

BNL Scientists Find Plants Suffer Less Damage Than Predicted From Ozone Depletion

While most people are aware of the direct relationship between sun and skin cancer, ultraviolet (UV) rays from the sun can also be harmful to most forms of life, including plants.

But newly published work by BNL researchers now indicates that, contrary to previous reports, plants are no more damaged by UV light than are any other organisms.

For much of the earth's history, all life forms have been protected from potentially damaging UV radiation by a protective layer of ozone in the upper atmosphere that acts like a sunscreen. Recently, however, the ozone layer has been inadvertently thinned by modern chemicals, thus allowing more ultraviolet radiation to reach the earth's surface.

To determine how damaging this extra UV may be to plants, since 1989, Senior Scientist Betsy Sutherland, Senior Biophysicist John Sutherland and Research Associate Elsie Quaite, all from BNL's Biology Department, funded by the U.S. Departments of Agriculture and Energy, have been studying the effects of ultraviolet radiation on DNA in alfalfa seedlings.

The results of their study — one of the first done in this research area — have just been published in the August 13 issue of *Nature*.

Surprising Results

DNA is the molecular basis for the genetic code. Contrary to predictions based on previous research, the BNL scientists found that DNA in plants is no more sensitive to damage by sunlight than DNA in other organisms.

The researchers explained that the amount of damage caused by any UV wavelength in sunlight is proportional to the ability of that wavelength to damage an organism multiplied by the amount of light of that wavelength present in sunlight. Sunlight contains only a small quantity of short wavelength UV light and huge amounts of longer wavelengths.

Previous researchers have thought that only short UV wavelengths — up to about 313 nanometers (nm) — damaged plants. Since ozone depletion increases the intensity of these



The Biology Department's (from left) Betsy Sutherland, Judi Romeo, John Sutherland and Elsie Quaite irradiate alfalfa seedlings with ultraviolet light, using a high-intensity monochromator.

short UV wavelengths, earlier investigators predicted that the increase in intensity of these short wavelengths would produce a major increase in damage to plants. The BNL work, however, shows that even longer wavelengths — up to 365 nm — can damage plant DNA.

"Since increased UV light from ozone depletion is only a small part of the UV burden that plants already

endure," John Sutherland said, "ozone depletion will cause a smaller increase in DNA damage in plants than previously thought."

Damage and Repair

Continued John Sutherland, "Accurate predictions of the effects of ozone depletion on plants are important because all living organisms depend on plants for survival."

To determine the effects of ozone depletion, the researchers exposed alfalfa seedlings to UV light in wavelengths from 270 nm to 405 nm, then measured the DNA damage caused by each wavelength. Alfalfa seedlings were used for the study because alfalfa is an important crop plant, and its seedlings are easy work with as well as to grow.

After the alfalfa plants were grown in the laboratory and exposed to UV light, the leaves were chopped into fine pieces, which were embedded in agarose plugs. The plugs were treated with enzymes that digest all the cellular components except the key ingredient under investigation — DNA.

UV radiation causes several chemical changes in DNA. Among the most important is the formation of pyrimidine dimers, a type of lesion in DNA that can lead to cellular mutations. To determine the extent of DNA damage in the alfalfa plants, the researchers use a sensitive test developed by Betsy Sutherland in 1983.

The test involves treating the DNA with a UV endonuclease, an enzyme that cuts DNA adjacent to each dimer. As dimer damage increases, the strands of DNA decrease in size. Gel electrophoresis is then used to separate DNA molecules by size. To compute the dimer frequency, the number of DNA molecules of each size is then determined by John Sutherland's imaging system.

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Giving the Lab's Water the Full Treatment

Last month, BNL used almost 4.6 million gallons of domestic water per day, making the Lab one of the larger public water suppliers in Suffolk County. What many people do not realize, however, is that the quality of the Lab's water is "as good if not better than most places in the county," says Robert Lee, a staff engineer with the Safety & Environmental Protection Division (SEP).

According to Kenneth Davis, General Supervisor of Operations in the Plant Engineering (PE) Division, the reason for the high quality of the Lab's drinking water is that the water supply at BNL, which comes from six wells, is constantly monitored and tested.

Explains Bob Miltenberger, an SEP senior health physics associate, "The Lab maintains a comprehensive sampling and analysis program in accordance with all New York State Department of Health regulations and as approved by the Suffolk County Department of Health Services (SCDHS). In this program, the Lab samples the distribution system, as well as the main water supplies."

This program includes monthly monitoring for bacteria, quarterly analyses for principal organic compounds, and annual testing for heavy metals, pesticides and other parameters. In total, each supply well and the distribution system is tested for over 100 potential contaminants during the course of a year.

"This is to verify that the water is not only good at the source or the point where it is distributed, but also at the receptor where people draw it and drink it," says Miltenberger. Data collected through this effort are published annually in the BNL Site Environmental Report and routinely reported to the SCDHS.

Several Control Measures

To control high levels of iron or manganese in three of BNL's drinking-water supply wells, the water goes through a state-of-the-art filtration process at the Water Treatment Plant (WTP) in Bldg. 624 before it is distributed. Run by PE, the WTP is capable of processing six million gallons of water per day. In it, the water is aerated, filtered, pH adjusted and chlorinated.

In addition to iron and manganese, groundwater used at BNL as drinking water has the potential to contain low concentrations of organic solvents such as 1,1,1-trichloroethane (TCA). On Long Island, many institutions, including BNL, have used and continue to use these

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Lowell Ross (left), Water Systems Supervisor, Plant Engineering (PE) Division, and Kenneth Davis, PE's General Supervisor of Operations, explain the Lab's carbon filtration system to Lorraine Madigan, summer student in the Public Affairs Office.

— Photos on pages 1 and 2 by Roger Stoutenburgh

Inside Info

Bryce Breitenstein, Head of the Occupational Medicine Clinic (OMC), has been appointed a member of the Suffolk County Board of Health. The Suffolk County Legislature made the appointment in mid-June by approving Resolution No. 357, under which Breitenstein will complete the three years remaining on unexpired term of a retiring board member.

According to the Suffolk County Code, the seven members of the Board of Health, "subject to the provisions of the Public Health Law and the Sanitary Code, shall have the power to adopt, promulgate, amend or repeal rules and regulations affecting public health in the county." Additionally, "The Board of Health shall, at the request of the Commissioner of Health Services, consider any matter relating to the preservation and improvement of public health."

First trained as a pharmacist, Breitenstein earned his M.D. at the University of Oregon. He has completed residencies in both internal medicine and in preventive medicine.

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Plants

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In 1987, this electronic imaging system won John Sutherland's group an R&D 100 Award from *Research and Development Magazine*. The system accurately measures damage to DNA by UV radiation and other physical and chemical agents.

Two years earlier, Betsy Sutherland had won the E.O. Lawrence Award for her outstanding contributions in the field of atomic energy.

Together, the Sutherlands are unique experts in this research area. Not only have they achieved international distinction for their studies of

how UV radiation produces genetic damage in DNA in human skin, but they also study how the repair mechanisms of these cells work to counteract such damage.

Next, the Sutherlands plan to investigate the repair mechanisms in plants that help to control DNA damage. Visible light activates an enzyme that reverses the formation of pyrimidine dimers, thus counteracting the damaging effects of UV light.

"Plants have excellent repair mechanisms," Betsy Sutherland said. "Our next step is to understand exactly how they work."

— Diane Greenberg

Elsie Quaitte (left), John Trunk and Denise Monte-leone, all from the Biology Department, use an award-winning electronic imaging system invented at BNL to analyze data on ultraviolet damage in alfalfa seedlings.



Water

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organic solvents as degreasing agents to clean oils and grease from equipment or parts used in a manufacturing process.

Although these solvents have many desirable industrial applications, past disposal practices and spills have resulted in the potential for this type of material to be found in groundwater. Consequently, New York State Drinking Water Standards (NYS DWS) require that drinking water contain less than 0.005 parts per million (ppm) of these compounds.

To ensure that water supplied to BNL employees and guests meets this criteria, BNL is required to monitor the water and report the results to the regulators at least once each quarter. In actuality, however, the Lab's water supply is monitored twice each quarter: once for regulatory compliance reasons and once for operational control.

According to Davis, if elevated organic concentrations should be detected, then BNL takes the same measures as the Suffolk County Water Authority to rid BNL's drinking water of such material.

"If there is a problem with any of our wells during sampling, the well is taken out of service until a high-intensity sampling program is completed," says Davis. "Based on these results, we make one of two choices: We either close the well in question

and cease using it, or we install some kind of treatment at the well, such as a carbon filtration unit."

Adds Davis, "We recently spent approximately one million dollars on carbon filtration systems for two wells. When the water is pumped out of the ground and into these filtration units, it goes through activated carbon, which adsorbs the solvents and removes them from the water."



At the Water Treatment Plant, Kenneth Davis explains to BNL summer student Lorraine Madigan how iron and manganese is filtered out of BNL's water supply.

Despite all the filtration and monitoring that BNL's water supply undergoes before reaching the user, sometimes contamination can be caused by equipment installed at the point of use. That's the case with some Lab water fountains, where lead used in the fountain's internal plumbing has been found to be leaching into the water passing through it.

For that reason, fountains where

lead concentrations have exceeded NTSDWS were taken out of service. Although many have been replaced, some fountains remain out of service for this reason and may still bear signs reading "Don't Drink the Water Here" or "Contaminated Water."

Lead concentrations in the BNL water supply — both prior to filtration and as it is distributed to each facility — have always been less than the NYSDWS. As Bob Miltenberger emphasizes, "It's important to remember that the elevated lead concentrations in the water were caused by the fountains themselves."

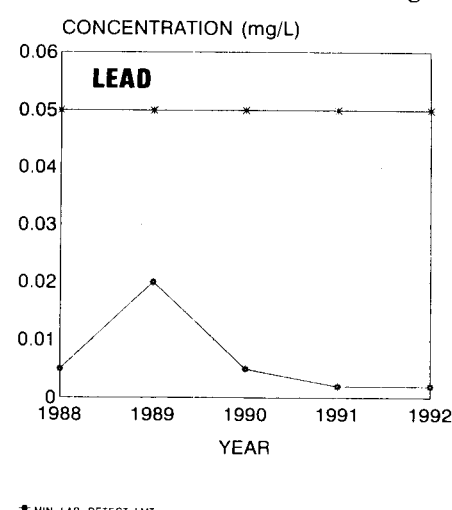
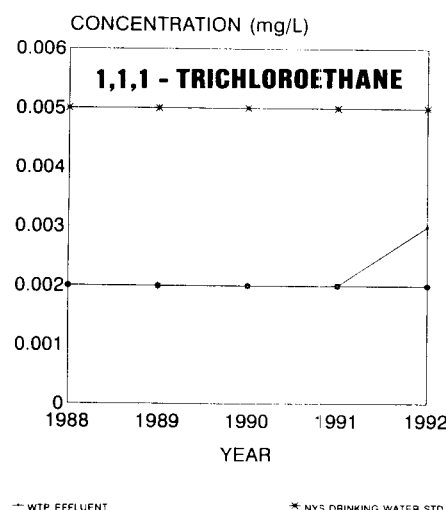
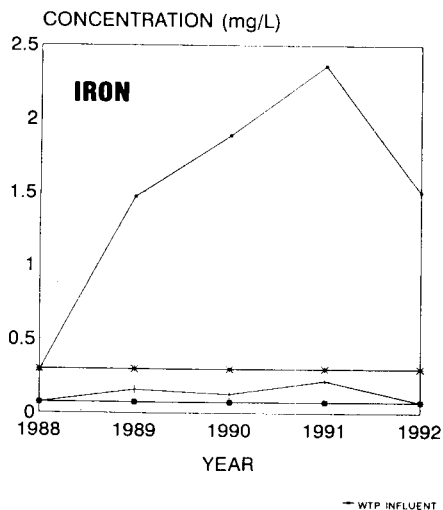
Miltenberger adds, "Water is one of our most precious resources, so many steps have been taken here at BNL to help preserve this resource. The treatment equipment installation, proper chemical disposal technology, and the water conservation program will help ensure the preservation of our water."

Any Lab employees or guests with questions about a specific tap or fountain, or about BNL water in general should contact their department or division safety coordinator, their building safety services representative, SEP or PE.

In summary, Lee reiterates, "The BNL water supply meets all NYSDWS and is routinely monitored to assure the quality of water distributed on site. Therefore, we feel that our water supply is as good, if not better, than any place in the county."

— Lorraine Madigan

Charts showing the average annual concentrations of iron, 1,1,1-trichloroethane (TCA) and lead in the water that comes into BNL's Water Treatment Plant (influent) and the water that goes out (effluent), as compared to the New York State Drinking Water Standards (NYS DWS). For the past five years, though iron concentrations may have exceeded NYSDWS before treatment, they have been below after treatment. Throughout this period, both TCA and lead concentrations have been well below NYSDWS both before and after treatment.



Patent Awarded

Sanford Lacks of the Biology Department, together with BNL Guest Scientists **Susana Martinez, Paloma Lopez** and **Manuel Espinosa**, has been awarded U.S. Patent No. 5,002,875. Their patent is for a method of cloning the gene that encodes an enzyme — a DNA polymerase-exonuclease called PolI — of the bacteria *Streptococcus pneumoniae*. Polymerase puts DNA links together, and the exonuclease takes them apart.

PolI is of particular interest because its polymerase and exonuclease activities work together in the repair of DNA. The exonuclease removes damaged DNA and the polymerase restores it. The exonuclease activity of the enzyme also

plays a small but important role in normal DNA replication.

In cloning the PolI gene, Lacks and his colleagues made two new recombinant plasmids, pSM22 and pSM23, which contain the gene. The inventors' approach was to use a technique that had previously been applied to the study and characterization of nucleases which are proteins that promote linkage of nucleic acid but that had never been used for detecting DNA polymerases.

Unique features of this approach include an unusual way of screening clones for exonuclease activity — by a DNase colony assay — and characterizing the product of the cloned genes by an original method for detecting nuclease activity in polyacrylamide gels. The procedure could be applicable in other cases for cloning genes that encode DNA polymerases.

Inside Info

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Before coming to BNL in April 1989 to head OMC, he was president of the Hanford Environmental Health Foundation, the occupational health contractor at the U.S. Department of Energy's Hanford, Washington site.

Peter Bond, who became Chairman of the Physics Department in July 1987, has agreed to continue his chairmanship for another term.

In announcing Bond's reappointment, BNL Director Nicholas Samios noted, "The Physics Department has been undergoing major realignments in the high energy and nuclear areas with the expansion of heavy-ion physics, and has a vibrant condensed-matter program utilizing the special facilities at BNL, the High Flux Beam

Reactor and the National Synchrotron Light Source. Peter's creative skills were important in responding to the many diverse challenges and, in particular, helped open and expand the heavy-ion program. His ongoing efforts will be critical to maintaining the vitality of the Department's efforts in these exciting frontiers of science."

With a 1969 Ph.D. in physics from Case Western Reserve, Bond came to BNL in 1972 as an assistant physicist, following a postdoc at Stanford University. Concentrating on basic research in nuclear physics, he was named BNL associate physicist in 1974, physicist in 1976 and senior physicist in 1986. Bond received tenure in 1978 and became Associate Chairman of Physics in August 1986 and Deputy Chairman in February 1987.

The Toothpaste Is in the Mail!

For those who are participating in the Adult Fluoride Study being conducted by the School of Dental Medicine at the State University of New York at Stony Brook, here's some good news: The dental supplies have been mailed, and participants should receive them sometime this month.

Unfortunately, this is a month later than scheduled due to a delay from the supplier, but future supplies for the four-year study should be mailed out quarterly and on a timely basis.

Any participants who do not receive supplies this month should call Mary Wood, of BNL's Occupational Medicine Clinic, Ext. 5923.

Wanted: Gospel Singers

In addition to Lab employees, membership in BNL's Gospel Choir is now open to members of employees' families, as well as employees of Lab subcontractors and their families.

To prepare for several upcoming concerts, the choir will rehearse next on Monday, August 17, from 11:30 a.m. to 1:30 p.m., in Berkner Hall. To join in, drop in at rehearsal, or call April Donegain, Ext. 2459, or Frances Ligon, Ext. 3709.

Atlantic City Trip

Tickets are still available for the next BERA-sponsored, one-day trip to Trump Castle & Casino on the Marina in Atlantic City, on Saturday, August 22. The initial cost will be \$20, but the hotel-casino will give a \$7.50 coin return and a choice of either \$5 towards food or an additional \$2.50 coin and a \$5 deferred-return voucher.

Buy tickets at the BERA Sales Office, Berkner Hall, weekdays from 9 a.m. to 2 p.m. The bus will leave the Brookhaven Center promptly at 9 a.m., with an extra pickup at LIE Exit 63, if requested. Return will be about 11:45 p.m.

For more information, call Carolann Zebrowski, Ext. 3347; Rosalie Piccione, Ext. 3160; or Kay Dellimore, Ext. 2873.

Softball

Standings as of August 7

League 1		League 2	
Blue Jays	11-2	Titans	11-2
Phoubars	8-5	Cocoon	9-3
Ravens	8-5	Dirty Sox	8-5
Up & Atom	6-6	Scram	7-5
Cool 'n' Gang	5-8	Phase Out	6-6
Magnuts	5-8	Lights Out	4-8
Revised Edition	5-8	Antiques	3-9
Six Pax	3-9	Lunatechs	1-11
League 4			
Sting Rays	10-2	Simply Awesome	5-7
Personnelities	9-3	Just 4 Fun	4-8
Roustabouts	8-3	Park Avenue	2-9
Snakebites	7-5	Source	2-10

Leagues 3 & 5 — Standings not available.

Arrivals & Departures

Arrivals

Poppy Pattanayak.....Medical
 Ronald T. Prwivo.....Accel. Dev.
 Michael T. Trager.....Accel. Dev.

Departures

This list includes all employees who have terminated from the Lab, including retirees:

Paul F. Hsieh.....Physics
 Roy J.J. LoVerde.....Accel. Dev.

Where Upton Is Really Up



The population's pretty small and the landscape's flat enough. But the astute observer will immediately note that, at an elevation of 4,234 feet, this could not be our Upton.

Mona Rowe, Public Affairs Office, snapped this photo in Wyoming while driving cross country last spring with her husband Michael Rowe, Department of Applied Science, and their daughters Courtney and Allison.

Volunteers Needed

Male volunteers, ages 25 to 45 and in good health, are needed to participate in brain and heart-imaging studies being conducted by BNL. A fee will be paid. For more information, call Naomi Pappas, Ext. 2694.

Call for Bowlers

The Bowling League announces that applications for the Tuesday night men's league in Port Jefferson and the Thursday night mixed league in Shirley are available at the BERA Sales Office. Priority registration for existing teams is due by August 21; new team registrations are due by August 28. A captains' meeting will be held on Wednesday, September 2, at noon, in Berkner Hall, Room B.

You don't have to be a great bowler to join the fun. For more information, call Debbie Keating, Ext. 7673, or Maryann Reynolds, Ext. 5241.

OCAW Meeting

The next meeting of the Oil, Chemical and Atomic Workers (OCAW) Union, Local 8-431, will be held at 4:20 p.m., on Thursday, August 20, at Foresto's Italian Restaurant, on Route 25 in Calverton.

Cafeteria Menu

Monday, August 17	
Soup: Vegetable	.80/1.10
Entree: Western Mexican chicken	3.35
Entree: Spinach frittata	3.20
Fitness: Chef's choice	3.45
Carvery: Hot pastrami sandwich	2.95
Grill: Sloppy Joe	2.95
Tuesday, August 18	
Soup: Beef barley	.80/1.10
Entree: Roast loin of pork	3.65
Entree: Chef's choice	3.20
Fitness: Vegetable-stuffed green pepper	3.20
Carvery: Hot roast beef sandwich	2.95
Grill: Monte Cristo	2.95
Wednesday, August 19	
Soup: French onion	.80/1.10
Entree: Egg foo young	3.35
Entree: Chef's choice	3.20
Fitness: Crispy baked fish amandine	3.35
Carvery: Hot baked ham sandwich	2.95
Grill: Corned beef melt on pumpernickel	2.95
Special: Pizza & pop	
Look for movie night at the Center Club.	
Thursday, August 20	
Soup: Beef noodle	.80/1.10
Entree: Southern-fried chicken	3.35
Entree: Sweet & sour pork	3.65
Fitness: Chef's choice	3.20
Carvery: Corned beef sandwich	2.95
Grill: Philly cheese steak	2.95
Friday, August 21	
Soup: Manhattan clam chowder	.80/1.10
Entree: Baked halibut	3.65
Entree: Chef's choice	3.20
Fitness: Baked chicken teriyaki	3.20
Carvery: Turkey sandwich	2.95
Grill: Fried chicken filet on croissant	2.95

Equipment Demo

IBM will demonstrate its UNIX workstation, the RISC System/6000, Wednesday, August 19, from 11 a.m. to 2 p.m. in Berkner Hall. In addition to running applications such as AutoCAD and Lotus on models in the RISC System/6000 family, IBM reps will demonstrate the recently released model 220, a low-end processor. For more information, call Ken Hammer, Ext. 7311.

The new Canon CJ-10 desktop, full-color system will be demonstrated by Leslie Supply Company Inc. on Thursday, August 20, from 9 a.m. to 2:30 p.m., in Berkner Hall. The Canon CJ-10 can function as a stand-alone color copier and design tool, or it can be interfaced to a Macintosh or IBM computer.

Winners' Circle

Employees with ideas for enhancing Lab safety or saving BNL money in areas outside their own job responsibilities should consider submitting their suggestions to the Employee Suggestion Program (ESP). ESP forms are available in department and division offices and through Personnel, Bldg. 185. An original idea could win 10 percent of the estimated savings, up to a maximum of \$10,000.

Congratulations to the following BNLers who have entered the ESP winners' circle:

- **Joseph Modjeska**, the Supply & Materiel Division's office machine repair mechanic, earned \$25 for pointing out a hazardous traffic condition created when drivers back out from Bldg. 452 onto Bell Avenue, which resulted in warning signs being installed in this location. He also won \$50, for suggesting that spring chains be added to doors on Bldgs. T-87 and T-88 for increased safety in case of gusting winds.

- **Thomas Tsang**, a physicist in the Instrumentation Division, suggested that warning signs were needed in the unlit apartment area to reduce driving hazards. This resulted in the installation of signs warning of sharp turns and a \$25 safety award to Tsang.

- **Richard Bernier**, a planner/estimator in the Plant Engineering Division, suggested the use of self-illuminating fire alarm signs, which will be included in future Lab construction. He was awarded \$50, to be reevaluated after one year when total savings will be better known.

Picnic Tomorrow

Afro-American Culture Club

Saturday, August 15; noon to 6 p.m.
 Adults, \$5; children 12 & under, \$3.
 Tickets: Bob Brown, Ext. 3569;
 April Donegain, Ext. 2459;
 Bruce Penn, Ext. 7213;
 or Barbara Simpson, Ext. 3888.

On Display: Tapestries By Pakistani Children

A children's-eye view of jungles and Pakistani village life will be shown in a tapestry art display sponsored by the BERA Art Society, in Berkner Hall, Room B, August 23-30.

Designed and handmade by the children in wool backed with cotton, the tapestries are chain-stitched in the tradition of a 2,000-year-old Kashmiri craft of embroidery found along the silk route.

Exhibition hours will be 10 a.m. to 3 p.m. on the two Sundays, August 23 and 30. From Monday through Friday, August 24-29, hours will be 11:30 a.m. to 1:30 p.m., and, on Monday, August 24, 5 to 7:30 p.m. Homemade refreshments will be offered at the lunch and evening receptions on Monday.

Hospitality News

The next meeting of the Women's Forum conducted by Marion Davis-Parzen will be Tuesday, August 18, at 10 a.m., in the playground in the apartment area. In the event of rain, the group will meet in the lounge of the Recreation Building.

The forum meets every third Tuesday of the month, to discuss women's issues, and to share experiences and concerns. Wives of Lab employees and guests are welcome. Come and bring the children.

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position. Consideration is given to candidates 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, handicap or veteran status.

Each week, the Personnel Division lists new placement notices. The purpose of these listings is, first, to give employees an opportunity to request consideration for themselves through Personnel, and, second, for general recruiting under 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, or call the JOBLINE, Ext. 7744 (282-7744), for a complete listing of all openings.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees.

DD 0472. SECRETARIAL POSITION - Requires an AAS in secretarial science or equivalent, several years' relevant experience, and excellent communication skills. Will provide diverse secretarial support for two experimental groups. Duties will include typing technical reports and handling administrative paperwork, correspondence and travel arrangements, and maintaining files. Physics Department.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside candidates.

NS 1062. ENGINEERING POSITION - Requires BSEE and minimum of three to five years' experience in digital hardware design. Experience with TTL and CMOS logic, PLDs and/or programmable gate arrays a must. Several years' experience with VME bus interfacing and embedded microcontroller hardware/software design also required. Experience with project planning, scheduling required; knowledge of PC-based CAD tools and microcontroller development systems a plus. RHIC Project, Accelerator Development Department.

NS 1060. COMPUTING/ANALYST POSITION - Requires BS in computer science or a related field and a minimum of three years' programming experience. Fluency in C and a good working knowledge of UNIX externals required. Experience in control systems, writing code for networked computers and cross development for embedded processors desirable. Work will involve developing and maintaining code for equipment-control computers used in accelerator control.

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