a specific architecture that determines its unique chemical function.

To do their research, Shanklin and his colleagues used different species of related cruciferous plants from which they took enzymes called desaturases and hydroxylases.

Both of these enzymes perform important tasks. Desaturases convert plant molecules called fatty acids from straight to bent, by turning single chemical bonds into double ones. Hydroxylases add hydroxy groups to the fatty acids' structure.

By careful detective work, the team identified which amino acids in the

sequence are responsible for a particular activity of the desaturase and hydroxylase enzymes. By modifying the genetic blueprint for the enzymes, they swapped several amino acids from one enzyme for their equivalents in another enzyme.

Then, they examined the consequences by implanting the genes in a plant known as *Arabidopsis*, plant scientists' equivalent of animal geneticists' well-studied fruit fly. An analysis of the oil that accumulated in the modified plant's seeds showed that the "morphing" had been successful — the desaturase had become a hydroxylase and vice versa.

The changes centered around the enzymes' active sites — areas that grab fatty acids and catalyze the chemical changes. "Picture an enzyme as an industrial punch press and its active site as the die," said Shanklin. "What

(continued on page 2)

## Medical Chair Nora Volkow Named Associate Director for Life Sciences

Nora Volkow, a board-certified psychiatrist and a world-leader in research on addiction, has been named Associate Laboratory Director for Life Sciences. She succeeds Richard Setlow, who has returned to research as a BNL senior biophysicist.

Volkow will head BNL's Biology and Medical departments, which together have about 150 employees. In Medical, major research areas include the development of new diagnostic techniques for nuclear medicine, neurosciences, cancer, medical physics and radiation therapy. Biology pursues research in molecular genetics, structural biology, genomics and biotechnology.

On the future of life sciences at the Laboratory, Volkow said, "My primary goal is to facilitate research in areas in which the two departments have unique expertise and resources. Besides continuing our partnership with the Department of Energy, I would like to secure more funding through other government sources, such as the National Institutes of Health, and through new collaborations and inter-agency agreements."

Among the initiatives Volkow considers most important in the Biology Department is the Proteome Project, a



Nora Volkow

large-scale effort to identify the structure of proteins and their functions. The project involves several national laboratories, universities and industry. In the Medical Department, boron neutron capture therapy, an experimental technique to treat a type of lethal brain tumor, remains a major initiative. Volkow hopes to expand this experimental therapy to determine whether it will be effective in treating other types of cancer.

Cancer research will be a major component of BNL's life sciences research in the new millennium, Volkow explained. "We will continue to focus on genome research, the effects of radiation on cells, and the repair processes of DNA — basic research that may lead to understanding the causes of cancer. Also, we'll continue to explore new radiation treatments, and ongoing research may provide new and more effective radiotracers for the diagnosis and treatment of cancer."

Another major area of research will be investigations of the human brain, to take advantage of the Lab's unique imaging resources.

Volkow will continue her own research, which involves the use of an imaging method called positron emission tomography (PET) to investigate the biochemical changes in the brain associated with drug addiction, alcoholism and aging. Her studies are focused on finding an effective pharmacological treatment of addiction and could aid in finding avenues for delaying and counteracting the deleterious effects of aging.

Volkow's vision for future research in life sciences at BNL is to take the information derived from the human

(continued on page 2)

## BNL Hosts PAC '99 in New York City








At the Tuesday, March 30, banquet held during PAC '99, the North American Particle Accelerator Conference hosted by BNL at the New York Marriott Marquis hotel in New York City, March 29-April 2, Under Secretary of Energy Ernest Moniz (left) gave the keynote speech, with an introduction by BNL Director John Marburger (right). Others at this table were (from left) Conference Chair Bill Weng, Alternating Gradient Synchrotron (AGS) Department; Jennie Weng, BNL's Financial Services Division; Conference Secretary Mary Campbell, AGS; Michael Iarocci, Relativistic Heavy Ion Collider Project; past President of the American Physical Society Andrew Sessler, Lawrence Berkeley National Laboratory; European Particle Accelerator Conference Chair Steve Myers, CERN, Switzerland; Peking University President Jiaer Chen, Beijing, China; and Carol Marburger. (See photos, pages 2 and 3.)





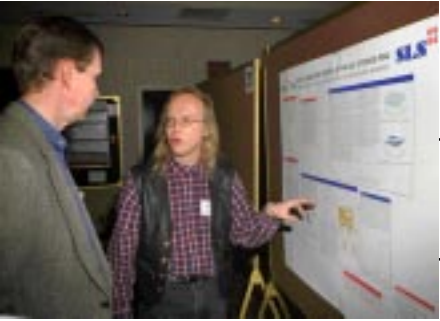
### BSA Lecture Today


Kip Thorne, a theoretical physics professor at the California Institute of Technology, will give a lecture entitled "Space-Time Warps and the Quantum: A Glimpse of the Future," today, at 4 p.m. in Berkner Hall. All are welcome, and refreshments will be offered after the lecture.



# Brookhaven National Laboratory Hosts PAC '99, World's Largest Accelerator Conference, March 29-April 2, 1999








**PAC '99**  
March 29 - April 2, 1999 • New York City

PAC sponsors are the American Physical Society's Division of Physics of Beams and the Institute of Electrical & Electronic Engineers' Nuclear & Plasma Sciences Society, with grants from U.S. Department of Energy, the National Science Foundation and the U.S. Office of Naval Research.



• 1,400 participants  
• More than 70 invited presentations  
• 1,300 poster papers

See also the Brookhaven Bulletin, April 2 and March 5, 1999.

Photos by Roger Stoutenburgh  
PAC '99 Logo by Pat Yalden

**Noon Concert**

The BSA Lunchtime Recital on Wednesday, May 5, 12-12:45 p.m., will be given by Elizabeth Francoeur, clarinet; Gabrielle Painter, violin; Sally Singer, cello, and pianist Naomi Niskala, in a performance of Messiaen's "Quartet for the End of Time."

Live performances of this work are rare due to the unusual combination of instruments, dictated by its composition in a concentration camp. The significance of the seven movements will be explained to the audience.

BSA Lunchtime Recitals are free, informal and open to all. Audience members may bring a box lunch into the hall to enjoy with the music, and may come and go as they please.

**In Memoriam**

**Roburt Werner**, who joined the Lab's then Health Physics Division as a firefighter on January 6, 1964, died on October 26, 1998, at age 71. He worked at BNL for 25 years, retiring as a fire captain on December 6, 1989.

**John Bunt**, an electrician who had joined the Lab in the then Road Section Division on September 23, 1947, died at the age of 70, on October 31, 1998. After 40 years in what is now the Plant Engineering Division, he had retired as an electrician A group leader, on August 5, 1987.

**Volkow** (cont'd)

genome project and apply it to understanding how the human brain works and how it is disrupted by disease.

After receiving her M.D. in 1980 from the National University of Mexico, Volkow did her residency at New York University's Department of Psychiatry, from 1981-84. During this time, she used the Brookhaven PET facility for research on schizophrenia. Then, at the University of Texas Medical School from 1984 to 1987 Volkow performed ground-breaking research on the toxic effects of cocaine on the brain.

In 1987, Volkow joined BNL's staff as an associate scientist to continue this research. She became associate

**Morphing Enzymes** (cont'd)

we have essentially done is learned how to change the die to make the punch press produce a different product."

**Diverse Applications**

These simple chemical changes can make huge differences in plant oil properties.

For example, a fatty acid molecule with two bends may be sensitive to heat, while a fatty acid with an added hydroxy group is heat-resistant and performs well as a high-temperature lubricant.

While there are hundreds of applications for existing plant oils, even more uses could arise from novel oils produced by plants that are given new enzymes.

The Brookhaven-Carnegie experiments were not performed on

chief of staff of the Lab's Clinical Research Center in 1990, and Director of the Nuclear Medicine Program in 1994. Then, in 1996, she became Medical Department Chair. Since 1987, she has been on the staff of the Department of Psychiatry, State University of New York at Stony Brook.

Among her many honors, Dr. Volkow received a Brookhaven Distinguished Research and Development Award in 1995 and the 1998 Brookhaven Town Award to honor women in medicine. Most recently, she was named 1999 Woman Scientist of the Year by the Museum of Science and History and the Association for Women in Science, Jacksonville Chapter, Florida.

— Diane Greenberg

crop plants whose oils are harvested for industrial use, but if crop plants could be similarly changed, farmers could produce a far more diverse set of oils.

Shanklin and his colleagues have studied desaturase and other plant enzymes for several years. In 1997, a team from Brookhaven and Sweden's Karolinska Institute were the first to alter a desaturase so that it made fatty acids bend at a different point and created an oil with slightly different characteristics.

This new achievement means that enzymes are more plastic, or able to be changed, than scientists had recognized.

"Not only can this knowledge be put to work in the field of designer oils, it also has implications for the concept of patenting enzymes," Shanklin said.

— Kara Villamil

**Hospitality Committee**

The Hospitality Committee invites all on-site residents, their spouses and friends to join in the following events. More details are posted in the laundry and on the door of the Recreation Building.

**Welcome Coffee**

Coffee is served to apartment area residents every Tuesday, from 10 a.m. to 11:30 a.m., in the lounge of the Recreation Building.

**Parent-Toddler Group**

Parents of two-year-olds are invited to bring the children to the Recreation Building every Wednesday, 9:30-11:30 a.m. For more information, call Sarah Zill, 821-2602.

**Equipment Demos**

On Monday, May 3, from 10 a.m. to 3 p.m., in Berkner Hall, Hewlett Packard will present new products. For more information, call Tammy Kubasko and Maribel Thomas, (732) 562-6114.

On Wednesday, May 5, from 9 a.m. to 4 p.m., in Berkner Hall, Karman Industrial Technologies & Thomson Industries will display linear motion and control technology in such products as ball screws, Precision 60 case shafting, linear bearings, True Planetary micron gearheads, complete multi-axis systems, stepper motors and digital linear actuators.

A drawing will be held to win a hand-held global positioning system. For more information, call Carmella Riggio, 436-5090.

**Farmers' Market**

The weather is improving, you can often leave off your coat — and, starting next Wednesday, May 5, from 11:30 a.m. to 1:30 p.m., the BNL Farmers' Market will be back in its every-Wednesday place on the grass near the parking lot of Berkner Hall. Come and check out what's on the market.

**Arrivals & Departures**

**Arrivals**

Severino Binello ..... AGS  
Kaori Kobayashi ..... Chemistry  
Kathryn J. Lancaster .... Info. Services  
Alexandre Vaniachine ..... Physics

**Departures**

Patricia E. Molina ..... Medical

Dosimetry badges will be changed today, Friday, April 30. Therefore, please place your badge in its assigned rack space before leaving work today.

**BROOKHAVEN BULLETIN**

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**Bowling**

**Red and Green League - Week of April 6**

R. Mulderig Jr. 236/213/202/651 scratch, R. Mulderig Sr. 227/216/208/651 scratch series, R. Deam 222/216/202/640 scratch, J. Griffin 245/225/638 scratch, R. Larsen 215/202, G. Miltenberger 231, T. Dilgen 229, A. Pinelli 214, E. Larsen 210, N. Besemer 208, L. Mulderig 204, M. Meier 204.

**Red and Green League - Week of April 13**

E. Larsen 265/215/215/695 scratch, R. Mulderig Jr. 257/246/202/705 scratch, J. Griffin 257/231/228/716 scratch, R. Raynis 256/223/228/717 scratch, R. Larsen 245/212/207/664 scratch, R. Mulderig Sr. 244/213/628 scratch, A. Pinelli 214/211, T. Sullivan 218/204/616 scratch, R. Picinich 298/663 scratch, M. Meier 247/639 scratch, K. Koebel 245, O. Mirjah 211, J. Sullivan 212, H. Dawson 212, S. Reynolds 204, E. Meier 202.

**Red and Green League - Week of April 20**

J. Griffin 260/214/208/682 scratch series, M. Meier 243/221/214/678 scratch, R. Larsen 222/212/203/637 scratch, R. Raynis 243/241/670 scratch, E. Larsen 236/223/647 scratch, O. Mirjah 210/204/200/614 scratch, J. Sullivan 240/210/636 scratch, R. Mulderig Jr. 229/224/642 scratch, T. Sullivan 257/615 scratch, K. Asselta 246, J. Meier 223, N. Besemer 216, H. Dawson 211, F. Wahler 208, M. Grau 202, R. Mulderig Sr. 202, E. Sperry III 202, J. Giuffre 201.

**Purple and White League - Week of April 8**

J. McCarthy 256/193/192/641 scratch, E. Sperry IV 213/211, D. Keating 211/176, P. Wynkoop 203/189, N. Besemer 202/188, M. DiMaia 201/191, L. Simes 216, G. Mehl 215, S. Logan 244/208, S. DiMaia 203, C. Johnson 191, P. Callegari 182, J. Zebuda 182, Donna King 183, T. Blydenburgh 177, B. Rothe 171, G. Mehl converted the 8/10 split.

**Purple and White League - Week of April 15**

J. Zebuda 233/184, A. Pinelli 224/193, Donna King 222/195, D. Keating 222/185, M. Guacci 213/213/622 scratch series, E. Sperry IV 212/195, B. Mullany 204/182, Eric Mamay 204/196, Don King 201/182, S. Logan 215, E. Meier 205, T. Dilgen 203, J. Meier 200, K. Washington 191/175, J. Addressi 201/191, K. Conkling 189/176, J. McCaffrey 185/182, P. Callegari 199, K. Batchlor 196, A. Scocca 195, N. Fewell 194, J. Holmstrom

**March Into May Draws Winners**

Today, Friday, April 30, marks the midpoint of the March Into May physical activity program that started on Monday, March 22.

In the first prize drawing among participants who returned their registration forms to their captains before April 30, Matt LaBarge, Waste Management Division, Donna Pfeiffer, Plant Engineering Division, George Walczyk, Instrumentation Division, and Robert Weggel, Physics Department, all won water coolers.

Eva Emmerich, Alternating Gradient Synchrotron Department, and Kara DeCastro, Department of Advanced Technology, both won exercise mats. The winners may collect their prizes from the Clinic, Bldg. 490.

To be eligible for the next drawing, the 367 participants should contact their March Into May captains to report the number of points they have accumulated for physical activity during the past five weeks.

For more information, contact your captain or Health Promotion Specialist Mary Wood, Ext. 5923.

**Motto Mania**

BNL's environmental protection program now has a motto. Laboratory Director John Marburger selected the winning entry out of a number of excellent entries received from employees throughout the Laboratory.

The winning entry, submitted by George Goode, Environmental Services Division, is:

**Exploring Earth's Mysteries ... Protecting Its Future.**

For his winning entry, George received a \$100 American Express gift certificate.

The Environmental Services Division will be working with Graphic Arts on the final "look" for the motto. ESD wishes to thank the BNLers who made suggestions for their enthusiastic and creative participation in the contest.

**Volleyball Party**

The end-of-the-season Volleyball League party will take place on Saturday, May 15.

There will be open play in the gym from 10 a.m. to 1 p.m., outdoor play at the gazebo from 2-6 p.m., a hot and cold buffet and soda. No alcohol will be served.

Tickets at \$5 a person are on sale from Denise Meisell-Bingham, Bldg. 97, Ext. 5873, children under 12 years of age may enter free.



# Bus Trip to U.S. Open

The BERA Tennis Committee is again sponsoring its popular bus trip to the U.S. Open Tennis Championships at the National Tennis Center, Queens.

The 1999 trip will take place on Tuesday, September 9, when the bus will leave from the tennis-court parking lot at 8:30 a.m., with a pick up at the Long Island Expressway Exit 63 park & ride. After the day's session, the bus will leave the National Tennis Center at 7:30 p.m.

The per-person cost of \$57 includes the day-session ticket (now \$41) and the round-trip bus fare, including a tip for the driver. Paid reservations are being taken at the BERA Sales Office, Tuesday through Friday, 9 a.m. to 1:30 p.m. Sign up early, as only 49 seats are available.

# Spring Aqua Aerobics

Seven weeks of water stretching and exercise classes will again be offered at the Lab pool, Bldg. 478, from 5:20 to 6:20 p.m., on Tuesdays and Thursdays. The first classes will be on May 4 and 6, respectively.

Sponsored by the Health Promotion Program of the Occupational Medicine Division, aqua aerobics classes are free, but participants must pay the pool fee of \$2 a session or show their season pool pass. Employees and their spouses may sign up for one or both classes by calling Health Promotion Specialist Mary Wood, Ext. 5923.



## Placement Notices

The Lab's placement policy is to select the best-qualified candidate for an available position. Candidates are considered in the following order: (1) present employees within the department/division and/or appropriate bargaining unit, with preference for those within the immediate work group; (2) present employees within the Laboratory; and (3) outside applicants. In keeping with the Affirmative Action Plan, selections are made without regard to age, race, color, religion, national origin, sex, disability or veteran status. Each week, the Human Resources Division lists new placement notices, first, so employees may request consideration for themselves, and, second, for open recruitment. Because of the priority policy stated above, each listing does not necessarily represent an opportunity for all people. Except when operational needs require otherwise, positions will be open for one week after publication. For more information, contact the Employment Manager, Ext. 2882; call the JOBLINE, Ext. 7744 (344-7744), for a complete list of all job openings; use a TDD system to access job information by calling (516) 344-6018; or access current job openings on the World Wide Web at <http://www.bnl.gov/JOBS/jobs.html>.

LABORATORY RECRUITMENT - Opportunities for Laboratory Employees

NS8187. ENGINEERING POSITION - Requires a bachelor's degree in engineering or one of the physical sciences, several years' experience working in a high-energy accelerator environment, qualification as a senior Radiological Control Technician, working knowledge of DOE and BNL radiological control requirements, and proficiency in standard PC programs. NRRPT registration and/or CHP eligibility is preferred. Responsibilities include supervising a staff of 4-5 RCTs at a collider/accelerator complex, assisting the Facility Support Representative in the implementation of Radiation Work Permit (RWP) programs, reviewing technical work documents and maintaining QA requirements for all analytical-grade field equipment. Radiological Control Division.

MK0762. ADMINISTRATIVE/SECRETARIAL POSITION (Term Appointment) - Requires an AAS or equivalent experience, a high level of competence in performing complex administrative secretarial skills, and a thorough knowledge of Laboratory practices, policies and procedures related to assigned administrative functions. Knowledge of one or more of the following required: Excel, Microsoft Access, Word, WordPerfect, Outlook or Power Point. Will function as a floater in the Director's Office and be responsible for maintaining records, developing reports on spreadsheet, database or file management software programs and provide considerable coordination and follow-through in assigned office areas. Will arrange conferences, meetings, travel, appointments, services and information gathering. Director's Office

DD7408. MATERIAL HANDLER - Administrative Support Division.

DD7409. MATERIAL HANDLERS (Temporary o/a 6/1/99 - 9/5/99 Administrative Support Division.

OPEN RECRUITMENT - Opportunities for Laboratory Employees and Outside Candidates.

MK 8221. MEDICAL FELLOW to work with the neuroimaging sciences group involved with imaging studies involving Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT) and Magnetic Resonance Imaging (MRI). These studies focus on functional, neurochemical and pharmacological aspects pertaining to substance

# Access Procedure Change at Main Gate

**In response to increased concerns regarding unauthorized access to the Laboratory, the Safeguards and Security Division (S&SD) intends to enforce the sticker requirement for all employee vehicles on the Laboratory site.**

**While current Laboratory regulations require all employees to have a sticker affixed to their rearview mirror, the regulation has not typically been enforced. However, safety and security issues have led to increased scrutiny of site access procedures, and a corresponding desire by BNL management to control access to the site more closely.**

**In the past, employees who did not have a sticker or were not driving their ordinary vehicle could show their ID cards in order to gain access to the site.**

**Now, employees who do not obtain a sticker may be required to wait while a report is written. Over the past two weeks, S&SD representatives have been distributing flyers to employees to explain the requirement and to give everyone an opportunity to register their vehicles.**

**“While this emphasis on vehicle registration may seem inconvenient to some, we have to do what is necessary to protect the safety and security of our employees and the Laboratory,” said Mike Bebon, Assistant Laboratory Director for Facilities and Operations. “It is a step we need to take at this time.”**

**Employees who do not currently have a sticker affixed to the back of their rearview mirror should obtain one as soon as possible. Employees who drive more than one vehicle will be issued a second sticker for their alternate car.**

**Stickers can be obtained at the S&SD Personnel Security Office in the lobby of the Brookhaven Center, Bldg. 30. Applicants will need their Laboratory ID, driver's licence and vehicle registration in order to obtain a sticker.**

abuse, neuropsychiatric disease, oncology and aging. Requirements include an M.D., board certification in any of the following: psychiatry, neurology, radiology, nuclear medicine or internal medicine and an interest in research. Under the direction of G.J. Wang. Medical Department.

MK7670. POSTDOCTORAL RESEARCH ASSOCIATE to work in the High Energy Theory Group, which has active programs in electroweak physics, collider and QCD phenomenology, lattice gauge theories and finite temperature field theory. Requires a Ph.D. in high energy physics. Physics Department.

NS8085. QA ENGINEERING POSITION - Requires a BS in science or engineering (EE preferred), and substantial experience in an engineering/manufacturing environment implementing quality management principles. Experience with ISO 9001 and/or DOE Order 5700.6C, configuration management principles and a strong working knowledge of Microsoft Access and Word is necessary. Excellent organization, verbal, written and presentation skills are required. Responsibilities will include performing assessments of departmental management systems; performing supplier evaluations/source inspections; reviewing and approving technical documents and developing and maintaining departmental QA documents/procedures. Alternating Gradient Synchrotron Department.

NS7394. JUNIOR-LEVEL INFORMATION SYSTEMS POSITION - (reposting) Requires a bachelor's degree in computer science, business information systems, or MIS and excellent oral and written communication skills. Candidates will have significant opportunity to be involved in all aspects of software development involved in the implementation of an entire suite of business applications utilizing both in-house developed (web based) and off-the-shelf (PeopleSoft) software in a Windows NT/Oracle DBMS environment. Responsibilities will include programming, networks, operations, documentation, training and end-user support. Business Information Systems. Fiscal Division.

NS7741. ADMINISTRATIVE/BUDGET POSITION - (reposting) Requires a BS in business administration or equivalent work experience, knowledge of administrative functions including accounting procedures and policies, processing of proposals, budget preparation and systems operation. Strong computer skills are essential, including ACCESS, EXCEL, and PeopleSoft. Demonstrated writing, organization, and communication skills are required; knowledge of Laboratory policies and procedures is desirable. AS&T Directorate/Budget Office.

DD8181. TECHNICAL POSITION - Requires significant relevant field experience, the ability to obtain and maintain DOE security clearance, respirator qualification, and the ability to complete RCT training successfully. Will provide field support to the Reactor Division in the area of ES&H services, primarily in the health physics specialty. Will perform, document and post radiological surveys. Safety and Health Services Division.

DD8186. TECHNICAL POSITION - Requires DOE RCT qualification and hazwoper training. Field experience, industrial hygiene and environmental protection activities is highly desirable. Responsibilities will focus primarily on performing routine and special radiological and industrial hygiene surveys in accordance with applicable federal regulations (10CFR835, OSHA, EPA) and BNL/S&HS/RP procedures. Other duties include issuance of respirators and personal protective equipment, writing safety instructions, RWPs, participating in facility safety inspections and emergency response. Safety and Health Services Division.