BROOKHAVEN BULLETIN
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BROOKHAVEN NATIONAL LABORATORY

Looking Back at Chernobyl

Part I: DNE Analyzes the Accident

With the clairvoyance of hindsight, we now know that one year ago this week, on the evening of Sunday, April 27, 1986, the northwest wind brought the first warning to the rest of the world that something was very wrong at a nuclear reactor in the Soviet Union.

That reactor was Chernobyl-4. Before 1:24 a.m. on Saturday, April 26 of last year, it was one of four similar reactors operating at the Chernobyl Nuclear Power Station in the Ukrainian Soviet Socialist Republic, located in the southwestern U.S.S.R. Today, it is entombed in a sarcophagus of concrete.

Chernobyl-4 was a three-year-old, water-cooled, graphite-moderated nuclear power reactor, producing 1,000 megawatts (MW) of electricity. Along with its sisters, it had just been featured in the February 1986 issue of *Soviet Life*, in which readers had been assured, "Even if the incredible should happen, the automatic control and safety systems would shut down the reactor in a matter of seconds."

The incredible did happen: Chernobyl-4 was blown apart, liberating an estimated 50 million curies of radioactive material into the environment.

Ironically, it happened because most of the safety systems had been disabled by the reactor's operators, in violation of the operations manual, during a test of a new emergency system.

The day after the two successive explosions and subsequent fire that destroyed the reactor, radiation monitoring stations in Finland received the first evidence of the Chernobyl accident. However, it wasn't until 9 p.m. on Monday, April 28, 1986, that the Soviets first admitted to it, citing an unauthorized, botched experiment and operator errors in violation of safety regulations.

Everyone listening to the news knew that Chernobyl was the worst accident in the history of nuclear power. But at the time, no one in the West knew the scenario that had led to the disaster or the reactor's design flaws that had permitted it. And it wasn't until August that the Soviets released significantly more information about the accident to the rest of the world.

The international effort to determine the cause and effects of Chernobyl, to reassure the public and to disseminate information to reduce the probability of a Chernobyl happening again involved many at BNL. Immediately after the accident and for months afterwards, staff members from the Department of Nuclear Energy (DNE), the Medical Department, the Safety & Environmental Protection (S&EP) Division and the Department of Applied Science (DAS) devoted their energies to understanding and explaining Chernobyl.

Mort Rosen

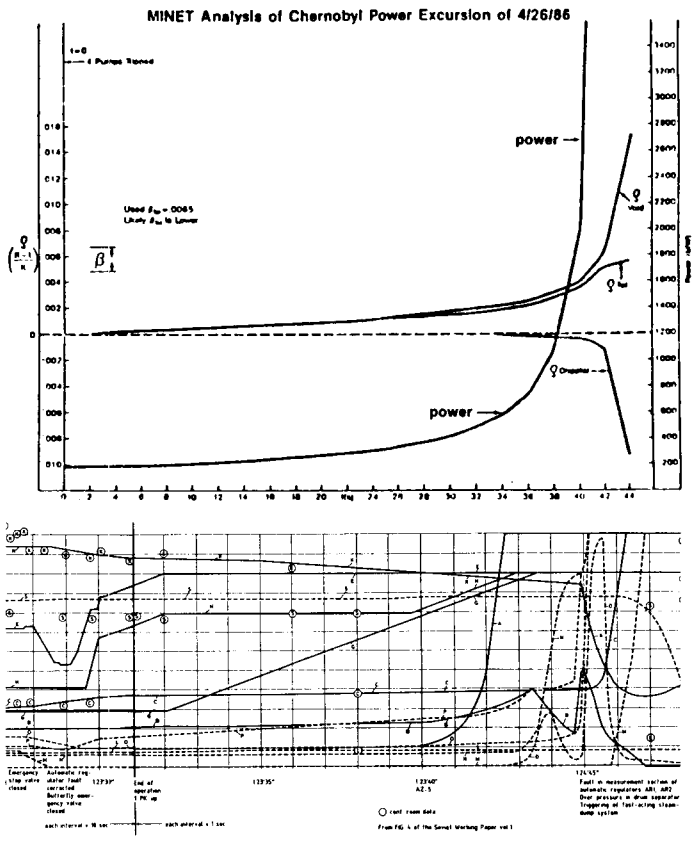
BNL's Chernobyl efforts, which will make nuclear power plants safer and will improve emergency response to and medical intervention after radiological accidents, are reviewed in this two-part report.

Graphite-Moderated Reactor

Because Chernobyl was a graphite-moderated reactor, this accident, though much more severe, was at first compared to the mishap in 1957 at Great Britain's graphite-moderated, air-cooled Windscale Reactor. As DNE Associate Chairman Donald Schweitzer had analyzed the Windscale accident in the early 60's for the Atomic Energy Commission and had reviewed the British accident scenario, he was one of the first BNL staffers called by Washington.

"Tuesday morning, I was called by the State Department and, an hour later, by the Nuclear Regulatory Commission [NRC]," recalls Schweitzer. "I was asked if I would go to the Soviet Union should the Russians ask for our assistance. I said that if I could help, I would go."

Though that request never came, Schweitzer became part of a task force that was formed at the request of the NRC to support its Chernobyl accident tracking team. Headed by DNE Associate Chairman Robert Bari, the task force was made up of DNE staff members George Greene, James Guppy, Peter Kroeger, Hans Ludewig, Stoyan Stoyanov and Arthur Tingle. By obtaining literature on Chernobyl-like reactors, DNE Senior Librarian Helen Todosow assisted the task force in its efforts.



At right: Gregory Van Tuyle's plot of the Chernobyl power excursion (top) and part of the Soviets' Figure 4 (bottom). Van Tuyle's plot of the reactor's power shows the same sudden, very rapid rise to 100 times normal power as do curves A and D of Figure 4.

At left: Gregory Van Tuyle (left) and John Carew.

Using the limited information available during the first few days following the accident, the task force qualitatively defined several alternative scenarios that could lead to a catastrophic accident in a Soviet-designed RBMK-1000 reactor, the design of Chernobyl-4. As well, they estimated what fission products had been released from the reactor.

Following this, Bari's task force helped the NRC write two chapters of the U.S. Factual Report on the Chernobyl Accident, which then was used by the U.S. delegation to the Post-Accident Review Meeting, sponsored by the International Atomic Energy Agency (IAEA) at its Vienna headquarters at the end of August.

Post-Accident Review Meeting

Little did DNE Chairman Herbert Kouts know, when he was named to the IAEA's International Nuclear Safety Advisory Group (INSAG) in 1985, that he would be attending the Post-Accident Review Meeting, be a co-author of the IAEA's report on Chernobyl and become an authority on the accident.

The 13 INSAG members, world experts in nuclear safety, regulation and radiation protection, advise the IAEA Director General, in Vienna. So, when the Soviets went to Vienna to discuss their analysis of the accident with nearly 600 delegates from 62 nations from August 25 to 29, Kouts and most of his INSAG colleagues were there.

Ten days before, the Soviets had presented the IAEA with their written account of the accident, a 300-page document in Russian. A U.S. representative to the IAEA sent a copy to the Department of Energy (DOE), in Germantown, Maryland, where it was translated over a weekend. "What they reported at the meeting we had already read in their report," says Kouts. "We wanted them to answer questions on our reading, but they just wanted to stick to the report, tell us what we already knew. Still, it was a fruitful meeting."

For another week, he and the other INSAG attendees remained at IAEA headquarters to write their accident summary. Says Kouts, "We went beyond what the Soviets told us: We included some analysis, drew some conclusions and made some recommendations based on that analysis. Our report still stands a year later: We continue to learn things, but not much has changed."

Power Excursion

In July, DOE had established an analysis team of scientists from Argonne National Laboratory, BNL, Oak Ridge National Laboratory and Pacific Northwest Laboratory. Team members from BNL included James Guppy, Head of DNE's Reactor Analysis Division (RAD); John Carew, RAD's Core Performance Group Leader and Gregory Van Tuyle, Leader of RAD's Advanced Reactor Safety Analysis Group. Within DNE, they were assisted by DNE Deputy Chairman Walter Kato and Arnold Aronson, Dimitrios Cokinos, William Horak, Robert Kennett, Peter Kroeger, Partha Neogy, Lev Neymotin, Gregory Slovik and Michael Todosow.

As they were to provide analytical support to the U.S. delegation, a translation of the Soviet report reached Van Tuyle and Carew the Tuesday before the Vienna meeting. "We were prepared — the causes could be analyzed using the computer codes that we use regularly in looking at different reactor types and different types of accidents for the NRC," explains Van Tuyle.

He continues, "By Wednesday night before the meeting, my analysis indicated a major power excursion — a sudden, very rapid rise in the power produced by the Chernobyl reactor."

"Late that night, I plotted the excursion and took it with me Thursday morning to a meeting with the rest of the analysis team at DOE headquarters. Though they were not as certain of its timing, Oak Ridge

(Continued on page 2)

Reports Available On Chernobyl

- **"The Chernobyl Accident," Brookhaven Lecture number 227 by Herbert Kouts on September 24, 1986; request BNL-52033 from Publications, Ext. 5068, Technical Information Division, Bldg. 477.**
- **"Report of the U.S. Department of Energy's Team Analyses of the Chernobyl-4 Atomic Energy Station Accident Sequence," November 1986; request DOE/NE-0076 from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.**

Mort Rosen

Among DNE staff involved in analyzing the Chernobyl accident were: (from left) William Horak, Lev Neymotin, John Carew, Partha Neogy, Gregory Van Tuyle, James Guppy, Gregory Slovik, Peter Kroeger, Arnold Aronson, Dimitrios Cokinos, Robert Kennett and Michael Todosow.

Chernobyl (Cont'd)

also predicted the excursion. We briefed the head of the U.S. delegation, who took copies of the excursion plots to Vienna."

The Russians reportedly saw Van Tuyle's plot either Sunday, August 24 or Monday, August 25. About the same time, they released their analysis — Figure 4 — a graph they had censored from their own report.

Figure 4

Figure 4 is a plot of the Soviet accident analysis, beginning at 1:18 a.m., Saturday, April 26, 1986, just six minutes before the reactor experienced the destructive power excursion. Van Tuyle and Carew had known it was missing from the Russian report.

"Had that figure been included in the initial report," says Carew, "we would not have had first to run many of the other possible scenarios, and we would have had the detailed input needed to run some of our more exact codes without first doing deductive preanalysis."

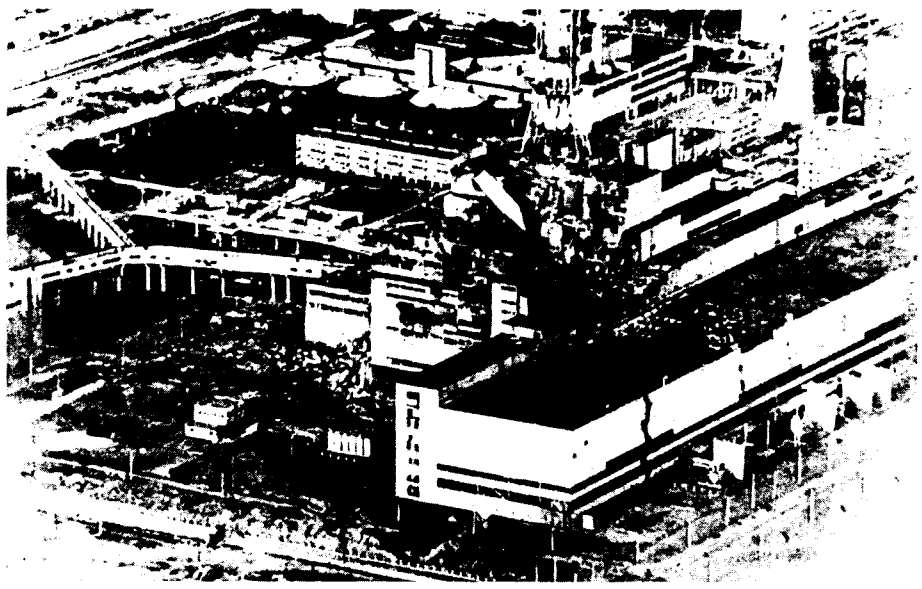
Van Tuyle was in Germantown when the Soviet graph was relayed to DOE headquarters Tuesday morning. "It took an hour of careful study before we knew that we had predicted the same accident that the Russians were finally admitting to," he recalls. "We immediately sent word back to Vienna that our analysis concurred with Figure 4."

Until the release of that figure, the Soviets were blaming only the Chernobyl operators' errors, never mentioning that the reactor's design may have contributed to its destruction. Says Van Tuyle, "Backed by our analysis, the U.S. delegation didn't have to waste time questioning the accident. Instead, they could question Chernobyl's most serious design flaw: its positive void coefficient."

Positive Void Coefficient

A positive void coefficient is a positive-feedback mechanism that amplifies any positive change. In other words, if a reactor core's cooling water boils excessively and "voids," or converts more water to steam, then the core's temperature, reactivity and power increase.

This causes the production of more steam, as the cooling water dissipates the heat from the overheated core — and the temperature, reactivity and power increase again. As this cycle escalates, the reactor produces increasing numbers of neutrons and becomes excessively reactive. Unless a reactor's operators can successfully intervene, this cycle can spiral upward uncontrollably until the fuel and the reactor are destroyed.



A Soviet photo of the Chernobyl-4 nuclear power plant a few days after the accident. The white arrow indicates the damaged unit.

As one of 14 RBMK-1000 nuclear power reactors in the Soviet Union, Chernobyl-4 had a positive void coefficient at power levels below 600 megawatts thermal [MW(th)] — making it prone to uncontrollable power excursions at low power.

"You aren't likely to get the same bad behavior if you have just graphite or just water — the combination is what made the Chernobyl accident possible," says Van Tuyle. "Regardless, U.S. power reactors are designed to preclude positive void coefficients under any conditions."

As Kouts points out, because it too is moderated by graphite and cooled by water, DOE's N-Reactor, a plutonium-production reactor in Richland, Washington, superficially resembles Chernobyl. In addition to other design differences, however, the N-Reactor has a negative void coefficient even at low power, so it is not predisposed to runaway power surges.

After Chernobyl, DOE assigned Kouts to a panel that reviewed the design and safety of the N-Reactor. As well, he is part of a National Academy of Sciences/National Research Council group examining the safety of DOE's ten reactors operating above 10 MW power, including BNL's High Flux Beam Reactor.

Controlled Test — Uncontrollable Reactor

As Kouts reported to the Laboratory in his Brookhaven Lecture on the Chernobyl accident on September 24, power in the Chernobyl reactor fell to dangerously low levels through a series of operator errors during a test of a new voltage regulator as part of a safety system. Low-power operation brought the positive void coefficient into play, but the game became deadly when the operator made the sixth bad move.

The operator blocked the scram circuit that would have shut down the reactor if a turbine trip had occurred, as one did during the test. Van Tuyle says that the DOE analysis team now believes that the turbine trip scram was blocked because the engineer in charge wanted to run the test twice: once with the voltage regulator in place and once without, so a direct comparison could be made.

At 1:23:04, the test began by tripping the turbine off. Beginning about 1:23:42, the power rapidly rose to around 300,000 MW(th) — 100 times normal power. Around 1:23:45, the reactor was destroyed.

The fuel had become so hot that it had disintegrated and burst through the cladding in many of the 1,661 zirconium-niobium fuel channels. Coming in contact with the core's cooling water, the fuel particles released their energy to the water, converting it to steam. The rapidly expanding steam created a tremendous pressure surge, which burst the fuel channels, pushed up the reactor's 1,000-ton cover and ejected some of the reactor's contents through the roof of the building, which did not have containment above the reactor.

Next week in Part II, the Bulletin looks at the roles of Medical, S&EP and DAS in dealing with the emergency response to the Chernobyl accident and studying the health effects of the accident.

— Marsha Belford

Inside Info

R. Christian Anderson retired in 1984, after almost 36 years at BNL, most of which he spent as Assistant Director, responsible for scientific personnel. Since 1976, he had also served as Chairman of the Stony Brook Council. Recently, he stepped down from that volunteer leadership role. In appreciation for his work on the advisory board that helps run the university, Anderson was honored in March at a dinner reception at the State University of New York at Stony Brook. During the program, President John Marburger presented Anderson with the Stony Brook Medal, noting that this rare recognition is authorized by the Stony Brook Council only for outstanding service to the campus community. Anderson also received a Stony Brook chair.

Equipment Demos

A demonstration of equipment manufactured by the LeCroy Corporation will be held in the lobby of Berkner Hall on Tuesday, May 5, from 9 a.m. to 4 p.m. On display will be digital storage oscilloscopes, waveform recorders (including a new 10-bit digitizer and a 1.3 gigasample/second recorder), and LeCroy's FASTBUS product line.

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RTI will present a seminar and product demonstration featuring transient wave digitizers manufactured by both the Soltec Corporation and Sequence Inc. The demonstration is slated for Friday, May 8, from 9:30 a.m. to 2:30 p.m., in Berkner Hall, Room D.

Coming Up

Penny Wise Budoff, a physician who is a pioneer in women's health care and the author of best-selling health care books for women, will speak in Berkner Hall on Thursday, May 14, at 5:15 p.m. Entitled "New Trends in Women's Health Care," her talk is sponsored by Brookhaven Women in Science.

Arrivals & Departures

Arrivals

Lipo Birstein ..... Physics
Alessandro G. Ratti ..... Accel. Dev.
Reginald P. Redman .... Central Shops
Victor J. Usack ..... AGS
Jonathan M. Wachtel ..... NSLS

Departures

None

Reminder — Register Those Vehicles

Employees are reminded that those who have not already done so should register their vehicles for on-site use. All vehicles should have 1987 registration stickers prior to May 31.

For ease of entry at the gate, people may also register their privately owned bicycles. For more information, call Susan Rackett, Ext. 5149, Safeguards & Security Division.

Addled Addresses

- Brookhaven Mate Lab.
- Brookhaven Rat Laboratory
- Birkhaven National Laboratory
- Brookheron National Lab Uptown, NY
- Brookhaven National Bank
- Brookhaven National Laboratory Lipton, L.I., New York
- Brookhaven National Library
- The Owner Brookhaven Natl. Lab

BNL's Fabulous Forty

On March 21, 1947, the U.S. Atomic Energy Commission formally turned over Camp Upton to Associated Universities, Inc., to begin BNL. Before then, however, there was already a core group of employees attending to site selection and the initial work that led to the realization of the new Laboratory. Twenty years later, on March 21, 1967, 37 of those employees were still employed at BNL and gathered for this photograph: (front row, from left) J. Georges Peter, John Garfield, Fred Van Dervoort, Alice Mabry, Olga Vario, Ruth Gardenier, Alma Huhn, Anna Kissel, Mariette Kuper, George Betz, Louis Lento, Jean Schulz, Robert Brouwer, Francis Jones; (middle row, from left) Martin Plotkin, Theodor Korsos, Joseph Washburne, Adam Lasky, John Cook, Robert Powell, Arnold Benson, Edward Buchholz, Henry Krauss, George Stoll, Kenneth Rose, Harry Hankins, Alfred Brunini, Charles Gerle; (back row, from left) Donald Mallory, Clarke Williams, Peter Paige, Horner Kuper, Charles Osborne, Benjamin Rutkowski, John Floyd, Richard Hill, Karl Walther.

Basketball Champions

Though they are the Longshots, they beat the odds and the other teams in BNL's Basketball League to take first place in both season play and the playoff game for the League championship. Their closest competition came from last year's winners, Hollywood, who tied their 10-2 record during the regular season, but lost to the Longshots in the playoff game that decided the season champs. The League playoff game that pitted the Longshots against Hollywood went into double overtime, but finally concluded in the Longshots' favor, 82-76. Here, the Longshots are assembled under the net with their trophies: (top) Team Captain Bob Rowley; (standing, from left) Co-captain Leroy James, John Cyr, James Garrison, Stephen Springston, Wayne Cummings; (front, from left) Fred Molone (Most Valuable Player, season), Reggie Seymore (Most Valuable Player, League playoff game) and Lee Walcott.

Peter Horton

P-CAD Seminar

Doug Marks, an applications engineer from P-CAD, will present a seminar in the Applied Math Department's seminar room in Bldg. 515, on Wednesday, May 6, from 9 a.m. to 4 p.m. (lunch break at 11:45 a.m.).

P-CAD is a computer-aided-design (CAD) software package for electronics. It offers "end-to-end" design capability, including schematic capture, simulating, manual and auto placement of parts and routing, and PLD design, either as modules or a complete package.

The morning session will be an introduction to P-CAD electronic CAD packages, including a demonstration. Gil Lipper of RTI will announce new releases from P-CAD.

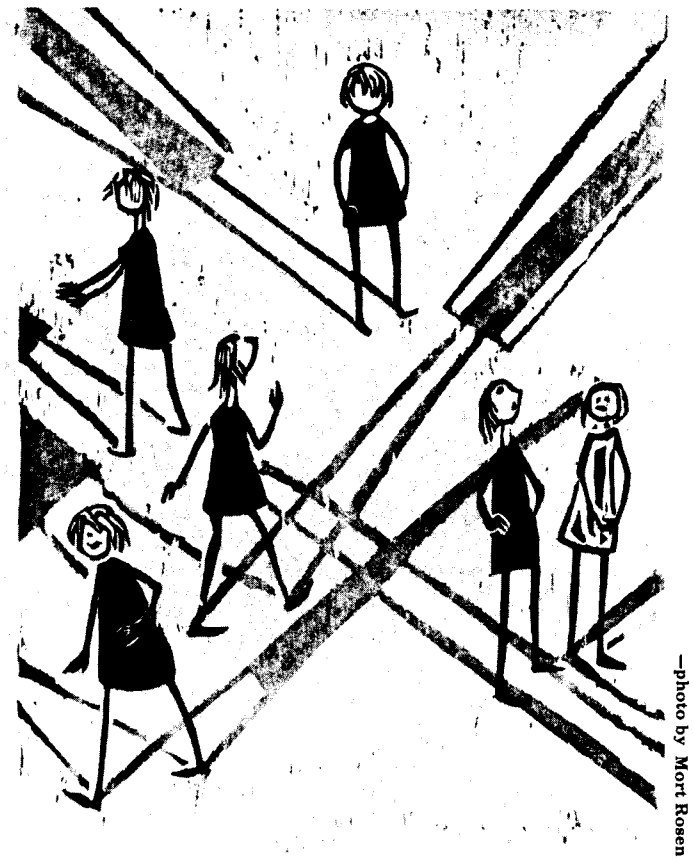
Beginning at 1:15 p.m., Marks will present more advanced concepts on electronics CAD and answer questions for current P-CAD users.

Stress Workshop

You can still sign up for the three-session Stress Management Workshop, to be given by Clinical Psychologist Cheryl Kurash and offered as a Health Promotion activity. The sessions will be held on Wednesdays, May 13, 20 and 27, from 5 to 6:30 p.m. in the conference room of Bldg. 535. The fee for all three sessions is $15. To register, mail your check, payable to Cheryl Kurash, with a note listing your name, Lab address and extension, to Elaine Friedman, Bldg. 490, before Friday, May 8. Space is limited to 25, so registration is first-come, first-served.

Addition

On the front page of last week's *Bulletin*, the four Soccer Club members who backed up Marshall Newton in the picture accompanying the story on "soccerballene" were: (from left) Akos Petö, Willy Eberl, Enrique Abola and Hanspeter Michel.



—photo by Mort Rosen

Quastler Exhibit Opens Tonight

After Gertrude Quastler carved her first woodcut in 1950, she produced many more artworks using the technique for which she is best known. Gertrude and Henry Quastler, who both died in 1963, came to BNL in 1956, when he joined the staff of BNL's Biology Department. After the move, Gertrude executed only two more series of woodcuts. *Entrance*, shown here, is part of her whimsical 1958 series of young girls. Pieces from this group are among the works by Gertrude Quastler that will be exhibited in Berkner Hall over the next week. The display will feature about half of the collection of some 130 Quastler artworks donated to Associated Universities, Inc., by Johanna Zimmerman of Pittsburgh, Henry Quastler's sister. Organized by the BERA Art Committee, the exhibit opens tonight, with a reception from 5 p.m. to 7 p.m. It may also be viewed on Saturday, May 2, from 11 a.m. to 3 p.m. The exhibit will continue from Monday, May 4, through Thursday, May 7, from 11:30 a.m. to 1:30 p.m.

Golf

The second tournament of the BGA season will be held on Monday, May 11 at the Timber Point Suffolk County Golf Course in Great River. Tee times will begin at 11 a.m. and may be obtained from Bob Sabatini, Ext. 3509, Bldg. 480.

Entry fees are $1 for BGA members, $2 non-members. Deadline for signing up for the tournament is noon Friday, May 8. Greens fees are $8, $4 and $14 for Suffolk County residents, senior citizens and non-residents, respectively. The tournament will be stroke play with gross and net winners by flight.

For the first tournament at Bellport Country Club, 78 golfers teed up — 21 more than last year. Low gross winners were Tom Romano (76), Joe Bauernfeind (87), Howard Vetter (96), Bryan Culwick (103) and Joe Carbonaro (108), in flights A to E, respectively. Winners of the kickers' competition with "net" scores of 80 were Jay Adams, Jim Desmond Jr., Jim Desmond III, Frank McNulty, Doug Sweely and Ralph Taylor. John Dioguardo and Bob Glasmann won closest-to-pin honors; Doug Sweely and Tom Romano had the longest drives.

The following poem was written by Joe Rocklein, AGS Department, who thought, "Now that spring is here and the golf season is near, I thought this little poem might be something BNL golfers can relate to."

A Perfect 10

Your first golf shot of the day
Is never made to order —
Rarely down the middle,
Usually in the water.

Your second slice is in the woods,
A place no one dare tread,
Your gutsy third comes whistling back,
Almost takes off your head!

You chip your fourth back into play,
Your fifth lands in the beach,
Your sixth sprays sand, but it's still there
Your seventh just might reach!

Oh well, two putts and down in nine
It happens now and then.
But wait, my ninth just rimmed the cup
Oh God, I took a "ten."

— Joe Roecklein

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Afro-American Culture Club

As last month's election of officers resulted in a three-way tie for the position of recording secretary, the Afro-American Culture Club will hold a runoff on May 6, from 11:30 a.m. to 1:30 p.m., in the lobby of Berkner Hall. The candidates are Pauline Dixon, George Grigg Jr. and Jean Sells.

Nursery School

The Upton Nursery School is now accepting applications from Lab employees to enroll their three- and four-year-old children for the 1987-88 school year. For more information, call Marietta Veligdan, 874-3447, or Dottie Alessi, 924-5984.

Hospitality News

Milica Stevanovic, a member of the Hospitality Committee, will be the guest speaker at the next Committee get-together on Tuesday, May 5, at 9:30 a.m., in the Brookhaven Center. The topic of her discussion and slide presentation will be Yugoslavia, her native country.

Please come and enjoy the morning with us. Bring the children; free babysitting will be provided.

Bowling

Red/Green League

High games were bowled by W. Kristiansen 233, K. Asselta 222/218/202 for a 642 scratch series, J. Morris 221, J. Ferrante 211/210, J. Muller 209/203, R. Adams 206, F. Hohmann 204, H. Arnesen 201, L. Jacobson 200.

Pink League

Ellie Kristiansen rolled a 186, Sandy Asselta 183, Pam Spencer 181, Maria Apelskog 180, Maryann Reynolds 179.

White League

Sharon Smith had a 224/590 scratch, Ed Sperry IV 215/604 scratch, Ken Riker 209, Ed Meier 201, Pat Manzella 200/196, Ruth Sheehan 191, Kathy Griffin 184.

Purple League

Paul Callegari had games of 237/208, Jim Petro 222/200, Ben Belligan 214, Tony Natoli 205, Joe Ferrante 201, Karen Vogel 201, Carol Beckner 200, Mary Addessi 196, Lee Barberich 184/179.

Cooking Exchange

The Cooking Exchange demonstration meeting planned for May 6 has been postponed until Wednesday, May 13. The meeting theme will be "International Health Foods."

All film badges will be changed tomorrow. Please place your badge in its assigned rack space before leaving work today.

Cafeteria Menu

Week of May 4

Monday, May 4		
Cream of spinach soup	(cup)	.75
	(bowl)	.95
Baked herbed chicken w/1 veg.		2.75
Broiled London broil w/1 veg.		2.95
Hot deli: French bread pizza		2.45
Tuesday, May 5		
U.S. Senate bean soup	(cup)	.75
	(bowl)	.95
Pot roast of beef w/1 veg.		2.75
Quiche Lorraine w/1 veg.		2.75
Hot deli: Turkey	(bread)	2.45
	(roll)	2.55
	(hero)	2.65
Wednesday, May 6		
Turkey rice soup	(cup)	.75
	(bowl)	.95
Beef stew w/biscuits		2.75
Baked meat loaf w/mushroom sauce & 1 veg.		2.75
Hot deli: Pastrami	(bread)	2.45
	(roll)	2.55
	(hero)	2.65
Thursday, May 7		
Purée of split pea soup	(cup)	.75
	(bowl)	.95
Spaghetti w/meat sauce & garlic bread		2.75
Shrimp & broccoli stir-fry over rice		2.85
Hot deli: Corned beef	(bread)	2.45
	(roll)	2.55
	(hero)	2.65
Friday, May 8		
New England clam chowder	(cup)	.75
	(bowl)	.95
Broiled fish w/1 veg.		2.85
Macaroni & cheese w/1 veg.		2.75
Hot deli: Roast beef	(bread)	2.45
	(roll)	2.55
	(hero)	2.65

Help Wanted At Cafeteria

Saga Foods, which runs the Cafeteria, needs several new employees to fill utility and general positions. Saga Foods is an equal opportunity employer. Anyone interested may apply in person at the Cafeteria.

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position, with consideration given to candidates in the following order of priority: (1) present employees within the department and/or appropriate bargaining unit, with preference to those within the immediate work group; (2) present employees within the Laboratory as a whole; and (3) outside applicants. In keeping with the Affirmative Action plan, selection decisions are made without regard to age, race, color, religion, national origin, sex, handicap or veteran status.

Each week, the Personnel Office lists new personnel placement requisitions. The purpose of these listings is, first, to provide open placement information on all non-scientific staff positions; second, to give employees an opportunity to request consideration for themselves through Personnel; and, finally, for general recruiting purposes. Because of the priority preference policy stated above, each listing does not necessarily represent an opportunity for all candidates. As a guide to readers, the listings are grouped according to the anticipated area of recruitment.

Except when operational needs require otherwise, positions will remain open for one week following publication date.

For further information regarding a placement listing, contact the Employment Manager, Ext. 2882.

SCIENTIFIC POSITIONS OPEN: The following staff positions are open. Candidates may apply directly to the department representative named, or through the Office of Scientific Personnel, Ext. 7813

POSTDOCTORAL RESEARCH ASSOCIATE — Protein crystallographer to study structures of prokaryotic ribosomal proteins. Contact: S.W. White, Biology Department.

POSTDOCTORAL RESEARCH ASSOCIATE — Recent doctorate to study the regulation of adenovirus protein function by phosphorylation-dephosphorylation. Contact: C.W. Anderson, Biology Department.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees only.

2597. RESIDENCE CUSTODIAN - (Temporary: 5/11/87-10/9/87). Staff Services Division.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside applicants.

2598. TECHNICAL POSITION - Requires AAS in mechanical technology or the equivalent experience. Must be heavily experienced in cryogenics system installation, operation and maintenance. In addition, the assignment will Include the assembly of UHV components, magnetic components, precision mechanical components and utilities. National Synchrotron Light Source Department.

2599. TECHNICAL POSITION - Requires AAS in electro-mechanical technology or the equivalent experience. Will work in the experimental program support group of the NSLS. Duties will be to construct, install and troubleshoot relay operated safety interlock systems. Must be familiar with a.c., d.c. and solid state relays; also must be able to wire circuits from schematics and wire lists. National Synchrotron Light Source Department.

2600. SCIENTIFIC ASSOCIATE POSITION - Requires BS in biochemistry or other associated fields. Will participate in studies of DNA structure, damage and repair. Experience in modern molecular biology and biochemistry, and ability to use computers and computer-controlled instruments required. Biology Department.

2601. EXPERIMENTAL MACHINIST (2 Positions) - Requires a minimum of five years' prototype experience in all-around machining, proficiency in job print interpretation, layout and machine set-up. Demonstrated ability and imagination in all phases of machine work is essential. Central Shops Division.

Autos & Auto Supplies

77 YAMAHA - 750cc, needs some work, best offer. Ext. 3328 or 286-3851 after 7 p.m.

78 CORVETTE - mint cond., completely redone, top to bottom, white/red interior, asking $11,500. 589-7496.

79 HONDA CM400T - excel. cond., crash bar, luggage rack. 929-5949 after 6 p.m.

WHEELS - Chevy pickup, 5 lug w/hub caps, $5/ea; 2 G78-15 tires on Chevy rims, $20/ea; 78 Honda Accord LX, 5 spd., depend., $375. Ext. 4081.

79 DODGE OMNI - blue, 4 spd., am/fm cass., new front tires, $550. Pete, Ext. 4819 or 289-7218.

78 CAMARO - 305, a/t, a/c, new radiator, battery, tires, exhaust system, $3,000 neg. 754-7137 after 5 p.m.

77 TOYOTA COROLLA - good mechanical cond., completely new brakes, reliable, $250. 744-5096.

84 CADILLAC - Fleetwood Brougham, low mi., $13,000; 81 DeLorean, 5 spd., black int., 7,500 mi., $20,000 neg, both loaded. Jack, Ext. 2021.

MOPED - Garelli, 50cc, excel. cond., $200. Ext. 4547 or 289-7470.

DATSUN 1200's - 1 running, 2 parts cars & boxes of spares, 3 for $500. Dave, Ext. 4636 or 475-2626.

TIRES - B78x13 on Pinto wheels, $30; other sizes available. Ken, 289-8212, eves.

80 VOLVO DL - standard, 2 dr., tan, high mileage, garaged, excel. cond., Volvo maintained. 929-6442.

86 GMC - pickup, loaded, 13k mi., high-rise cap, running boards, must sell, $12,500. Bert, Ext. 2050 or 273-4359.

79 MAZDA RX7 - silver, 4 spd., am/fm cass., excel. cond., $3,500. Ext. 2949 or 427-2435.

TRUCK RIMS - 15"x7", white spoke, 5-lugs; Ford truck tires, 10.5LT/15 on 15"x7" 5-lug white spoke rims. Ext. 2075 or 473-4937 after 6 p.m.

80 HONDA PRELUDE - 5 spd., elec. sunroof, Blaupunkt stereo, good cond.; wire wheel covers, set of 4, fits 15" tires, like new. 325-0447 after 6 p.m.

YAMAHA MINIBIKE - used, any reasonable offer. Ext. 7156 or 751-3223.

76 OLDSMOBILE OMEGA - 4 dr., red, velour interior, runs very well. 473-5012.

77 CAMARO - V8, a/t, black; 73 Capri, stand., decor group, many new parts; 79 Pontiac Sunbird, must sell. 744-0725, eves.

81 DATSUN 210 - wagon, 30+ mpg, very reliable, good cond., high mi., $900. 472-1479.

86 JEEP CHEROKEE - 4 cyl., 5 spd., a/c, stereo, Laredo pkg., 4k mi., $14,500. 475-4792 after 5 p.m.

70 CHEVY NOVA - 6 cyl., a/t, green, $500; 79 Chevy Malibu wagon, white, p/s, p/b, a/c, a/t, runs well, $1,100. 281-2452.

73 MERCEDES BENZ 280 - 4 dr., gas, white, green int., very clean, $4,300. Ext. 4099 or 689-9214.

77 MONTE CARLO - high mileage, $500 neg. Jack Allentuck, Ext. 2412.

TOW BAR - new, 5,000 lbs. capacity, frame mount, $150. 289-0413.

79 T-BIRD - rebuilt motor, body in great cond., $2,000. Jerry, Ext. 7427 or 475-5591 after 5 p.m.

78 LINCOLN CONTINENTAL - Towne Car, white, 4 dr., a/c, loaded, good cond., $1,300. 924-6657 after 5 p.m.

86 ALFA ROMEO - excel. cond., must sacrifice, $13,000 or best offer. 667-3902 after 6 p.m.

75 MERCURY BOBCAT - $600. 399-4897 after 6 p.m.

81 MERCURY CAPRI - 4 cyl., 5 spd., sunroof, stereo-cass., clean, $3,000. Ext. 4100 or 727-1789, eves.

81 VOLVO DL - 2 dr., yellow, good cond., 6 new tires, cruiseamatic, a/c, 67k mi., asking $5,975. Linda, Ext. 7745 or 878-2844, eves.

77 ELDORADO - new tires & exhaust system, am/fm stereo w/tape, good cond., must sell. Ext. 7732.

85 CHEVY S-10 - pickup, 4x4, 4 spd. Tahoe, am/fm cass., all-terrain tires, bed cover, black & silver, mint. 286-1358.

39 PLYMOUTH - 2 dr. sedan, 86k mi., r/h, good cond. Frank, Ext. 2022 or 399-4480.

75 MGB - maroon convertible, best offer. Karen, 924-3547, eves.

72 ENGINE - 350, 2-bolt main, heads rebuilt top to bottom, $725. Ken, 473-7460 after 6 p.m.

84 CHEVY MONTE CARLO - a/t, a/c, 45k mi., $6,000. Ext. 5125.

ENGINE - 84 Chevy, 229 V6, low mileage, for rebuilding or parts; 76 Ford Maverick, new brakes, battery, very good cond. 924-7476.

APACHE CAMPER - solid state, fold-up, sleeps 6, stove, dinette, ice box, sink. 475-3553 after 5 p.m.

83 DODGE 400 - a/t, a/c, am/fm, 53k mi., good cond., $4,650. Ext. 7958 or 281-1862.

TAGALONG TRAVEL TRAILER - 17', sleeps 6, $1,600. Ext. 4289.

79 PONTIAC TC-3 - must be seen, $2,500 neg. John Paul, 281-3686, eves.

65 AVALON TRAVEL TRAILER - 17', sleeps 6, 2-way refrig., toilet, gas heater, $950. Ext. 5131.

78 CONCORD - a/t, p/s, am/fm cass., 6 cyl., 66k mi., new exhaust, recent battery & brakes, asking $1,500. 281-0360 or beeper 266.

84 CHEVY TRAVELVAN - custom, all power, G20-V8, alarm system, built-in CB, a/c, cruise, 32k mi. Ext. 3624 or 929-3860.

81 CHEVETTE - 4 dr., am/fm cass., Jensen coaxail speakers, new water pump, timing belt, starter, clutch, $1,400. 878-8177.

TIRES - rims, (4), Firestone Supreme P205-75R15 on Chevy sport rims, almost new, 5k mi. Gregg, Ext. 2022 or 727-2861.

75 CAMARO - perfect running cond., dependable, many new parts, $500. 878-8302 after 5 p.m.

Boats & Marine Supplies

19½' BAYLINER - Capri Bowrider, 1984, Volvo I/O, trlr., Coast Guard & ski equipment, full canvas, all covers, extras, $8,500. Ext. 2981 or 473-7809.

22' COLUMBIA - sleeps 4, large cockpit for day sailing, 6½ h.p. Johnson, cradle, mooring, $5,500. 981-4216.

30' COLUMBIA II - f/water-cooled, full covers, V.H.F., new d/f, swim platform, $17,500 neg. Jack, Ext. 2021.

27' BRISTOL WEEKENDER - new diesel, aux., 5 good sails, fully equipped, teak trim. 941-9423.

16' GARVEY - 1981, fiberglass over mahogany plywood, fish well, 25 h.p. Evinrude, Hunter netting, trailer, $1,800. 567-3729.

14' AMF SUPER-SAILFISH - good cond., w/Shoreline trailer, $650. 265-1308 after 7 p.m.

17½' TRAVELER - 1966, fiberglass, outboard, gas tanks, rope, anchors, excel. cond., asking $1,200. John, 878-4414.

18' RENKEN - 1983, I/O, 120 h.p. OMC w/trailer & full cover, excel. cond., $5,000. 744-9474.

8' ELI - fiberglass sailing dinghy, like new, $550. Al, Ext. 7588.

25' LANCER SLOOP - shoal keel, 1986, 9.9 h.p. Evinrude, elec. start., excel. cond. 289-8693.

Miscellaneous

SONY RECEIVER - and turntable, Akai cassette, deck, Genesis speakers, $400. Ext. 3328 or 286-3851 after 7 p.m.

POOL - 15', above ground, all accessories, you take down. $100. Ext. 4289.

RIDING MOWER - John Deere, model 68, 30" blade, w/bagger & snowplow, good cond., $600. 744-6423.

LAFAYETTE TELSAT CB - SSB-100 w/range boost. $150. Mike, Ext. 4312.

DINING ROOM - Colonial, trestle table, (6) high-back chairs, large hutch, excel. cond., like new. Ext. 2456 or 758-4684.

AM/FM RADIO - Alpine, cass., (2) Jensen speakers, (2) Alpine speakers, clock, 7-band graphic equalizer, $425. John, 878-4414.

DRAFTING SET - K&E, Jupiter No. 9406B, 9-piece, like new, $45. Dick, 878-1580 after 6 p.m.

LAZY-BOY RECLINER - excel. cond., $100. 475-7454 after 6 p.m.

GAS STOVE - apartment size, very good, clean. 924-7476.

PROM GOWNS - (2) pink, (1) rose, asking $50. ea., orig. $150. Colleen, 473-7793.

DINETTE TABLE - white Formica and oak, w/4 cushioned swivel chairs, $400. 475-4792 after 5 p.m.

PICTURE FRAMES - assorted, 16"x20" and 20"x 24". Pat, Ext. 2452.

CRIB - dresser & mattress, yellow, Simmons, good cond., $120. 567-9025 after 6 p.m.

STOVE - avocado, self-cleaning, double oven, 40" wide, $75; sofa, trad. style, blue & white velvet, $50; fp utensils, $10. Ken, Ext. 7915 or 744-0722.

19" TV - Zenith, black & white, portable, good cond., $45 or best offer. Ext. 3701.

POOL - above ground, 16' diameter, 2 yrs. old, best offer, you pick up. Ext. 2809 or 588-9019.

CHANDELIER - antique brass, $35; hanging Tiffany-style fixture, $35; brass Tyndale lamp, $40. 475-4792 after 5 p.m.

SONY STEREO SYSTEM - HP250, am/fm w/external speakers, $70; card table, felt top, $40; twin headboards (2), maple, $15. Tony, Ext. 2050.

BICYCLE - girl's, Ross, 20" wheels, excel. cond., $45. 751-8403 after 6 p.m.

FILTER - swimming pool, 100 lb. sand, s/s, ¾ h.p. motor & pump, $100. 289-0413.

DINING ROOM - 6 pieces; freezers; color TV, 19"; living room set, 3 pieces; divider; bedroom set, 5 pieces. 666-8539.

REFRIGERATOR - Admiral, 6 yrs. old, frost-free, brown, $150; washer, Westinghouse, white, $125; Kelvinator chest freezer, $25. Ext. 4070.

REFRIGERATOR - freezer, 20 cu. ft. top, bottom frost-proof, $175. 744-5954.

MOWER - Sears Best, 4 h.p., self-prop., elec. start, never used, was $585, now $375 firm. Ext. 3593.

WATERBED FRAME - queen-size, headboard, heating unit, velvet side rails, best offer. Denise, Ext. 3630.

JVC SPEAKERS - (2), 3-tweeters, (1) mid-range woofer on each speaker, $200. Joseph, 878-6791.

AZALEAS - 5' diam., U-dig; Franklin stove. 689-9234.

XMAS TREES - brand-new, in boxes, 7½', $50. Tony, Ext. 2050.

AIR CONDITIONER - Philco, 5000 Btu, works perfectly, $100; queen spindle bed, dark pine, no bedding, $75. 929-8105 eves.

SIAMESE/BALINESE KITTENS - for Mother's Day. Whitey, Ext. 2913 or Ramona, 928-3088.

CONVECTION OVEN - Farberware; dinette set, (4) chairs, table. 475-0509.

BUNK BEDS - (2) mattresses (1) new; old Hotpoint chest freezer, working, price neg. 286-4145.

REFRIGERATOR - 24"w x 56"h x 27"d, $55; b&w TV, 12", like new. Bill, Ext. 2378 or 758-3284.

METAL BAND SAW - brand-new, $225; drill press, brand-new, $225; top soil, screened, delivered, $12./per yard. 924-7746.

STEREO SPEAKERS - (2) Ultraliner 260, 75 watts, $80; stereo cabinet, $20. Brehm, 744-3767 after 6 p.m.

COLONIAL HUTCH - Bennington, table & chairs, mint cond., asking $1,000. Sylvia, 234-9718.

SEARS SHOP-VAC - older model, wet/dry, 16-20 gallon, w/attachments, good cond., $20. Betty, Ext. 3382 or 472-1601 after 5:30 p.m.

JACUZZI POOL FILTER - w/motor for in-ground pool, used 2 seasons for above ground pool, $195. Ext. 2254.

14-CHANNEL CB - Realistic One-hander, $25; air brush compressor, $35; 19" Zenith b&w TV, $25. I. Meyer, 929-4326.

SONY 8MM CAMCORDER - CCD8AFU, like new, auto focus, standard access., w/guarantee, $995. Paul, 727-4859.

FLOWERS/VEGETABLES - 4 & 6 pack, large selection, delivered week of 5/11, 80¢/pack. 727-6818 after 3:15 p.m.

CHEST OF DRAWERS - (4), wood painted blue, 30x16x36, $40. Ext. 7112 or 286-9725 after 6 p.m.

BATHROOM - white porcelain tub, bowl, sink w/faucets, vanity, medicine cabinet w/lights, shower doors. 281-6026 after 5 p.m.

GENERATOR - Agtronic, 4 kW, still in orig. box, $500; Sears table saw, 7¼", w/access., older model, $75. Mark, Ext. 5350 or 369-0793.

CRIB - old but good cond., walker, stroller. John, Ext. 5279 or 473-0794.

CHILD'S BEDROOM DESK - & nightstand, white, French, like new cond., $100. McGeary, 363-2796.

MOVING SALE - classic dining room set, club chairs; Colonial swivel rockers; 3 cu. ft. refrigerator; port. elec. sewing machine & more. 273-5574.

TEETER TOTTER - new, for pre-school child, Gym Dandy, $15; sofa, trad., aqua blue & white velvet, $75; fireplace utensils, $10. 744-0722.

LOVESEAT - Colonial, w/matching curtains & wooden rods, $150 for all; Castro convertible ottoman, opens to single bed, $100. 928-1942.

DOUBLE WINDOW FAN - portable, 10", new, still in box. $40. 588-9163.

Car Pools

BETHPAGE - driver needs car pool. Lou, Ext. 4615.

PATCHOGUE - van pool, seat open, leave name and number. Ext. 4669.

STONY BROOK - van pool wants two riders. Sid, Ext. 4125 or Paul, Ext. 2476.

Yard Sales

MILLER PLACE - Saturday, 5/2, lawn furniture, canopy bed, tub enclosure, lots more. 744-5036.

MASTIC BEACH - 250 Laurelton Dr., Sat. & Sun., 5/2 & 5/3, 10 a.m. to 5 p.m., furniture & toys. 281-4547.

PATCHOGUE - 56 So. Summit Ave., 5/2 & 5/3, group sale, children's items, furniture, books.

Real Estate

Real Estate advertised for sale or rent is available without regard for the race, color, creed, sex or national origin of the applicant.

For Rent

PORT JEFFERSON VILLAGE - 1 lg. rm. w/kitchenette, sink, stove, $75/wk. Ext. 2050.

N. SHIRLEY - lg. furn. studio apt., w/kit., pvt. ent., util. inc., 1 person only, non-smoker, no pets, 5 min from Lab & stores, security, $425/mo. pays all. 281-8044.

EASTHAM, CAPE COD - 4 bdrm. home, compl. furn., 2 baths, washer/dryer, dishwasher, deck, short walk to beaches, wks. open July. 722-3865.

HILTON HEAD, SC - 2 bdrm. condo, sleeps 6, many extras, beach, pool, tennis, golf, taking fall rentals, $400/wk. 585-9149.

For Sale

SHOREHAM NORTH - 4 bdrm. Colonial, 2½ baths, den/fp, bsmt., fenced, patio, formal d/r. 744-1750.

MILLER PLACE - 4 bdrm. Colonial, formal l/r, d/r, lg. f/r, 4 baths, $250,000. 331-1718.

RIVERHEAD - 12'x55' mobile home, 2 bdrm., 1½ bath, l/r, eik, new shed, dbl. drive, corner lot in adult/55 park on Peconic River. Jeff, Ext. 2907 or 727-5915 after 6 p.m.

PORT JEFFERSON - 4 bdrm. Colonial, 2½ baths, formal d/r, center hall, den/fp, finished bsmt., ½+ acre, lovely area. 928-6389 after 6 p.m.

POCONOS - 3 bdrm. chalet, l/r, d/r, family rm., w/wood burning stove, kitchen, w/w, garage, paved roads, pools, lake, clubhouse, tennis, guarded entrances, more, sacrifice for $105,000. 286-4652.

SHOREHAM - 3 bdrm. ranch, l/r, d/r, eik, playrm., attached utility shed, heavily wooded acre, SWR schools, low taxes, $129,000. Ed, Ext. 7786 or 744-7796.

MASTIC - So. of Montauk, 12 min. from Lab, 3 bdrm., Cape, l/r, d/r, 1 bath, 100x140 fenced corner, less than a mile from bay, low taxes $1,300. $97,000. 281-9079.

BELLPORT VILLAGE - 3 bdrm. Colonial, ⅓ wood acre, l/r w/fp, d/r, eik, family rm., attached garage, walk to shops & schools, many extras, $185,000. Ext. 3046.

RIVERHEAD - ranch, gas heat, new windows, alum. siding, $60,990. Ext. 4289 or 395-4818.

PORT JEFFERSON STATION - ranch, 75'x200', mint, 3 bdrm, d/r, l/r, kitchen, garage, full bsmt., low taxes, new vinyl siding, new roof, $119,990. 473-3328.

Wanted

JON BOAT - lightweight, aluminum. Ken, Ext. 3263.

TIRE - (1), used, 155SR15. Ext. 3926.

BABYSITTER - my home, mature woman preferred. 924-7476.

TYPEWRITER - electric, good cond., reasonably priced. L. Kopp, Ext. 2265.

HOUSE TO SIT - free, caring, responsible, experienced, any period after 5/30. Jack Allentuck, Ext. 2412.

BOAT TRAILER - for 19'. George, Ext. 5288.

GARAGE DOOR - 16'. 744-2805 after 6 p.m.

RIMS - for Ford Fairmont, 14", 4 lugs. Ext. 4475.

O/B ENGINE - 35 h.p. Don, Ext. 4821 or 286-2267.

EXPERIENCED PERSON - in crewel/embroidery to quickly finish easy but time consuming project, will pay. Diana, ext. 3379.

HOUSE - for summer, for two or more single people, starting in June. Mark Catan, 928-2774.

CAR FOR VISITOR - 7/6-8/2, approx., write Prof. E. Leader, Physics Dept., Birkbeck College (Univ. of London), Malet St., London WC1E 7HX, or call (1)631 6289, days, or (1)435 8824 eves.

YOUNG COUPLE - to live in Elder-Share home w/6-8 senior citizens, to help supervise, prepare meals; expenses & stipend. H. Severen, 751-1731.

SENIOR CITIZENS - to share large Mt. Sinai home; share costs, responsibilities, companionship. Hannah Severen, Elder-Share, 751-1731.

Services

Services are listed as a courtesy to BNL employees. They are neither screened nor recommended by the ***Bulletin****.*

SPACKLING - free estimate. Kevin, 563-1189.

RUG SHAMPOOING - clean your rugs for spring, very reasonable, Lab discount. 924-9637, leave message.

FENCING - chain link, stockade, post/rail, panel weave, custom work. 434-9280.

TRANSFER YOUR MOVIES - to VHS tape, expertly done at a low cost. 467-8297 eves./wknds.

FRENCH TUTORING - by a French native. Kamal, Ext. 3098 or Amina, Ext. 5508.

BRICKWORK - patios, walks, swim pools, Belgium block, landscape ties. Tony, 698-9274.

CALLIGRAPHY - all occasions, reasonable rates. Neesha, 928-2994.

MICA WORK SPECIALISTS - in modern contemporary furniture, custom-designed kitchen cabinets, countertops. Gary, 732-6009.

SPACKLING - suspended ceiling, basements, dens, bdrms., studies, free estimate, Suffolk only. John, 281-3342 after 6 p.m.

LAMAZE CLASSES - June & July due dates, $45/6 wks. Pat, 744-4494.

GENERAL CONTRACTOR - carpenter, extensions, dormers, garage, conversions, basements, decks, kitchens, licensed. Jim, 698-2501.

MAGICIAN - children's parties, lab discount, sculptured balloons, book early, brochure avail. 395-3963.

CUSTOM-BUILT DECKS - windows & doors, free estimates, licensed & insured. 878-2233.

PARTY TENTS - for rent, we set up & take down. Fred Kuehl, Ext. 7947, beeper 792 or 588-2268.

DRAFTING - Need work done? Call for estimate or leave message. Mark, 924-0960.

In Appreciation

We wish to express our gratitude to all for your visits, gifts, prayers, cards and phone calls following our recent house fire. May God bless each and every one of you. — Raymond, Cecilia, Troy & Darrell Mayo

Ads left out of this issue due to lack of space need not be re-submitted to appear in the next issue.