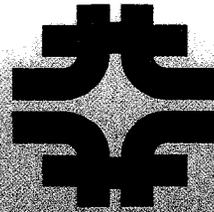


PFX

Procedures
for
Experimenters



Fermilab

Fermilab Warning Signals

Steady Klaxon

Fire

Evacuate according to plan.

Intermittent Klaxon

Tornado (indoor signal)

Go to shelter, according to plan.

Steady Siren*

Tornado (outdoor signal)

Go to shelter, according to plan.

Whooper Horn.

Radiation or hazardous atmosphere

Evacuate immediately, according to plan.

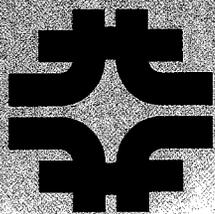
“According to Plan”

Wherever you work—in whatever part of Fermilab—you need to learn the plan for evacuation in case of fire or other hazards, and the plan for seeking shelter from a tornado. Ask your host division’s Environment, Safety and Health staff for this important information.

If you don’t have time to reach a designated shelter, seek shelter from a tornado in the nearest ditch or natural depression in the ground.

In an emergency, call 3131.

* Fermilab tests the tornado siren at 10:00 a.m. on the first Tuesday of every month.



Fermilab

As an experimenter at Fermilab, you have come to work at the largest, most active research laboratory for high-energy physics in the United States. Since its founding in 1967, Fermilab's mission has remained unchanged—to provide unequaled resources for talented people from around the world as they seek to understand the fundamental particles and forces of the universe.

This manual has been prepared to give you information about Fermilab and about your obligations and responsibilities. It is not a contract of employment. Fermilab reserves the right, in its sole discretion, to interpret policies on a case-by-case basis and to change policies and procedures at any time.

Fermi National Accelerator Laboratory
P.O. Box 500
Batavia, Illinois 60510

Phone: 708-840-3000
Fax: 708-840-4343
Telex: 708-373-6609

Operated by Universities Research Association, Inc.,
under contract with the United States Department of Energy.

Particle physics has never been a solitary science. From the beginning, the scale of experiments has put it beyond the reach of anyone working alone. And as machines grow more powerful and energies higher, the human dimensions of our science change as well. Because so many of us must work together to carry out experiments, we must depend on each other to hold to the highest standards of scientific research—and of health and safety.

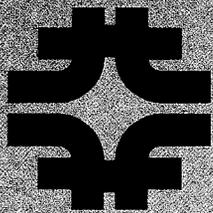
Now we have the opportunity to challenge ourselves to establish better procedures for working safely together, with regard and respect for our community and our environment. At Fermilab we have determined to seize this opportunity and to welcome the changes it brings. We have prepared this handbook as part of our commitment to make sure that every experimenter who comes to work at Fermilab understands and accepts this challenge.

At Fermilab our policy is to conduct research so that people's safety and the protection of the environment receive the highest consideration, while at the same time we make the best use of laboratory facilities. We strongly believe that high standards of environmental protection, safety and health are fully compatible with accomplishing critical research. We are committed to conducting research in ways that never compromise environment, safety or health.

As in no other field, high-energy physics gives us the chance to work just at the frontier of knowing about the universe, to look straight at the horizon of what we know, and over the horizon to what lies beyond. As Fermilab's director, it is my hope that every experimenter who comes to Fermilab will have a part in this unique experience, with the highest regard for the demands of working wisely and well with others in one of the great endeavors of our time.



February, 1992



Fermilab

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Physics at Fermilab

An experiment in particle physics at Fermilab begins with a proposal from a group of experimenters to the laboratory director. The director considers experimental proposals with the help and advice of the Physics Advisory Committee, a panel of distinguished physicists usually from outside institutions. For accepted proposals, the laboratory provides resources—particle beams, innovative high-resolution detectors, low-cost parallel computation, and engineers and technical specialists—so that collaborators from more than a hundred universities and laboratories across the country and dozens of foreign institutions can carry out experiments at the forefront of high-energy physics. Universities Research Association, Inc. (URA), a consortium of 77 research universities throughout the United States and Canada, holds a contract with the U.S. Department of Energy (DOE) to operate Fermilab.

...**C**ollaborators from more than a hundred universities and laboratories across the country... can carry out experiments at the forefront of high-energy physics.

A series of particle accelerators culminates in the Tevatron, the first synchrotron made with superconducting magnets. Fermilab provides beam for experiments in three ways.

In the fixed-target mode, the Tevatron accelerates protons to 800 GeV, then extracts and transports them to the experimental areas. The Tevatron can simultaneously supply about 12 experiments with beam. A second mode, which can run concurrently with fixed-target programs, uses antiprotons stored and cooled in the Pbar source for experiments with a gas jet target. In the third mode, the collider mode, the Tevatron accepts and accelerates protons and antiprotons to 900 GeV, in opposite directions, and brings the circulating beams into collision. To exploit the resulting 1.8 TeV center-of-mass energy, two large collider detectors, CDF and D0, operate at two sites around the Tevatron ring.

Over the next few years, a project called Fermilab III will upgrade the Tevatron's luminosity in a series of steps, providing a two- to threefold increase at the beginning of each successive collider run. Each step will coincide with upgrades in the ability of the CDF and D0 detectors to use the increased luminosity. The completed upgrade will provide a peak luminosity of $>5 \times 10^{31} \text{ cm}^{-2} \text{ sec}^{-1}$ at 2 TeV center-of-mass. Because they will produce a much more intense primary beam, the accelerator improvements will benefit fixed-target physics experiments as well as collider runs.

Fermilab Milestones

The director considers experimental proposals with the help and advice of the Physics Advisory Committee.

- **June 21, 1965**
Under contract from the U.S. Atomic Energy Commission, Universities Research Association incorporates to build and operate a new national accelerator laboratory.
- **December 16, 1966**
The AEC chooses a site 30 miles west of Chicago.
- **March 1, 1967**
URA appoints Robert Wilson Fermilab's first director.
- **June 15, 1967**
Operations begin at Oak Brook, Illinois.
- **November 21, 1967**
President Lyndon Johnson signs bill authorizing National Accelerator Laboratory.
- **December 1, 1968**
Groundbreaking for Linac.
- **October 3, 1969**
Groundbreaking for Main Ring.
- **March 1, 1972**
First 200 GeV proton beam passes through Main Ring.
- **December 14, 1972**
Main Ring energy doubled to 400 GeV.
- **May 11, 1974**
NAL renamed "Fermi National Accelerator Laboratory."
- **May-June 1977**
Upsilon discovered.
- **October 19, 1978**
Leon Lederman appointed director.
- **July 1, 1982**
CDF groundbreaking.
- **December 1982**
Advanced Computer Program formed.
- **July 3, 1983**
First acceleration of beam to 512 GeV in Energy Doubler, or Tevatron.
- **October 21, 1986**
First acceleration of Tevatron to 900 GeV.
- **January 3, 1987**
First $p\bar{p}$ collisions at 1.8 TeV.
- **December 2, 1988**
Dedication of Feynman Computing Center.
- **December 8, 1988**
Tevatron achieves record luminosity.
- **April 20, 1989**
John Peoples appointed director.
- **October 7, 1989**
Groundbreaking for Science Education Center.
- **April 24, 1990**
High-Energy Physics Advisory Panel gives Main Injector project highest priority in base high-energy physics program.
- **October 1, 1990**
Fermilab receives funding for Linac upgrade, first step in Fermilab III.

The People of Fermilab

Successful particle physics experiments need more than experimenters and fast-moving particles. They take planning, consulting, financing, detection, computing, engineering, construction, bookkeeping, communication, and consideration of safety and effects on the environment. They use the skills and experience of physicists, engineers, technical specialists, administrators and the people who provide the services they need: purchasing, building, hiring, trans-

portation, safety, information, meals, housing, child care, recreation. The employees of Fermilab work in myriad capacities to create an outstanding laboratory for high-energy physics research. Each person who works at Fermilab brings a unique combination of skills and experience and spirit to the job. Every experimenter should recognize the human rights principle of Fermilab as the standard for the way we work together.

The Laboratory and the Environment

Wilson Hall ("The High Rise") reaches into the sky above 6,800 acres of Illinois that hold—besides the country's busiest high-energy physics lab—lakes and ponds, upland forests, fields of corn and soybeans, oak savannas and reconstructed native tallgrass prairie.

At Fermilab, we have a strong commitment to stewardship of the land. From a 10-acre beginning in 1975, in partnership with the Nature Conservancy and hundreds of volunteers, we have reconstructed about 700 acres of our site to something approaching their native condition, creating one of the largest tallgrass prairies in the world. Wild ducks and geese far outnumber physicists at Fermilab; and, beside the Industrial Area, buffalo roam.

In 1989, the DOE made Fermilab a National Environmental Research Park, a protected outdoor laboratory for studying ecosystems of the Midwest. As part of a nationwide environmental research effort, called ParkNet, sponsored by DOE, ecologists come to the Fermilab Research Park from their home institutions to carry out their research. Environmental scientists working as ParkNet researchers sign a memorandum of understanding with Fermilab and are bound by the same procedures as users of the physics resources.

Fermilab experimenters need to recognize and help implement the environmental policy, with its goals for the entire Fermilab community.

Human Rights at Fermilab

"The policy at the Fermi National Accelerator Laboratory is to pursue its scientific goals with an emphasis on equal employment opportunity and a special dedication to human rights and dignity.

"Fermilab attracts scientists, not only from this country, but from many other nations all over the world. Foreign visitors, laymen as well as scientists, come to the laboratory to participate in its work. They represent a wide variety of races, nationalities, cultures and beliefs. It is essential that we provide an environment and maintain an atmosphere in which both staff and visitors can live and work with pride and dignity without regard to such differences as race, religion, sex, or national origin.

"In any conflict between technical expediency and human rights we will stand on the side of human rights. This is because of our dedication to science. The support of human rights in our laboratory and its environs is inextricably intertwined with our goal of making the laboratory a center of technical and scientific excellence. The latter is not likely to be achieved without success of the former."

From Robert Wilson's original policy statement on human rights at Fermilab

"At Fermilab, restorationists have brought to life a functioning prairie ecosystem supporting some 125 native plant species. Previously missing prairie fauna like meadowlarks, falcons, bobolinks, coyotes and foxes have turned up to make the tract their permanent habitat."

*From a March
1991 New York Times article on
prairie restoration at Fermilab.*

Fermi National Accelerator Laboratory conducts scientific research with regard for the protection of the community and the environment. We believe that high standards of environmental practice are fully compatible with accomplishing critical research, and we are committed to the incorporation of environmental protection practices in the daily conduct of experimental physics.

To advance the goals of restoring and enhancing environmental quality, Fermilab's policy is to:

- Educate experimenters and employees at all levels to protect the environment by preventing pollution, minimizing waste and by the consistent choice of the least toxic means to achieve experimental goals.
- Encourage initiatives in establishing sound pollution prevention and waste reduction practices.
- Take measures to minimize contaminants and wastes through source reduction and recycling.
- Evaluate the environmental impact of actions and take all necessary measures to mitigate their effects.
- Strengthen self-assessment programs and act swiftly to correct deficiencies.

To advance the search for a judicious understanding, based on scientific research, of the preservation of environmental balance between human activities and nature's response, Fermilab makes its land resources available to qualified investigators to conduct ecological research.

Fermilab uses its opportunity as an open laboratory to demonstrate to the public the means to minimize or avoid the detrimental impact of scientific research on the environment and to foster environmental awareness in the community.

“ was the lone employee, wondering who, if anyone, would come to help me turn that cornfield into a physics laboratory.”

—Robert Wilson, on his first months as Fermilab director, in 1967.

How We're Organized

Operating under a directorate, Fermilab has three divisions and six sections. The Accelerator Division (AD) designs, constructs and operates the machines that provide high-energy protons and antiprotons. The Research Division (RD) takes responsibility for mounting high-energy physics experiments and transporting beams to them. The Computing Division (CD) operates and maintains most of the laboratory's computers and computer networks and provides much of the hardware and software used for data acquisition, offline analysis and general computing at Fermilab.

The Physics Department (PD) supports Fermilab staff physicists in their physics research and serves as the home for research associates, Wilson fellows, Lederman fellows and guest scientists.

The Business Services Section (BSS) manages site security, telecommunications, mail, the Fermilab Fire Department, procurement, stockrooms, warehousing, shipping, receiving, payroll, accounting and the Legal Office. The Facilities Engineering Services Section (FES) coordinates construction and facility operations and maintenance, as well as civil engineering, architectural design and major construction inspection. The Laboratory Services Section (LSS) administers Fermilab's personnel function and manages the library, the Users' Office, the Users' Center, the Guest Office, the Activities Office, the Medical Office, the Public Information Office, publications, housing, the cafeteria and child care, as well as the Education Office.

The Technical Support Section (TSS) manages the machine shops and much of the laboratory's mechanical engineering support, and designs and builds accelerator and analysis magnets. The Environment Safety and Health Section (ES&H) monitors Fermilab's environment, safety and health programs, conduct independent reviews and serves as the ES&H reporting channel to DOE.

The Fermilab Directorate oversees all these organizational units and directly supervises the budget, internal audit, quality assurance, value engineering, technology transfer and program planning.

The organization table on page 30 of this handbook presents Fermilab organization at a glance—or at least at a gaze.

Members of the Fermilab Users' Organization hold yearly elections for the Users' Executive Committee (UEC), whose members meet periodically with the director and laboratory staff to maintain close contact with planning, programs and operations. The UEC does not involve itself with program decisions but does suggest candidates for membership on advisory committees.

People come to do physics experiments at Fermilab from dozens of institutions and traditions, each with its characteristic ways of doing things. Here at Fermilab, we too have found our own ways to work together safely and effectively, with respect for others, for resources and for the environment. While you are an experimenter at Fermilab, we ask that you learn and follow the policies and procedures we've established. Here in Chapter Two, we have collected the most basic information every Fermilab experimenter needs to know and use.

In an Emergency

In any emergency, dial 3131 from any laboratory telephone. From a non-laboratory telephone, dial 840-3131.

When the operator answers, tell your name, your location and the emergency. Stay on the phone until the operator has all the necessary information and tells you to hang up. The operator will activate the emergency response.

The inside front cover of this handbook explains the meaning of alarms and warning signals at Fermilab. Please take a few minutes to make sure you know what each one means, and how to respond.

Fermilab has staff and equipment available to provide emergency medical service. Anyone who needs further medical attention is taken immediately to a community hospital. For emergency medical aid, dial 3131.

We have designed and organized the laboratory to create a safe working environment, and to respond to emergencies such as personal injury, accident, fire or radiation incident.

The emergency coordinator has the responsibility and full authority for directing an emergency response.

Registration as an Experimenter

To become an experimenter, or user, at Fermilab, you must officially register with the laboratory and receive your identification card. You should register on the first working day after you arrive. To register, go to the Users' Office, on the first floor of Wilson Hall, East side, WH1E, open Monday through Friday from 8:30 a.m. to 5:00 p.m.

When you register, you give basic information about yourself, your home institution and your experiment at Fermilab. You need to certify that your medical insurance is valid while you are at Fermilab, and you need to sign a statement that you have read this chapter and agree to comply with its provisions. You receive basic training in Fermilab safety.

Fermilab policy calls for users' institutions to sign a document called a "User Facility Class Waiver" covering rights in patents developed at Fermilab. If your institution has not yet signed such a waiver, the Director's Office arranges for a responsible officer of your institution to sign one.

After you register, you will receive authorization to get an identification card and the keys you need from the Keys and ID Office, WH1NE. Your ID card is valid for two years or for the duration of your medical insurance, whichever is less. When you receive your ID card, we ask you to keep it with you while you're at Fermilab. You'll need it to make stockroom withdrawals, for example, or to enter the site after hours. You need to show your ID at a security guard's request.

Some large experiments, such as CDF and D0, also require experimenters to register with the experiment.

Spokespersons

The laboratory needs to maintain clear, direct and consistent communication with each experiment at every stage from proposal to conclusion. The scientific spokesperson serves as the primary link between the laboratory and the experiment. Thus, every group of experimenters at Fermilab must designate a scientific spokesperson and a deputy spokesperson; occasionally, experiments choose to designate co-spokespersons. The spokesperson (or the deputy) takes responsibility not only for the scientific and technical aspects of the experiment but also for other aspects, including environment, safety and health (ES&H). Usually the spokesperson reports to the head of the Research Division in the exercise of ES&H responsibilities; but sometimes a memorandum of understanding (MOU) may set forth another reporting structure. A group may change its spokesperson at any time by notifying the Program Planning Office in writing.

Physicist-in-Charge of an Active Experiment

Members of the laboratory staff often need to discuss with a responsible member of an experimental group an urgent matter concerning safety, scheduling or operation of a given experiment. Scientific spokespersons are not necessarily on site or within call at all times during the active period of the experiment.

Thus, each experiment designates a "physicist-in-charge," within one hour's travel of the laboratory, who has that responsibility.

The physicist-in-charge has authority to act as the spokesperson for the

Responsibilities of a Scientific Spokesperson

- Serve as main contact for the laboratory in all matters related to a proposal or experiment.
- Respond to questions and concerns during evaluation of a proposal for an experiment.
- Prepare a memorandum of understanding (MOU) in consultation with divisions and supervise preparations for an accepted experiment.
- Maintain a current list of experimenters in the group present at the laboratory.
- Ensure that all members of the group have medical insurance valid while at Fermilab.
- Arrange and be responsible for on-site housing used by the group.
- Ensure that all members of the group have registered, have valid ID cards and appropriate stockroom withdrawal authorization.
- Make financial arrangements for the experiment.
- Ensure that all members of an experiment understand and comply with Fermilab ES&H regulations. If any violation of the rules occurs, the spokesperson has the responsibility to take corrective action and prevent recurrence.
- Make sure that every member receives timely and appropriate ES&H training.
- Arrange for work space for the group.
- Approve computer accounts for the experiment and regularly review the experiment's computing needs.
- Obtain pre-operational review approvals for experimental systems before operation of the experiment.
- Identify the deputy spokesperson and the physicist-in-charge.
- Report any change in senior membership of the collaboration in writing to the Program Planning Office.
- Submit copies of publications and Ph.D. theses.

experiment in the absence of the spokesperson for matters of safety, running schedule and technical matters that demand immediate attention. The physicist-in-charge generally attends the weekly All Experimenters' Meeting and keeps in touch with experiment scheduling.

Working Safely at Fermilab

Fermilab conducts its research in compliance with all regulatory requirements that affect the environment, safety and health. Research must never compromise ES&H. To

make sure we follow this policy consistently, we have developed a comprehensive safety program, stated in full in the *Fermilab ES&H Manual* (reference copies in ES&H Section and all division and section offices). Failure to conform to the procedure and regulations of the safety program may mean denial of user access to laboratory facilities.

Who is responsible for safety at Fermilab? Each user is accountable to the head of the experiment's host division—either the Accelerator or

the Research Division—for the safe design and operation of experimental apparatus. The section and division heads have the responsibility for the safe operation of their respective areas, and the laboratory director is ultimately responsible for safety.

The laboratory ES&H Section audits the laboratory safety program and provides technical support, special services and consultation. The head of the laboratory ES&H Section has the authority, delegated by the laboratory director, to stop any unsafe or hazardous activity, including experimental activities. Senior safety officers in the divisions and sections and the Research Division Operations crew chief also have authority to stop unsafe activities.

Any experimenter who knows of conditions that may be safety violations has the responsibility to report the conditions to the spokesperson or to safety staff. Anyone who views an assigned task as a hazard should request a review by the safety officer. Complaints about safety violations may be filed either with the ES&H Section or, if more formal action is needed, with the DOE.

ES&H Requirements for Experiments

As a user, you will work with the senior safety staff for your host division. The safety staff will help you review your procedures and equipment for potential hazard.

The spokesperson for every Fermilab experiment must obtain all the necessary review approvals before operation of the experiment begins. The Research Division calls this an “Operational Readiness Clearance;” the Accelerator Division calls it an “Operational Permit.” Experiments within Accelerator Division enclosures need both Research Division and Accelerator Division reviews and

approvals. These experimental aspects require review and approval before an experiment can operate:

- Mechanical systems
- Flammable gas safety
- Cryogenic safety
- Hydrogen target safety
- Electrical safety
- Radiation safety/controlled access
- Compliance with OSHA and other regulations

The publication *Review Procedures for Experiments* explains all aspects of the review process, from experimental proposal through operation.

ES&H Resources for Experimenters

Staff. Each Fermilab division and section has its own safety staff—senior safety officer, radiation safety officer and environmental protection officer—to provide technical support and to carry out ES&H programs.

In addition, the Fermilab ES&H Section staff has areas of particular expertise that you may want to make use of: instruments and techniques for monitoring radiation; distribution and management of radioactive

sources; and transporting and disposing of both radioactive and non-radioactive hazardous waste, for example. The section’s Activation Analysis Laboratory (AAL) provides services to characterize radioactivity around the site and helps calibrate beam current monitors. Your host division office will tell you who the safety staff are and how to reach them.

Training. All experimenters attend appropriate training courses before they use Fermilab facilities. Experimental conditions dictate course requirements; the Research Division or Accelerator Division safety officer determines the courses you need to take. Some common courses:

- Radiation Safety
- Controlled Access
- Oxygen Deficiency Hazard
- Laser Safety
- Crane Operation
- Forklift Operation
- Confined Space
- Radioactive Sources
- Chemical Safety/Hazard Communication

ES&H References

You can get ES&H reference materials in the ES&H Section or from division safety officers. For example:

- *Fermilab ES&H Manual*
- *Fermilab Radiation Guide*
- *Fermilab Emergency Plan*
- *Research Division Safety Manual*
- *Accelerator Division Safety Manual*
- *The Fermilab Spill Plan*
- *National Electric Code*
- *National Fire Code (NFPA)*
- *Review Procedures for Experiments*
- *Material Safety Data Sheets (MSDS)*

Basic Safety Rules

Radiation Safety

You must have up-to-date radiation training and wear a film badge to enter radiation areas. You can get a temporary badge at the ES&H Section, WH7NE, and at various locations around the site. If you plan to stay at Fermilab for six months or more, apply for a permanent badge to the film badge manager in the Radiation Physics Staff Group in the ES&H Section.

Consult your host division radiation safety officer (RSO) to find out about specific radiation safety training requirements that apply to you and your experiment.

No one may bring radioactive sources onto the site or remove them from the laboratory without receiving prior authorization from the source physicist in the ES&H Section.

Movement of radioactive sources and other radioactive materials from one location to another on site must have prior approval by the ES&H source physicist or area RSO. No radioactive material may be moved in private vehicles.

If you want one, you must arrange with the source physicist in the ES&H Section for the loan of a radioactive source. You may never tamper with the configuration of the source holder.

Only specifically authorized people who have had appropriate training may enter controlled access areas,

and they may enter only under specifically prescribed conditions. You become qualified to make a controlled access only after authorization by the host division RSO.

While an accelerator is operating, an electronic enclosure interlock system keeps people out of the area where radiation rates rise to harmful levels. Tampering with any part of the enclosure interlock system is forbidden and may lead to exclusion from the laboratory.

Always consult the host division safety staff or the ES&H section when you must dispose of radioactive or other hazardous waste.

Electrical Safety

Do not work on electrical equipment unless it is disconnected or until it has been de-energized by use of "lock and tag" procedures discussed in the *Fermilab ES&H Manual*.

The laboratory discourages the use of extension cords, cube taps and "temporary wiring."

All portable electrical equipment and power tools must be adequately grounded or double-insulated when connected to a power source.

Pregnancy and Radiation Safety

Fermilab's policy provides that radiation exposure to unborn children as a result of occupational exposure to pregnant workers be maintained as low as reasonably achievable. The *Fermilab Radiation Guide* and radiation safety officers can provide more information about radiation and pregnancy. The spokesperson for the experiment has the responsibility to make sure that all females in the group understand the potential hazards of exposure to radiation in pregnancy.

These pages give you the most elementary rules in force at Fermilab for working safely with radioactive sources, electrical equipment and hazardous materials, as well as for general laboratory safety. Keep in mind that they are not a comprehensive list of ES&H requirements. More detailed safety information appears in Chapter Ten of this handbook and in the Fermilab ES&H Manual.

Hazardous Materials Safety

Read hazard warning labels on containers to find out how to handle a chemical or other material safely. If the container has no label, do not use the material until you know what it is and how to handle it.

You can find detailed information on the hazards of a product on Material Safety Data Sheets (MSDS). To locate MSDS, see your host division safety staff.

To obtain and properly use a respirator to control the inhalation of toxic materials such as dusts, fumes and solvent vapors, and carbon monoxide, see the safety staff of your host division and the *Fermilab ES&H Manual*.

Store flammable solvents such as methanol and acetone in safety cans and flammable-storage cabinets. Specific regulations govern the use of hazardous chemicals in radiation areas.

Laboratory Safety

You must wear safety shoes when there is a risk of foot injury. You may charge safety shoes to your experiment budget.

You may obtain prescription safety eyeglasses through the ES&H Section, WH7NE; you may charge them to your experiment's budget. Both the stockroom and the division safety staff supply non-prescription safety eyewear.

You must wear hearing protection whenever the noise may rise above the standard of 85 dBA. Usually such areas are posted. You can get various types of hearing protection devices from the Fermilab stockroom, division safety staff and the ES&H Section.

You must register all lasers brought to the laboratory with the ES&H Section before use. Other laser requirements may include training and eye examinations. See your host division safety staff for required procedures that apply to you.

All ladders and scaffolding used at the laboratory must meet the prescribed ANSI and OSHA standards in their construction and use. Never use metal ladders for electrical work or in areas where there is any possible contact with live electrical parts.

Only persons who have been formally qualified by training may operate powered lifting and moving devices such as cranes and forklift trucks.

You must have a written permit from the host division safety officer before you enter a confined space; typical examples of confined spaces include manholes, tanks, pipes, sump pits, and Cerenkov counters.

You must have current medical approval and authorized oxygen deficiency hazard training before you may enter areas posted as oxygen deficient hazard (ODH) areas.

Fermilab traffic regulations conform to those of the state of Illinois as prescribed in *Rules of the Road*. Violation of traffic regulations may provoke disciplinary action. Illinois state law requires automobile liability insurance for private vehicles.

Fermilab has a general prohibition against bringing firearms or any other weapons on site. Hunting and trapping are strictly prohibited.

Fermilab fully supports state and federal laws concerning the drug-free workplace.

In an emergency, call 3131.

Protecting the Environment

At Fermilab, our policy is to conduct research with regard and respect for the environment. We find high environmental standards fully compatible with accomplishing critical research. (You'll find more information about environmental standards in Chapter Ten of this handbook.) Here, we give two basic environmental rules.

"Restoration is a healing art.
The first rule is to do no harm."

*Dr. William R. Jordan, 3d,
founder of the Society
for Ecological Restoration, in a
March 1991 New York Times article
on ecology at Fermilab.*

Host division safety staffs must review all purchases of chemicals or transport of chemicals to the laboratory. To reduce environmental impact, bring on site only as much of a hazardous material as you actually need, and choose less toxic or less hazardous alternatives whenever you can.

You must arrange disposal of chemicals through your host division environmental safety officer.

Visitors in Experimental and Operating Areas

Potential health and safety hazards exist throughout the laboratory—high voltages, oxygen-deficient atmo-

spheres, explosive gases, toxic chemicals, heavy rigging, complex machinery and radiation. Delicate, carefully aligned apparatus necessary to the operation of the experimental program is vulnerable to damage. For these reasons, experimenters must follow the rules governing the admission of visitors to experimental areas. Chapter Seven explains these rules in more detail. Every user and Fermilab employee who has a visitor has the responsibility to know and follow Fermilab safety practices and procedures for the visit.

Children at Fermilab

Everyone under 18 years old, including children of employees, visiting scientists and DOE employees, must be continuously supervised by an adult while visiting Fermilab. Children may be permitted in certain office areas designated by the division or section involved, subject to approval by the division or section head.

In general, children may not visit laboratory areas, defined as areas that are neither public nor office areas and including beam line enclosures and service buildings, experimental halls, counting rooms, portakamps (except those used exclusively for offices), non-office areas of assembly buildings, machine shops, and gas sheds. On a case-by-case basis, the division

head may give permission for properly escorted children to visit specific laboratory areas for a specific length of time. You must get permission before allowing children to visit a laboratory area. No children may visit any area containing radioactive materials or radiation hazards under any circumstances.

Computing Guidelines

After you receive your Fermilab ID, you may request an account on the central computers operated by the Computing Division: for example, the FNAL VAX cluster, a central mail hub and general interactive machine. You can get an account request form on the eighth floor crossover of Wilson Hall. Also on the eighth floor are the Consulting Office and the Computing Division library, which provides documentation.

The federal government funds computing facilities at Fermilab to support research projects undertaken by the laboratory, and regulates their use. Chapter Eight of this handbook presents these regulations in detail; but, to sum up, application for and assignment of an account on Fermilab-owned computers carries with it acceptance of legal responsibilities including proper use of the computing facilities, protection of accounts and passwords against improper use and hacker penetration, and observance of restrictions on licensed software. •

- Living with the time
- Mail and phone
- Medical care
- Food service
- Day care
- Transportation
- Recreation

In the Woodland period, from 2,500 B.C. - 500 A.D., visits to the Fermilab site were brief; hunting and gathering nuts and berries were main activities. Afterwards the Indians would return to their more permanent settlements along the banks of the larger rivers."

*From a history of the Fermilab site
by Adrienne Kolb, archivist*

Experimenters come to Fermilab for a few days—or a few years. While they're here, Fermilab provides services—from help in finding a place to live to teaching English—for users and their families.

The Users' Office, Resource for Experimenters

When an experimenter comes to Fermilab, the Users' Office, WHIE, (ext. 3111) performs the introductions between user and laboratory, handles registration and ID cards, and gives new users information about laboratory policies, procedures and facilities. Throughout the experimenter's stay, the Users' Office provides information and responds to questions and concerns. The staff takes telephone messages and accepts mail for users who don't have another point of contact in the laboratory, maintains a copy machine for users and provides secretarial and administrative support to the Users' Executive Committee.

Personal Help for You and Your Family

Newcomers to Fermilab can get general information, school information, maps, guides and information directories from the Guest Office, WHIE, (ext. 3440). If your family plans to come with you to Fermilab, please tell the Guest Office; we'd like to welcome them and tell them about our services and programs.

You can make arrangements through the Guest Office to enroll children in local schools. The Guest Office will be glad to send you the Certificate of Child Health Examination form, required by the state of Illinois for all children entering local schools. Your child's doctor should complete this form just before your departure for Fermilab. The West Chicago school

district provides free bus transportation for children who live on the Fermilab site.

Family members who live on site and would like identification to enter the site during off hours can get residence identification cards at the Housing Office, located in Aspen East in the Village.

We encourage foreign visitors to request Fermilab's *Guide for Foreign Visitors*. It informs you about health insurance, social security cards, drivers' licenses and other things you need to know before you arrive. The Guest Office will be glad to send it.

You can request to have sent to your mail station a biweekly copy of the *Fermilab Cultural Calendar*, with information about films, concerts and other activities at the laboratory, in the neighborhood and in the Chicago metropolitan area. The Users' Office also has copies of the current *Cultural Calendar*.

Users and spouses who are learning English may wish to enroll in the English language class. You can get information or sign up for this free class at the Guest Office.

Twice a week, morning coffee hours sponsored by the Guest Office provide an opportunity for spouses of experimenters to meet and get acquainted.

You can buy tickets for programs in the Fermilab Lecture and Arts Series at the reception desk in the Wilson Hall atrium. It's a good idea to make reservations as early as possible to be sure to get a seat.

A Place to Live

Fermilab's Housing Office (ext. 3777) in the lobby of Aspen East at the corner of Sauk Boulevard and Batavia Road in the Fermilab Village helps experimenters and their families find housing while they are at the laboratory. The Housing Office compiles an annual brochure, *Apartment and Townhouse Information*; most of the apartment complexes it lists offer one-year leases. The staff also maintains a book of privately owned properties for rent or lease and, each spring, prepares a list of homes available just for the summer. The Housing Office staff are glad to help you find off-site housing, but you should make contractual arrangements directly with the landlord.

Living On Site

Facilities. Fermilab has furnished houses, apartments and dormitory rooms on site for users to rent for up to nine months. (If you're staying longer, we ask you to find a home off site.) You can purchase weekly maid service (required in houses and

apartments with more than one experimenter) at an additional charge. Dormitories have lounges and kitchens; the dormitory room charge includes weekly maid service.

The Housing Office needs to know the names of all tenants in each unit at all times. When an experimental group rents a house, apartment or dormitory rooms, the Housing Office needs to know as each new guest arrives or departs. Please update the name card on the door to show the current occupants.

For on-site repairs, services and complaints, call ext. 3777, the Housing Office. For emergency repairs after working hours, call the switchboard operator, who will make arrangements for service.

Reservations. The laboratory makes housing assignments based on individual needs and the best interests of the laboratory program. The Housing Office maintains a current reservation list. You may sign up for housing at any time, but the deadline for summer reservations is usually early March; for fall housing, mid-July.

Cancellations. The Housing Office must receive cancellations for dormitory rooms by 1:00 p.m. of the reservation date. For houses and apartments, the Housing Office must receive cancellations two weeks before the scheduled arrival date or a fee equal to two weeks' rent will be charged.

Rental Payment. You can pay your rent by budget code, cash, check, Visa or MasterCard. Guests who pay in cash must pay in full before they leave the laboratory.

Tornados

In case of a tornado, take shelter. Shelter areas are located in the Village at the following addresses: Aspen East (Batavia and Sauk Blvd.), Dorm 3 (1 Shabbona), Proto-Booster (Neuqua and Potawatomi), Shelter 20 (next to the Day Care Center) and 14 Sauk Circle. Find out exactly where you should go in case of a tornado the day that you arrive in the Village—don't wait until an emergency happens.

Registering and Check-Out. You may pick up keys in the Housing Office, Monday through Friday, 8:00 a.m.-4:45 p.m. At other times, please pick up your keys from the Communications Center, WH1NE.

Check-out time is 10:00 a.m. in houses and apartments, 1:00 p.m. in dormitory rooms. Please turn in keys to the Housing Office at Aspen East or to the Communications Center, WH1NE. Late check-out means an extra charge of one day's rent.

Pets. We allow pets in houses and apartments, but not in dormitory rooms. Before you bring a pet into a housing unit, you must sign a statement in the Housing Office that the pet's owner will take responsibility for keeping the animal "under control." If the pet is a dog, the owner must produce a valid license and a recent rabies vaccination certificate. Pet owners are liable for any damage or injury their pets cause. Failing to notify the Housing Office about the presence of a pet may result in the denial of housing accommodations.

Telephone calls. All units have private telephones. You must charge personal long-distance and toll calls to a personal credit card, or make them collect. Place overseas calls through the Fermilab operator. The operator will require a budget code and other information for chargeback. The Fermilab operator will obtain time and charges for personal calls, for which callers pay the laboratory cashier, WH4E. You can call Canada and most parts of Mexico by direct dialing. There are pay telephones located at 18 Sauk Blvd. and in the Aspen East basement.

Laundry and linen. Laundry facilities are located at 18 Sauk Blvd., the basement of Aspen East and 10 Sauk

Circle basement. All house and apartment residents receive clean rental linen once a week.

Mail

Support Services staff pick up and deliver mail twice daily in Wilson Hall, Cross Gallery and Neutron Therapy. Other buildings have morning delivery and pickup only. Wilson Hall has mail chutes at the north end of each floor. Village resident mailboxes are located at 18 Sauk in the Village.

You can arrange for overnight mail (Express Mail) through the mailroom, in the basement of Wilson Hall, (ext. 3210). Express Mail leaves Fermilab at 2:15 p.m. daily to guarantee delivery the next morning. The mailroom delivers incoming Express Mail directly to the mail station. The mailroom, open weekdays from 1:00-4:00 p.m., offers all typical postal services except money orders. You must pay postage for all personal mail.

Phone

Fermilab has a federal government telephone system. The laboratory's main telephone number is (708) 840-3000. For incoming FTS calls, the laboratory's FTS number is 370-3000. Callers can reach users and employees directly by dialing (708) 840- and the four digit extension number, or 370- and the four digit extension number for incoming FTS calls. Within the laboratory, the four digit extension number suffices to place calls.

To avoid expensive calls from pay phones, callers can reach Fermilab from Chicago, including O'Hare airport, by dialing 326-5533 and asking the Fermilab operator for the desired extension.

Place all outgoing international calls through the Fermilab operator. The operator will require a budget code and other pertinent information for chargeback. The Fermilab operator will obtain time and charges for personal calls, for which callers pay the laboratory cashier, WH4E.

Fermilab's TELEX number is 373-6609. The Communications Center at WH1NE, (ext. 4251) will send or receive TELEX messages.

The laboratory's main facsimile number is 4343. Other facsimile numbers are listed in the Fermilab telephone directory.

To request telephone installations, submit a Telephone Service Request Form (available from most secretaries) to Telecommunications, WH5W, (ext. 3788). These forms require signature approval from the appropriate department head. Phone installations require three weeks advance notice and a user account code.

Users may borrow pagers from the Telecommunications Office, WH5W, (ext. 3788).

Medical Care

Emergencies. In an emergency, dial 3131. Fermilab has staff and equipment available to provide emergency medical service 24 hours a day, 365 days a year. Anyone seriously injured is taken immediately to a community hospital that has agreed to provide emergency care for people injured at Fermilab.

Urgent care. The Medical Office, WHIW (ext. 3232) is staffed by registered nurses on weekdays from 7:00 a.m. to 5:00 p.m. A physician is on the site weekdays between 8:00 a.m. to 12:00 noon and 1:00 p.m. to

"The labor we delight in
physics pain."

—Shakespeare, Macbeth

5:00 p.m. Should you need immediate medical care when the Medical Office is closed, go directly to the Emergency Room (phone 859-2222) at Mercy Center Hospital, 1325 Highland, Aurora, just south of the E-W Tollway on Route 31.

Routine care. Users should consult health care providers in the community for non-emergency medical care. Users must show they have medical insurance coverage while they are at Fermilab. Users will be billed by the provider for any medical services not covered under their regular health insurance plan.

Pharmacies in the United States require prescriptions for the purchase of most drugs. Eyeglasses require prescriptions as well.

Food Service

The cafeteria on the first floor of Wilson Hall serves breakfast, lunch and dinner, Monday through Friday; weekend service offers only breakfast and lunch. Full service is not always available on holidays. Hours are posted near the cashier. Call Food Services (ext. 3646) to make arrangements for special events. Call ext. 3463 for a recording of the daily menu.

You'll find vending machines in the southwest corner of the first floor in Wilson Hall, in the Cross Gallery of the Accelerator, the Meson laboratory, Feynman Computing Center, and at 18 Sauk Blvd. in the Village. Report problems with vending machines to Food Services (ext. 3646).

Day Care

Fermilab operates an infant and day care facility, the Children's Center, at 28 Shabbona in the Village. The

infant care section for children six weeks to three years has infant, pre-toddler and toddler sections. The day care section cares for children three to six years of age. Hours are 6:45 a.m. to 5:30 p.m. with full-day and half-day programs. Enrollment is based on availability. For information, call the Accommodations Office (ext. 3082) or the Children's Center (ext. 3762).

Fermilab has a summer day camp for experimenters' and employees' children from seven to 12 years old. Camp has full- or half-day sessions. Call 3126 for information.

Travel and Transportation

Reservations. The Fermilab Travel Office, WH1E, (ext. 3397) makes reservations for air travel, car rental and limousine service. You can pay for travel by personal check, cash or charging to a budget code. Limousine companies in the Fermilab area will not accept reservations charged against a Fermilab budget code without prior approval from the Travel Office.

On-Site Transportation. The Fermilab taxi provides transportation on site from 8:00 a.m. to 4:30 p.m. on weekdays. To call the taxi, dial 4225 (HACK).

Off-Site Transportation. No public transportation serves the laboratory site, but the Travel Office has information about the quickest and least expensive transportation in the area.

Airtran-O'Hare van service offers the most convenient and cheapest way to reach Fermilab from O'Hare International Airport. The van service brings you directly to or from the

Fermilab site. You may arrange for the Airtran-O'Hare service by calling the Fermilab Travel Office weekdays (840-3397) or Airtran (961-5500) weekends. You should make reservations at least 24 hours in advance. Same-day reservations are accepted only subject to space availability.

Rental and Lease Cars. Commercial rental and lease cars at special rates are available to Fermilab users. Call the Travel Office (ext. 3297) for information and reservations.

Government Vehicles. Government vehicles are available from the General Services Administration, Chicago Fleet Management Center, 7345 West 100th Place, Suite 108, Bridgeview, IL 60455. Users supported under a federal contract may be authorized to use them. Cars must be picked up and returned to the Chicago street address. Requests for these vehicles must be made prior to pickup, via the user's home institution.

Any user who may need to use a government vehicle while working at Fermilab must make arrangements with the home institution to obtain a valid U.S. Government Motor Vehicle Operator's Identification Card (Form 346) and the authorization to use governmental vehicles prior to arriving at Fermilab. Vehicles, when available, may be assigned from the department office to drivers holding a valid state license.

Personal Vehicle Insurance Requirement. The state of Illinois has a mandatory insurance law that requires drivers to have liability insurance on their personal vehicles. Users have the responsibility to make sure their vehicles are insured.

Are We Having Fun Yet?

Recreational Facilities. The Users' Center, at 10 Che Che Pinqua in the Fermilab Village, is open Monday through Friday from 5:00 p.m. until midnight, and Saturdays from 7:00 p.m. until midnight. The Center has a bar, ping pong, pool, electric shuffleboard, cards, chess and checkers, and movies every Saturday night. You'll also find a color television set and VCR, a grand piano and a small library. Children must have responsible adult supervision.

Chez Leon

A gourmet restaurant in the Users' Center serves two meals each week—lunch on Wednesdays at 12:30 p.m. and dinners (for between 30 and 55 guests) on Thursdays at 7:00 p.m. You'll find the upcoming menu in the *Cultural Calendar*. Make reservations (they're required) by calling ext. 4512.

You can buy a season pass to the swimming pool, adjacent to the Village Barn, or pay a daily fee. Arrange for a pool pass or children's swimming lessons through the Activities Office, WHIE, (ext. 4544). You can rent a canoe at a nominal cost through the Activities Office; call ext. 3126. Tennis and basketball courts and turf softball diamonds are next to the Village Barn. The upper level of the Anderson Barn, just off Sauk Circle, has a squash and handball court.

The gymnasium, at 16 Potawatomi, includes an exercise room, a fully-equipped weight room and locker rooms, with 24-hour access for members. You can purchase a gym membership at the Activities Office, WHIE.

The Activities Office brochure has information about recreation facilities and programs, clubs and leagues.

Cultural Activities. Fermilab sponsors many cultural activities in the 830-seat Norman F. Ramsey Auditorium at the south end of Wilson Hall.

The Fermilab Arts Series features monthly Saturday evening performances of internationally acclaimed dance, theater, comedy, chamber music, jazz and folk music ensembles. In the "Science and Human Values" Lecture Series, Fermilab hosts distinguished guests from many disciplines. You can obtain information and tickets at the reception desk in the atrium of Wilson Hall.

Fermilab's International Film Society offers international, feature and documentary films, usually on the second and fourth Fridays of each month. You don't need to make reservations or buy tickets in advance, but there is a nominal charge at the door.

The Art Gallery on the second floor of Wilson Hall offers bimonthly exhibits of paintings, photographs and sculpture, ranging from high-tech to ethnic. Fermilab invites the public to view these lively and varied exhibits seven days a week, during daytime hours. •

Laboratory Publications

Fermilab Report. Quarterly, the laboratory publishes a collection of articles of general interest to the scientific and technical community. We encourage users to submit to the Publications Office brief research notes and other general material for publication in *Fermilab Report*, distributed widely both on and off site. To join the mailing list, ask the Publications Office, WH6NW, (ext. 3278). You can obtain single copies of current and back issues from the Publications Office.

FermiNews. The Publications Office distributes copies of Fermilab's bi-weekly, on-site newsletter. The Publications staff invites employees and users to send newsworthy items for publication to the Publications Office. Requests to get on the mailing list should be directed to the Publications Office, where you can obtain single copies and back copies.

nalcal. A weekly (Friday) calendar of times, topics and locations of all meetings of general interest, seminars and colloquia held on the site, with general announcements at the bottom of the page. Please submit material for the following week's calendar to the Director's Office, WH2E, (ext. 3211) by noon on Wednesday.

Monthly Update. At the end of each month, the Publications Office produces the "Monthly Update List" of all technical reports prepared during the month by Fermilab staff. This list is sent to subscribers, who may order copies of any report on the list. To subscribe to the "List" contact the Publications Office, WH6NW, (ext. 3278). The *Monthly Update* lists Technical Memos, Physics Notes and Preprints. Technical Memos (prefix TM) are primarily internal documents. They are usually techni-

"An active field of science is like an immense anthill; the individual almost vanishes into the mass of minds tumbling over each other, carrying information from place to place, passing it around at the speed of light."

Lewis Thomas, *The Lives of a Cell*

Publications Office

Publications

Seminars, colloquia and
meetings

Publishing your work

Public relations

Visual media services

cal in nature, but can be on any topic. They are sent to off-site requesters only with the author's permission. Physics Notes (prefix FN) are physics papers intended for limited external distribution, primarily to high-energy physics libraries. They are distributed through a mailing list. Preprints are papers that have been submitted to journals or conferences. Preprints have a large external distribution. You can obtain copies of TM's, FN's and preprints from the Publications Office.

TECHPUBS. The Publications Office maintains a database of all Fermilab technical reports. Available on the VAX Cluster, the database, called TECHPUBS, is updated monthly. For information, enter HELP TECHPUBS. If for some reason you cannot access TECHPUBS, call ext. 3278 or ext. 3887 and the Publications Office staff will help you find the information.

Closed Circuit Television. Transmits information about the status of laboratory operations throughout Fermilab. Besides displays of information specific to experiments, there are four general displays.

Channel 13 - General information about the accelerator including ramp and intensity; messages of general interest to the user community.

Channel 12 - The experimental program status; the current operating schedule.

Channel 10 - Display of electrical power usage.

Channel 9 - Video News and other laboratory-related video programs.

Selected Fermilab Publications

Information and procedural guides of interest to users

- *Fermilab Research Program Workbook*
- *Fermilab Emergency Plan*
- *Fermilab Safety Handbook*
- *Guide for Foreign Visitors*
- *Fermilab Radiation Guide*
- *Fermilab Telephone Directory*
- *NALWO Guest Guide*
- *Cultural Calendar*
- *Activity List (Recreation)*
- *Education Programs at Fermilab*
- *Personnel Policy Guide*

The Users' Office staff can tell you where to find copies of these publications.

Library

The Fermilab library, WH3SX, concentrates in the areas of high-energy, particle and accelerator physics with additional resources in astrophysics, nuclear physics, mathematics, engineering and computer science. The library has about 12,000 books, from introductory texts to more advanced research and including published proceedings of conferences. You will also find reference materials, such as technical dictionaries and encyclopedias, handbooks of tables and formulas, standards and specifications, biographical sources and atlases.

The library subscribes to some 200 journals and other periodicals on subjects listed above, as well as newspapers and popular magazines.

Each week the library receives about 150 preprints from high-energy physics institutions worldwide. The library has proposals for experiments at Fermilab and their results, along with Fermilab FNs (Physics Notes), TMs (Technical Memos), and Fermilab preprints and theses.

The library has a proof-sheet collection, indexed by subject, containing

the laboratory photo file, with photographs of equipment, apparatus, experiments, staff members and laboratory activities.

The library's audio-visual room has a television and VCR for viewing the collection of videotaped conferences, lecture series and other technical programs.

You can use the library's online catalog via terminals in the library or over the network via SET HOST FNLIB or TELNET FNLIB.FNAL.GOV. At the Username prompt, enter LIBRARY. The introductory screens will give further information about using the online catalog and about other library services.

The library offers SLAC/SPIRES High-Energy Physics files and other online databases produced by commercial vendors. Hundreds of databases, representing a wide range of subjects with international coverage, provide references to journal articles, reports, books, conference proceedings and more. The staff of the library or the Publications Office can help you use them.

You may request materials you don't find in the Fermilab library. Through interlibrary loan, the library staff borrows books and requests copies of articles, reports, patents, etc. from local, national and international sources. The library staff works Monday-Friday, 8:30 a.m. - 5:00 p.m., and by appointment.

"Oh that my words were now written! oh that they were printed in a book."

Job 19:23

Publication

Fermilab Publication Policy. Users choose the time and place of publication of results of research conducted at Fermilab. However, the laboratory asks spokespersons for experiments to follow these procedures:

1. When you submit for publication a scientific or technical manuscript developed from work at Fermilab, send three copies to the Program Planning Office, WH2E, MS105. One copy goes to the Program Planning Office, one to the library and one to the Fermilab Publications Office.
2. The title page of the manuscript should show the experiment number and the name of the journal or conference to which you are submitting the manuscript.
3. A footnote on the title page of the article identifies work done at Fermilab. The footnote should read, "This work was performed at the Fermi National Accelerator

Seminars, Colloquia and Meetings

As a courtesy to the laboratory, experimenters traditionally present oral reports of their experimental results at Fermilab before submitting manuscripts for publication or giving talks elsewhere. Regular seminars and colloquia (see *nalcal* for schedule) provide opportunities to present reports. Seminars and colloquia include:

- *All Experimenters' Meeting.* Weekly discussion of experiments in progress, with emphasis on current status, objectives and needs.
- *Theoretical Physics Seminars.* Weekly reports on formal and phenomenological theory by staff members and visitors.
- *Physics Colloquium.* Weekly presentation of important results in particle physics and other fields of general interest. Generally presented by an outside speaker talking about a completed research project.
- *Accelerator Division Seminar.* Twice-weekly talks on accelerator physics and technology at Fermilab and elsewhere.
- *Joint Experimental-Theoretical Seminar.* Informal weekly seminar on research in progress.
- *Computing Techniques Seminar.* Informal seminars on computing topics.
- *Research Division Seminar.* Internal seminars on beamline design and experiment detector R&D. Held irregularly—watch the notice boards.
- *Theoretical Astrophysics Seminar.* Weekly seminars on current topics.
- *CDF-D0 Lunch Seminars.* Held weekly.

Laboratory, which is operated by Universities Research Association, Inc., under contract DE-AC02-76CH03000 with the U. S. Department of Energy."

4. If you make substantial revisions to the submitted manuscript, please submit three copies of the revised manuscript to the Program Planning Office, with an explanatory note and the experiment number.

A Note about Publications. The Publications Office sends all reports arising from DOE-supported work at Fermilab—including reports published through other institutions,

such as universities—to the DOE Intellectual Property Office at Argonne National Laboratory for review of potentially patentable information. Thus, if you submit a report written as a result of your work at Fermilab to a conference or journal but do not publish it through Fermilab, you must nonetheless send a copy to the Publications Office for DOE review.

The Publications Office offers the brochure "Author Guidelines" that

outlines the steps for submitting and processing a technical paper and explains copyright and acknowledgment obligations.

Graduate theses. A graduate student submits one copy of a graduate thesis resulting from research done at Fermilab to the Program Planning Office. The Program Planning Office sends this copy to the Publications Office and then to the library.

Media Relations

The Public Information Office acts as the official clearing agent for press releases and information issued to the media about research results and other activities at Fermilab. Please submit copies of any releases mentioning work at Fermilab to the manager of Public Information, WHIW, M.S. 206, before release. The staff can offer support to home institutions in preparing press releases by providing background information, photographs and other materials.

Public Relations

The Public Information Office has materials users may find useful at their home institutions, including a selection of general-interest photographs of the laboratory in 8" x 10" prints or in slides. You can borrow the *Welcome to Fermilab* video and sets of overhead transparencies from this office, which also supplies general information about the laboratory, post cards, books and other materials.

Visual Media Services

Photography. A Fermilab photographer (ext. 3349) offers several services:

- Full studio for portraits and tabletop photography.
- Large-format cameras, field lighting and commercial photography techniques to provide the highest quality photography.
- A computer database on all photos taken by the department.
- Copies of photos, overheads or slides. (Order from Visual Media Services by mail or phone.)
- Consultations on long-range projects.

You can make an appointment for photographs of groups, equipment and apparatus. Experimenters ordering services must have written authorization from their spokesperson.

Videotape Services. Video production staff at Fermilab (ext. 4364) can help you produce videotapes about research or for training. To produce a videotape, production personnel consult with you and prepare a treatment outline and production agreement for each video project. The outline contains the general approach and description of the tape's contents as well as expected expenses and a deadline. For small projects that require little or no editing, you can use easily operated video recording equipment. The video production staff offers consultation on script development and graphics and pro-

vides tape duplication services, with copying fees for tape stock charged back.

Duplicating Services. The laboratory provides services (ext. 3323) in the basement of Wilson Hall to duplicate materials related to the scientific mission and business of Fermilab. Full-time personnel operate high-volume, high-quality duplicators and bindery equipment. Mail or bring duplication-ready materials to the areas, along with appropriate duplication requisitions, one for each request. Duplicating Services cannot handle requests for more than 5,000 copies of one original or more than 25,000 copies of two or more originals. A rush request must have Duplicating staff approval and may require overtime budget approval. Self-service machines in our walk-up area handle smaller copier jobs. Services include an engineering drafting copier.

Educational Services

Fermilab offers more than 35 science and mathematics education programs to students and teachers in grades K-12. You may find teaching materials developed for these programs useful for conducting similar programs at other institutions. Two programs deal directly with physics at Fermilab: "Beauty and Charm at Fermilab," an introduction to particle physics for grades 6-9, and "Topics in Modern Physics" for grades 11- introductory college. For information call ext. 3092. •

The Fermilab director, usually advised by the Physics Advisory Committee (PAC), determines the experimental program by selecting from submitted proposals the experiments to carry out using Fermilab resources. The PAC consists of 13 members appointed by the director for overlapping four-year terms. The director customarily seeks advice from the Users' Executive Committee in selecting new PAC members.

The Program Planning Office coordinates the experimental physics program at the laboratory, developing experimental schedules and establishing priorities among experiments, in consultation with the director.

Proposing an Experiment

Scientists who would like to carry out an experiment at Fermilab first submit a formal research proposal to the laboratory director. Although it's not a requirement, it sometimes helps to discuss the proposal with Fermilab staff before making the formal submission.

Before beginning to prepare a proposal, experimenters should read the publication *Review Procedures for Experiments*, which explains all the reviews required from the proposal stage through the experiment's operation and decommissioning.

Consideration of Proposals

In deciding whether or not to approve an experiment, the director usually relies heavily on the recommendations of the PAC, which meets several times a year to consider proposals. During an open PAC session, the proponents, or scientists proposing an experiment, make an oral presentation to the PAC meeting. After the presentation the PAC has a pre-

liminary discussion of the proposal and the presentation. Afterward, the PAC may have questions or comments for the proponents. The proponents make written responses to the questions for distribution to the PAC in time for their next meeting.

At subsequent meetings the PAC considers all the material available regarding the proposal, including the responses to questions and impact statements prepared by laboratory staff, before making a recommendation to the director.

Deciding on Proposals

The director makes a decision about the proposal on the basis of the PAC recommendation, an ES&H impact statement prepared by the experiment's host division, and other factors. The decision may result in approval, deferral or rejection of the experimental proposal.

Approval. The director may grant Stage I approval if the proposed physics goals are worthwhile, the experiment seems technically feasible, and the cost in laboratory resources and running time of the experiment appear appropriate for the expected physics results. Experimenters need to recognize that Stage I approval does not represent a commitment of laboratory resources, either in support for setting up the experiment or in running time. Rather, it helps laboratory staff and experimenters in planning long-range projects.

After Stage I approval, the experimenters and the laboratory carry out a careful technical design and cost study for the experiment, and prepare a first draft of the memorandum of understanding (MOU), as described later in this chapter. If the

How to Propose an Experiment at Fermilab

■ Prepare a cover page.

Title of proposal

Names and institutions of researchers, with one designated as scientific spokesperson and one as deputy spokesperson

Telephone number and e-mail address of spokesperson

Date of submission

■ Write a one-page summary.

Major physics objectives

Experimental techniques

■ Prepare the text.

Objectives of the experiment and physics justification

Description of reactions to be studied, measurements to be made and the analysis that will yield the physically interesting results

Description of experimental apparatus, including data acquisition system

The capabilities of detector elements and sensitivity of final results to claimed capability

Floor plan of proposed experimental setup

Estimate of time needed for setup, testing and data-taking

Required beam conditions, including intensity, length of flat-top and cycle time

Estimate of off-line computing needs

Cost estimate of major detector components

Estimated requirements for laboratory facilities and manpower for the construction, installation, operation and removal of the apparatus

Description of hazardous or toxic materials to be used, if any

■ Submit 40 copies of the proposal to:

Program Planning Office
Fermilab, M.S. 105
P.O. Box 500
Batavia, Illinois 60510

Fermilab sends copies of proposals received to the libraries at Fermilab, SLAC, BNL, LBL, CERN and IHEP/Serpukhov. The titles of the proposals are published in *Fermilab Report*.

PAC finds the results of this procedure acceptable, and the experiment fits into the overall priorities of the experimental program, the PAC recommends Stage II approval. In some cases, the director grants full approval without the Stage I-II process.

Deferral. The director may defer the decision on a proposal for a number of reasons; for example, a technical question may need clarification; the appropriate Fermilab facility may not be available within a reasonable time; or the director may want more information. In the case of deferral, the director notifies the spokesperson in writing of this decision and the reasons for it, specifying the conditions to be met before reconsideration.

Rejection. The director may reject a proposal. The director notifies the spokesperson in writing of this decision and the reasons for it.

Withdrawal of a Proposal. The proposal may be withdrawn from consideration at the request of the spokesperson.

Withdrawal of Approval. The director may withdraw approval if the conditions of the experiment's approval have changed sufficiently to warrant reconsideration. The director will not withdraw approval without first discussing the situation with the experimenters and with the PAC.

Appeals. Proponents who wish to appeal a decision should send a written appeal to the director. The director may form an ad hoc committee to help in reviewing the proposal. The final decision on the appeal rests with the director.

Test Beam Requests

Detector R&D or calibration of a detector in a beam line require a less formal consideration process. However, experimenters must submit a written request to the Program Planning Office well in advance of the proposed beam use time.

Letters of Intent

A scientist may submit a letter of intent (LOI) describing a particular physics goal or measurement, without the details of a full proposal. However, it will not receive formal consideration.

Memorandum of Understanding

When the director notifies the spokesperson that a proposal has been approved, the laboratory asks the spokesperson to review with the Research Division head and the Computing Division head the sup-

port required for the experiment. If the experiment places heavy requirements on accelerator operations or takes place within an Accelerator Division enclosure, then the Accelerator Division head reviews the proposal as well. Normally, the division heads ask the spokesperson to prepare a draft memorandum of understanding, or MOU, for implementing the experiment. Then the relevant departments within the Research, Computing and Accelerator Divisions review the draft.

In particular, the division heads review the draft MOU for feasibility of the experiment in terms of personnel, cost, accelerator impact and time scale. If the request for support in the MOU differs significantly from the proposal, or if the proposal cannot be implemented with the available resources of the divisions in a

reasonable time, the proposal goes back to the director for reconsideration. When an acceptable MOU has been drafted, it goes to the director for signature.

The MOU serves two important purposes. First, it lets the laboratory assess the demands posed by approved experiments, including the adequacy of available funds and the scope of the experimental program. Second, after the laboratory and users have negotiated and accepted the document, it serves as an understanding between Fermilab and the users through the planning and data-taking steps of the experiment. The MOU includes computing needs for data analysis and provision for the removal of the apparatus. The more specific the MOU, the fewer the misunderstandings that arise during the course of the experiment.

Drafting an MOU.

Personnel. The MOU provides a list of people who work on the experiment and their home institutions. The MOU clearly designates a scientific spokesperson and deputy spokesperson for the experiment. The document shows any additional research commitments for each participating physicist listed. The withdrawal of a senior physicist from an experiment requires a revision of the MOU and may lead to reconsideration of the approval for an experiment.

Beams. The MOU sets forth details of the beam requirements, such as maximum momentum, incident proton intensity, beam intensity, and spill length or luminosity.

Equipment and Services. The MOU sets forth all major items and services needed for the experiment, clearly identifying which items Fermilab will provide and which will come from users. To facilitate review of the

How to Request Test Beam

As long as possible before anticipated test beam use, submit to the Program Planning Office a written request with the following information:

- Physicists and institutions involved in the study, and the name of the spokesperson
- Description of the detector to be studied and the purpose of the study
- Physical layout of the detector and associated equipment
- Beam requirements, including an estimate of the beam time needed
- Data Acquisition System and other electronics to be used, and computing needs
- Financial arrangements
- Hazardous materials involved, if any
- How long you will occupy the experimental area
- Other special conditions

Appropriate members of the laboratory staff study the document to determine feasibility of such a test. Then the spokesperson and the liaison physicist prepare an MOU to the laboratory directorate for review and authorization.

“Then you should say what you mean,’ the March Hare went on.

‘I do,’ Alice hastily replied; ‘at least I mean what I say—that’s the same thing, you know.’

‘Not the same thing a bit!’ said the Hatter. ‘Why you might just as well say that “I see what I eat” is the same thing as “I eat what I see!”’

Lewis Carroll, *Alice’s Adventures in Wonderland*

MOU, ordinarily the laboratory list is separated into subgroups, one for each department at the laboratory that will make a contribution. As a rule, the laboratory provides general purpose, reusable equipment for approved experiments, while users provide items unique to each experiment, or items that the group will keep after the experiment ends. The right margin of the page shows the cost of each item.

The MOU includes estimates of construction costs of building special facilities for the experiment. It also includes estimates of major operating costs such as rigging, gases, computing and the like. The laboratory may distinguish between operating and equipment costs in editing the MOU.

Funding. The MOU presents a summary estimating what funds will be available and in what fiscal year, including required incremental funds. It is recognized by all parties that these estimates are contingent on actual funding received by Fermilab and the other institutions. The document should indicate sources of funding and give a rough breakdown of budgets. In particular, the MOU should specify the experimenters’ funding source (DOE, NSF, etc.) and contract number for each institution and budget code at Fermilab.

The laboratory normally adds administrative charges to user direct charges. (See Chapter Six.)

Special Considerations. The MOU tells how much beam time the experiment needs, taking into consideration the time needed for setting up, testing, data-taking and dismantling of the experimental equipment. If the proposal’s approval calls for a specific number of particles on target, the MOU should say so. This is

called the duration of the run, and it influences planning; it must agree with the conditions of approval. This section describes any special operating conditions that may be required—test beam needs, for example. For experiments performed within accelerator enclosures, a protocol between the Accelerator Division and the experiment outlines the safe design, installation and operation of the experimental apparatus. It addresses requisite safety responsibilities, reviews and concerns.

Experimental Planning Milestones. The MOU presents experimental milestones in sequence and includes tentative dates for beginning the installation and for beginning data-taking. If the experiment requires construction of major pieces of equipment, the MOU should specify dates for one or more stages of the design, procurement and construction process.

Computing. The MOU sets forth the allocation of computing resources to the experiment according to terms negotiated between the Computing Division and the experiment.

The experiment offline liaison and the Computing Division offline liaison (see Chapter Eight) negotiate the offline portion of the Computing Section of the MOU. To determine the computing resources required for data analysis, the experimenters describe plans for analyzing their data and the number of stages anticipated, from code development through production, stripping, final data analysis and Monte Carlo.

The MOU sets forth the Computing Division’s support of experiments’ online requirements. The Computing Division MOU coordinator, in collaboration with the departments involved in experiment support,

The memorandum of understanding lets the laboratory assess the demands posed by approved experiments and serves as an understanding between Fermilab and the experimenters.

meets with the experimenters during the early stages of experimental planning to define the commitment of the division to the experiment's online and data acquisition needs, among other things. For online needs, they consider:

- Software support needed for the experiment during the online life cycle stages of planning, commissioning and running.
- The overall architecture of the data acquisition and online system.
- The computer system types, the attached peripherals and networking considerations.
- Front end instrumentation and data acquisition buses to be employed.
- Online and data acquisition software requirements.
- Hardware and software maintenance and support requirements.

The Computer Division then budgets for the above requirements and procures the necessary resources. Experimenters should make sure to allow enough time for procuring equipment before the expected turn-on dates, because no stock facilities exist for some devices and systems.

ES&H. The MOU delineates safety and health risks the experiment poses, and the means to ensure the safe installation and operation of the experiment, including any special training or equipment experimenters will require. If the experiment poses risks to the environment—in the disposal of hazardous waste, for example—the MOU must show the plans for dealing effectively with them. The MOU should present the complete sequence of ES&H reviews

required through the planning, installation and operation of the experiment as set forth in *Review Procedures for Experiments*.

Finally. The MOU includes a copy of the current one-page summary of the experiment, as an appendix. MOUs need to be amended from time to time; in some cases, the spokesperson and the laboratory completely rewrite them.

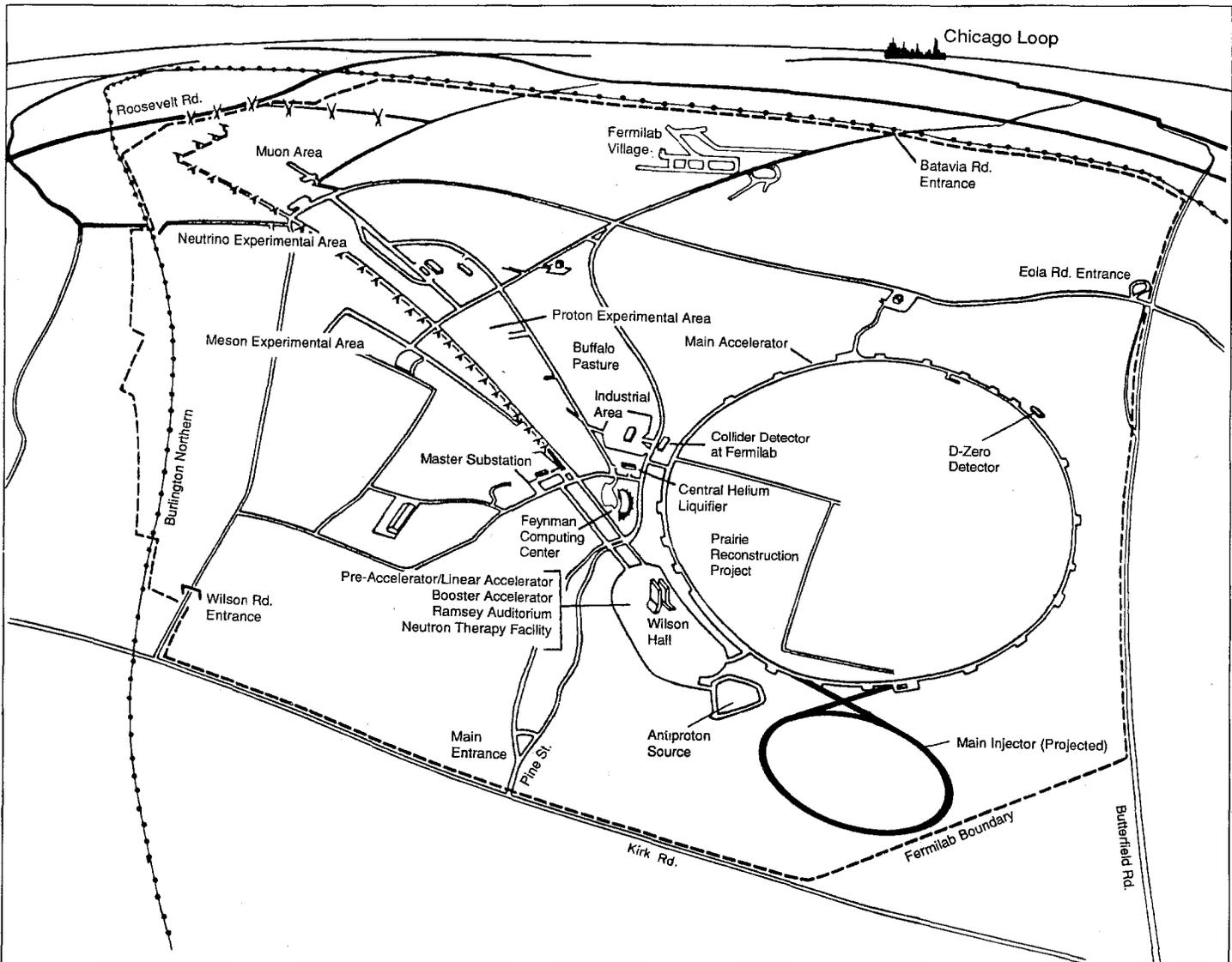
Schedule of Experiments

The Program Planning Office develops the schedule of experiments following the guidelines set by the director.

At the Monday All Experimenters' Meeting (see *nalcal* for schedule), all groups with running experiments or preparing experiments to run describe the status of their experiments and present their requested running conditions for the forthcoming week to the Program Planning Office.

After the meeting with the experimenters, the Program Planning Office holds another meeting to discuss the coming week's schedule. Representatives from various sections of the laboratory meet with members of the director's office to discuss the details of the schedule and to assign priorities. When accelerators are operating, that meeting produces a written schedule showing which experiments are scheduled to receive beam, the allotted intensity and the week's priorities. •

Fermi National Accelerator Laboratory



Fermilab's 6,800 acres contain the Main Ring and 350 buildings, including laboratories, shops, assembly bays,

administrative offices, a medical office, a cafeteria, warehouses, recreational facilities and housing for experimenters.

Directorate

Budget
Director, Deputy, Associate and
Assistant Directors
Internal Audit
Office of Research and Technology
Office of Self-Assessment
Applications
Program Planning
Quality Assurance and Value
Engineering

Accelerator Division

Accelerator Operations
Accelerator Physics
Booster
Controls
Cryogenics
ES&H
Electrical and Electronic Support
Headquarters Staff
Instrumentation
Linac
Main Accelerator
Main Injector
Mechanical Support
Neutron Therapy
Pbar Source
RF
Switchyard
Systems Departments

Computing Division

Access Liaison
Central Computing
Computer R&D
D0 Computing and Analysis
Data Acquisition Electronics
Distributed Computing
Equipment Support
ES&H
Experimental Astrophysics
Headquarters Staff
Online Support
Online and Equipment Support and
Allocation
Physics Analysis Tools
Special Assignments
Technology Tracking & Transfer

Research Division

Administrative Support
Astrophysics
CDF
Cryogenics
D0
Electrical and Electronics
ES&H
Mechanical
Research Facilities
SDC
Site Operations
Theoretical Physics

Business Services Section

Accounting
Emergency Services
ES&H
Information Systems
Legal
Material

ES&H Section

Activation Analysis Lab
Environmental Protection
Health and Safety
Radiation Physics Technical Support
Radiation Physics Staff

Facilities Engineering Section

Building Inspection and Repair
Building Services
Energy Management
Engineering and Planning
ES&H
Main Injector Support
Operations and Maintenance
Quality Assurance
Roads and Grounds
T&M Coordination

Laboratory Services Section

Accommodations
Activities
Education
Employment
Equal Opportunity and Counseling
ES&H
Information Services/Publications
Library
Medical
Personnel
Visual Media Services

Physics Department

Conferences
Data Support
Detector Development Support
Electrical
ES&H
Mechanical
Physicists
Task Groups A-E
Technicians

Technical Support Section

Conventional Magnet Fabrication
Design, Drafting and Tooling Support
Engineering
Engineering Laboratory
Engineering Records
ES&H
Industrial Management
Machine Shop
Magnet Test Facility
Manufacturing Engineering
Material Control
Material Development
Process Engineering
Production Assembly
Superconducting Magnet Fabrication

Running Your Experiment

Finances

Billing

Procurement

Stockroom

Property management

Shipping

Machine shops, materials testing, magnet fabrication and testing

Engineering & planning, time & materials, operation, maintenance, repairs

On-call, temporary and contract personnel

Finances

To help users set up and carry out experiments, Fermilab provides a variety of materials and services to experimenters and bills the cost to the users' home universities or laboratories.

To use home institution funds for carrying out an experiment at Fermilab, the user establishes an account: the home institution writes a purchase order to Fermilab, directed to the manager of the Accounting Department, WH4E, indicating the user's level of signature authority, the dollar limitation, the type or classification of services or materials covered, and the time period for which the order is valid. The dollar amount and the time period should both be adequate to complete the experiment. (When the user exceeds either, the home institution issues a change order.) Then the user receives a budget code to use at Fermilab, much like a department store charge account.

The experiment's spokesperson establishes authorizations—for example, stockroom withdrawal authorization—with the concurrence of the fiscal officers of the users' home institutions so that users' ID cards have appropriate coding.

In some cases, the Program Office of the DOE High Energy Physics program puts university funds directly into Fermilab's "Financial Plan" to be used by and for the institution's experimenters at the laboratory. Although the funds are for the use of the university personnel, because they are in the Fermilab Financial Plan they are subject to the terms and conditions of URA's prime contract with the Department of Energy for operation of Fermilab.

Billing

Fermilab submits monthly bills against the institution's purchase order for such items as purchase requisitions, special services rendered and telephone expenses.

To reimburse the laboratory's administrative costs, the bill includes a surcharge, Billed General and Administrative (G&A)/Indirect Cost Allocation, added to the total billing (except for travel, housing and food services). For more information, including exceptions and the "Billed G&A Rates," refer to "Billed G&A Policy & Procedures" available from the Fermilab Accounting Department.

Invoices must be paid promptly; payment terms per DOE Directive are "net 30 days." It is the institution's responsibility to have a payment system in place to assure prompt payment of Fermilab invoices.

Institutions with accounts more than 90 days past due may be suspended from doing research at Fermilab or using any of Fermilab's facilities, including computing. The suspension lasts until the accounts are brought current. Habitually delinquent accounts may mean permanent denial of access to the Fermilab site or the use of its facilities.

Invoices with disputed charges should be processed less the disputed charges, with the deductions and the reasons noted. If the Fermilab Accounts Receivable Group cannot resolve the question, then the Accounting manager resolves the dispute. Fermilab will not consider disputed charges delinquent.

Institutions must pay charges incurred by users not in accordance with their institution's policies—personal phone calls, travel not preapproved, for example—because

"Certainly there are lots of things in life that money won't buy, but it's very funny—
Have you ever tried to buy them without money?"

Ogden Nash

Fermilab considers the user an agent of the institution. The institution must recover the unauthorized cost from the individual user.

Although most of the policies and procedures are the same as those under a "cash reimbursement policy," as outlined above, there are some differences. When the Department of Energy puts funds into Fermilab's contract for a particular institution, the head of the Business Services Section sends the institution a detailed policy and procedure statement concerning the use of these funds. This memo is also available from the laboratory's Accounting Department.

Supplying Your Experiment

Fermilab's Purchasing Department buys standard or "off-the-shelf" items and establishes service agreements for the maintenance and repair of equipment such as computers and printers. We encourage users to ask Purchasing for information about the availability of products, as well as to arrange to have local sales representatives call to discuss technical matters. Users will find an extensive catalogue library on WH4W.

Users may purchase items for cash from local vendors. For reimbursement, present receipts and a valid budget code.

The Contracts Department acquires all items to be built to Fermilab design or performance specifications. The Fabrication Procurement Group procures items fabricated by machine shops to print specifications. The Department's staff, who have extensive machine shop experience, advise users on estimated cost, production time and the achievability of design tolerances.

How to Procure What You Need

Fermilab has a standard purchase requisition form that you should fill out and send to the headquarters office of your host division. The staff processes the order and maintains accounting records. (Note that you must get ES&H Section approval for the purchase of radioactive sources; see Chapter 10.) Items purchased are normally delivered to Receiving and then delivered to the user by Fermilab personnel. However, if circumstances warrant, you may pick up materials directly from Receiving; to do so, make arrangements in advance with the Receiving Department's foreman (ext. 3542).

Fermilab's contract with the U.S. Department of Energy obliges the laboratory to conform to DOE and federal procurement regulations. For procurements of more than \$2500, the laboratory must obtain at least three bids. However, procurement regulations recognize that situations sometimes make competitive bidding impractical or impossible. In these circumstances, Fermilab may exercise judgment waiving the bidding procedure, documenting why competitive bids were not solicited and how the laboratory determined that the price was fair and reasonable. If you feel you need to make a sole-source procurement for more than \$2500, consult the Purchasing Department manager (ext. 4168) or the Contracts Department manager (ext. 3767) for guidance.

Fermilab Stores

The *Fermilab Stores Catalogue* lists all supplies available in the Fermilab storerooms. Users may borrow copies from division or section offices or storerooms. To see a catalog on the VAX network, type "setup stock" at the \$ prompt.

The Fermilab Material Supply Group maintains three stockrooms:

- Stockroom 01 - Wilson Hall Catacombs, ext. 3730, 3015
- Stockroom 03 - Site 38, Warehouse 1, ext. 3825
- Stockroom 05 - (Metals Only) Village Metals Cut Shop, ext. 3400, 3034

The Site 38 and Wilson Hall stockrooms are open on workdays from 8:00 a.m. - 11:45 a.m., and from 12:30 pm - 4:30 p.m. You can get emergency access to stockrooms at other hours by calling Security at either the guard desk in the Wilson Hall atrium or the Communications Center, WHINE, (ext. 3000).

How to Withdraw Stock

Only authorized personnel with valid Fermilab identification cards may withdraw stock. ID cards have codes to indicate the total permitted dollar value per withdrawal:

- "X" Not authorized to withdraw stock
- "1" Not to exceed \$500.00
- "2" Not to exceed \$2500.00
- "3" Unlimited

Make withdrawals in person or by submitting a list of your requirements including stock numbers, quantities, descriptions, your ID number and a valid budget code. Possession of a Fermilab ID with an authorization code of 1, 2 or 3 does not mean automatic stockroom authority; certain stock items—alcohol, for example—require special authorization. The stockroom handles requests for these items on an individual basis.

To order stock compressed gas, call ext. 3808 and tell the type of gas, how much you need, your budget code, group, delivery instructions, name, badge number and telephone extension. Orders placed by 2:00 p.m. will normally be filled the next day.

Property Management

To distinguish Fermilab-owned equipment from user-owned equipment, users should clearly identify all equipment they bring to the laboratory.

The Property Management staff help users arrange for long- or short-term loans of Fermilab equipment for use off site. After approval of the request by the Fermilab division directly responsible for the equipment, the Property Management Group handles the administration of the loan.

Fermilab has very limited warehouse storage space. However, because we recognize that sometimes experimenters need to store experimental apparatus and equipment, rather than returning them to the home institution, experimenters can arrange for storage by calling the Warehouse Group (ext. 3577).

Note that Fermilab does not permit storage of hazardous materials such as flammable liquids, corrosives or radioactive materials. The laboratory grants storage on a space-available basis. Charges for materials in warehouse storage are billed semi-annually to the requestor's budget code. There is no charge for material stored outdoors—for example, at the railhead.

Shipping Experimental Materials or Equipment to Fermilab

Before making a shipment to Fermilab, consult the Traffic Department (ext. 3470) for specific shipping information and instructions. The shipping address is:

Fermi National Accelerator
Laboratory
Wilson Road
Batavia, Illinois 60510

Attention: Shipping and Receiving
Department

c/o User's Name and Experiment
Number

For all shipments, provide the Traffic Department with the experiment number, agency or shipper, the name of a user at Fermilab familiar with the shipment, delivery destination at Fermilab, the size, weight, and number of pieces, an itemized list of equipment, and storage requirements, if necessary. After the equipment arrives at Fermilab, make all subsequent arrangements through the liaison physicist in the experimental area.

Technical Support Services

Machine Shops. Experimenters who need the services of a machine shop can call on two large shops, the Village Machine Shop and the Wilson Hall Shop, and 11 smaller satellite shops located throughout the site, all operated by the Technical Support Section (TSS). You can request these services through your liaison physicist; you'll need a purchase requisition and suitable drawing. The satellite shops, each staffed by a machinist, contain some equipment that qualified non-machinists can use.

Shipments From Foreign Countries

Through the services of the U.S. Department of Energy and the U.S. Department of State, Fermilab will arrange for a U.S. Customs waiver, post a Temporary Importation Bond (T.I.B.), or pay import duties on materials shipped to the laboratory from foreign countries. Getting a waiver takes a minimum of three weeks.

Besides following the general instructions, users shipping materials from foreign countries need to provide additional information, in advance, to the traffic administrator (ext. 3470), either by telephone or letter: foreign consigner; foreign freight forwarder; waybill/airbill number and package identification number; date of shipment; port of entry; vessel name or aircraft flight number; arrival date; value of shipment for customs purposes; a brief description of the equipment; and the experiment number. Receipt of this information will enable the laboratory to effect delivery of the equipment with least delay. The experimental group must pay any storage charges incurred while the shipment is being cleared through Customs. As an economy measure, route inbound shipments on a "freight prepaid" basis and outbound shipments on a "freight collect" basis.

(The machinist in charge at the site decides if you're qualified.) You can also obtain ready access to any of about 60 commercial Chicago-area machine shops through the Task Order operation at TSS.

Product Testing and Measurement. Do you need to evaluate conformity of manufactured products to dimensional and material specifications? The Quality Control Group of TSS has an array of test and measurement systems for this purpose, including computer-controlled 3-D coordinate measurement machines, capable of making almost any mechanical or optical measurement. The group has hardness testers and inspection systems using ultrasonic, eddy current and magnetic induction techniques. The Quality Control Group also has a blanket order with an outside firm to do quick-turnaround chemical analysis and physical testing of samples.

Materials Testing. When it comes to special materials—polymer composites and adhesives, for example—and their properties, you may want to consult with the Materials Development Group at TSS. This group has expertise in formulating special epoxy resins for everything from optical adhesives to cryogenic materials and the insulation of high power and superconducting coils. They can advise you in almost any area of plastic materials. They have a testing lab for tensile, compressive, impact, creep, cryogenic, optical and some electrical properties with environmental chambers and high- and low-temperature facilities. They have several TV-equipped microscopes, and metallographic sample preparation equipment.

Magnet Testing. The Magnet Test Facility at Technical Support offers a unique service for precision measurement of magnetic fields. This ser-

vice can test beam-line type magnets that can be transported to the testing area located in the IB1 building at the Industrial Area. Equipment (called the "zip-track") for mapping fields in large experiment analysis, is operated by the Research Division.

Facilities Engineering

Engineering and Planning. The Engineering and Planning Group (ext. 3617) of the Facilities Engineering Services Section (FES) offers the services traditionally found in an architectural-engineering firm: architecture, civil and environmental engineering, mechanical and controls engineering, fire protection, electrical engineering, estimating and construction management. The Group sometimes uses task order contracts with commercial architectural engineering firms to augment its own manpower. The spokesperson for an experiment should arrange through the host division to schedule the services of this group for preliminary engineering studies and reviews. The associate laboratory director for technology considers the laboratory research program in setting priorities for conceptual and final design work, building modifications or new facilities.

Time and Material (T&M) Coordination. Installing experiments may require the services of construction tradesmen—riggers, iron workers, millwrights, carpenters, electricians, pipefitters, HVAC workers, sheet metal workers, insulation and general construction laborers and heavy equipment operators. The Time and Material Coordination Group at FES (ext. 3492) coordinates this manpower for experiments on a task order basis. To request T&M labor,

the experiment's spokesperson defines the work and submits a "T&M Task Order Request" through the experiment's liaison physicist or building manager.

Operations and Maintenance: Work Central Requests. Operation, maintenance and repair of all electrical, mechanical and refrigeration equipment not associated with experimental gear, as well as all general site utilities, fall within the responsibilities of the Operations and Maintenance Group. They take responsibility for the 345/13.8 KV power distribution system, industrial cold water, deionized/low conductivity water, domestic water, pond water, sanitary and waste water, the master substation and central utility building. Requests for services go through the building manager of the experimental hall to Work Central, whose staff coordinates work orders, parts, data entry and reports.

Building Maintenance—Outside. Exterior maintenance and repair of all Fermilab buildings, including carpentry, painting, roofing, siding, windows and overhead door service fall within the responsibilities of the Building Inspection and Repair Group of FES (ext. 3302). The group also handles trash removal and propane gas distribution and conducts the building inspection program. An experiment's spokesperson requests these services through the building manager of the experimental hall. (Lock service? See the Security Group of the Business Services Section.)

Building Maintenance—Inside. Cleaning and custodial services of all Fermilab buildings come from the Building Services Group (ext. 3824

or 4753) of FES. The group also handles operations and interior modification and repair of Wilson Hall. Direct requests for deliveries, moves and set-ups in Wilson Hall to the building manager.

Care of Roads and Grounds. Roads, parking lots and hardstand maintenance and repair fall within the responsibilities of the Roads and Grounds Group (ext. 3303) whose staff also manage snow removal, traffic barricades, road signs, landscape care, wildlife care and nuisance animal control. Make requests for service through the building manager of the experimental hall.

Staffing Your Experiment

On-Call Personnel. Experimenters may requisition on-call personnel through the Fermilab Employment Office (ext. 3324). On-call employees fill short-term, temporary openings either full- or part-time and receive the following benefits: shift premium, overtime, social security and workers compensation. Complete a purchase requisition with experiment number, university, name of the Fermilab group to which assigned or where located, budget code, description of duties, skill requirements and expected length of assignment. The requisition requires approval by the section or division head responsible for the experiment and the laboratory director. A personnel administrator from the Employment Office will coordinate the employment process with the experimenter. The personnel administrator will arrange for the employment physical exam of a selected candidate and enroll the person as an on-call

employee. Time sheets go to the Employment Office, which also distributes paychecks.

Temporary Help and Contract Labor. An experimenter may requisition temporary help or contract labor through the Business Services Contracts Department (ext. 3387). The purchase requisition must include a description of the work to be done, skill requirements or special qualifications, dollar limits, period of employment and budget code and university information. The Contracts Department provides the experimenter with resumes and arranges for interviews and background checks. After evaluation of resumes and interviews, the experimenter notifies the Contracts Department of the selected candidate, along with a written summary of the evaluation criteria and rationale used in the selection or rejection of the individuals interviewed, and the date and time the individual will start work, the duty location, the name of the immediate supervisor, and any special reporting instructions.

A contract employee must complete an Agency Employee Registration form within three working days of assignment at Fermilab. The form should be sent to Fermilab Emergency Services at Mail Station 102. For more information about temporary help or contract labor, call the Contracts Department (ext. 3387).

People who work as on-call, temporary and term employees are Fermilab employees and are bound by the Fermilab personnel policy, even if the funds for Fermilab to pay their wages and salaries come from users' institutions. •

Experimenters use the extensive resources of Fermilab's Research Division for planning, design, set-up and operation of experiments at Fermilab. The division's Mechanical, Electrical and Electronics, Site Operations, ES&H, Cryogenics and Research Facilities Departments support the fixed-target experimental program and test beams, including operation of beamlines, as well as collider experiments. CDF and D0, the two large collider experiments, and SDC, the Solenoidal Detector Collaboration, have their own Research Division departments. The Research Division Office is located at WH7X, ext. 3200.

Liaison and Beamline Physicists

Every experiment has a liaison physicist assigned by the Research Division to serve as the key connection between the experiment and the division. The liaison physicist coordinates laboratory support for the experiment—helping develop the memorandum of understanding (MOU), coordinating installation and providing support for operation of the experiment. A fixed-target experiment also has a beamline physicist who consults with the experimenters and designs and commissions the beamline to meet the needs of the experiment. (Note that the Computing Division and the Accelerator Division also provide liaisons to experiments.)

Building Managers

Throughout the experimental areas and the Research Division support departments, each building has a building manager. The building manager has the responsibility to ensure compliance with all the rel-

evant safety rules and codes, and for coordinating ES&H-related work in the building. Experimenters should work closely with the building manager to make sure their work complies with ES&H standards. The Research Division conducts regular safety inspections of buildings and experiments.

Services for Experiments

Each experiment's MOU sets forth the services it needs from the Research Division; and the liaison physicist—or the department, for CDF, D0 and SDC—coordinates the work.

Office Space for experimenters, arranged through the division office.

Engineering. Engineering specialists within the Research Division support departments are available for general technical consultation. In addition, they participate in ES&H reviews required for the Operational Readiness Clearance (defined below). Because the Research Division has only limited engineering resources, the MOU must identify in advance any direct division engineering support required for detectors, stands, magnets, electronics or other needs.

Mechanical Shop and Detector Construction Facilities. The Research Division operates facilities to build experimental apparatus, often providing the tools and technicians to work with experimenters on such projects.

Installation. The Research Division oversees the rigging, electricians and other trades to install experiments. Outside contractors provide these services, collectively called "T & M," (for "time and materials").

Research Division
Operations
ES&H
Operational Readiness
Clearance
Safety responsibilities
and safety training
Rules for tours, visitors
and children

Fermilab's Facilities Engineering Section handles the installation contracts (see Chapter Six) and Research Division staff supervise the work.

Zip-Track Magnetic Field Mapping. Experiments that need the zip-track, a device for mapping the magnetic field in analysis magnets, should request to use it in the MOU and arrange for scheduling as early as possible.

Survey and Alignment. The Research Division's Alignment Group provides all survey and alignment services, from civil construction to the precision alignment of experimental apparatus. To ensure accuracy in installation, experimenters designing apparatus should consult the Alignment Group during the design phase on the method of alignment, the required accuracy and the need for fiducial marks.

EPICURE, the Beamline Control System. EPICURE, a VAX/VMS-based control system for beamlines, allows users to control and monitor the parameters of the beam. Data from EPICURE comes via DECNET to an experiment's own VMS computers. The EPICURE system includes a beamline control vax-cluster, DISNEY, and a software development cluster, WARNER.

An experiment can establish a group account for running existing beamline control software. The experiment must designate a group account manager, who can add experiment-specific programs to the group account menu and who disseminates password information. Individual accounts can be arranged for users who need to develop such experiment-specific programs.

Information on EPICURE accounts and facilities appears in the *EPICURE User's Guide Volume I: "Guide to EPICURE for Beamline Users,"* available on WH12E from the group leader of the Controls Group or the system manager. For information on the data-acquisition interface between EPICURE and your experiment's computers, see Controls Software Release No. 32.3, also available on WH12E from the group leader or the system manager. If your experiment requires this connection, the experiment's system manager will need to install EPICURE software on the experiment's VMS computer.

EPICURE includes a protection system that restricts control of beamline devices. If you need to control specific devices, you must file a "Privilege Request Form," bearing the approval of the beamline physicist and radiation safety officer, with the Operations Group.

Operations

The Operations Group of the Research Division operates the beamlines and their associated safety systems, helps operate CDF and D0, and responds to unusual occurrences throughout the experimental areas. The Operations Center, on Road A, (ext. 4538, electronic mail DISNEY::OPS) is the coordination center, staffed 24 hours a day during accelerator operation.

To request a change in beam conditions during beam operation, to request access to interlocked beamline enclosures or to report failure of Fermilab equipment, call the Operations Center. The crew chief knows the program schedule and the current operating conditions of the accelerator and beamlines and will relay

requests or information appropriately. When necessary, the crew chief will call in experts to repair equipment.

The crew chief and the crew of the Operations Center have both the responsibility and authority to ensure that experimenters follow all applicable safety and operational procedures throughout the experimental areas.

Environment, Safety and Health

Within the Research Division, senior safety officers, an environmental protection officer, an industrial hygiene officer, an occupational safety officer, radiation safety officers and radiation control technicians help experimenters plan and operate safe experiments that don't harm the environment. The ES&H staff work with experimenters and Fermilab staff to develop, implement and monitor safety policies and procedures. The ES&H Group has copies of the Research Division's ES&H Manual and the *Fermilab ES&H Manual* for experimenters to use.

The Spokesperson and the Research Division

Of the responsibilities of spokespersons listed in Chapter Two, two have particular importance for the Research Division: obtaining the Operational Readiness Clearance, and informing experimenters about specific hazards of the experiment and the training they require.

Operational Readiness Clearance

The spokesperson for an experiment has the responsibility to obtain an Operational Readiness Clearance (ORC) from the Research Division before operating all, or any part of,

Safety Responsibilities of Experimenters

Experimental installations pose safety hazards. The Research Division holds experimenters responsible for:

Knowing and abiding by laboratory safety rules.

Obtaining required safety training. Consult division ES&H staff for assistance.

Knowing and following the safety and other applicable requirements as outlined in the Research Division ES&H Manual and the *Fermilab ES&H Manual*.

Reporting unsafe working conditions to the spokesperson and the Fermilab ES&H Section or Research Division ES&H Group.

As soon as they register, experimenters must inform the experiment spokesperson of their arrival at the laboratory, in order to make sure they know and understand their safety responsibilities and to ensure that each experimenter receives all required training as dictated by the needs of the experiment.

As soon as they register, experimenters must inform the experiment spokesperson of their arrival at the laboratory.

the experiment's apparatus. ORC is a sign-off checklist showing that various aspects of the experiment, including flammable gas systems, cryogenic systems, mechanical transporters, pressure vessels and electrical systems have undergone and passed a safety review by the division, that the experiment has provided all specified documentation, and that the division and the spokesperson have jointly conducted a final safety walkthrough. While the division (through the liaison physicist) will help the experiment through this process, the spokesperson has the responsibility to ensure that the experiment meets the conditions of the ORC.

The Research Division reminds you of two important radiation safety rules: First, you must get permission from the Fermilab ES&H Section before bringing any radioactive sources on site, whether attached to experiment apparatus or not. Second, any material to be removed from a beamline enclosure (including

an enclosure in an experimental hall) must be measured for radioactivity. Call 4262 if you need help from a radiation technician.

Access to Experimental Areas

Hazards at experimental areas may include:

- Exposed high-current and/or high-voltage electrical connections
- High magnetic fields
- Oxygen Deficiency Hazard (ODH) (usually resulting from potential release of cryogenes)
- Flammable or explosive gases and liquids
- Chemical hazards (typically solvents, heavy metals)
- Pressure and vacuum vessels
- Radiation hazards from the beam, or from radioactive sources often attached to the experiment apparatus.
- Falling, and back injuries.

Experimenters who give tours have the responsibility to have and to communicate accurate information about the local hazards and about the rules for such visits.

Areas are posted to indicate hazards present. You must have special training before you can enter any area posted as a radiation area or an ODH area.

Safety Training

The spokesperson takes responsibility for ensuring that experimenters receive all the required training that applies to their jobs. Individuals must ensure that their own training is both complete and current.

Radiation Safety and Controlled Access. Normally each experiment receives this training as a group, but individuals may watch video presentations at the Operations Center. Anyone who intends to enter an area posted as a radiation area must have radiation safety training. Anyone who enters an interlocked beamline or experiment enclosure must first have controlled access training. Radiation safety training is valid for two years, and controlled access training for one year.

Oxygen Deficiency Hazard. To enter an area posted as an ODH class one or above (class zero indicates no hazard), you must have specific training and equipment, which you can arrange through the Research Division ES&H Group.

Crane or Forklift Operation. Any experimenter who intends to operate a crane or forklift must have the required training and authorization. You can arrange crane or forklift training through the Research Division ES&H Group.

Other training courses include radioactive source training for anyone issued radioactive sources by the source physicist, and laser safety training required for those who use Class III or IV lasers.

Research Division Rules for Tours and Visitors

Normally only registered experimenters and Fermilab employees have access to experiments. A tour for a group of three or more visitors requires the prior permission of the Research Division head or designee if it includes access to posted radiation areas. The Operations Group crew chief must be informed of tours for one or two visitors. Experimenters who give tours have the responsibility to have and to communicate accurate information about the local hazards and about the rules for such visits. For example, will the visitors enter an area where they must wear personal monitoring equipment such as film badges? Guides must also obtain permission for tours in advance from the spokesperson, liaison physicist or building manager.

The Research Division allows children (under 18 years old), including children of employees, visiting scientists and DOE employees, to enter only designated areas, typically office areas not at experiments. All children must be continuously supervised by an employee or a registered user. On a case by case basis, the division head may give permission for properly escorted children to visit specific laboratory areas for a specific length of time. •

Scientific Data
Acquiring resources
Computing at Fermilab
Computing Division services
Workgroup computing
Online support
Proper use of Fermilab computers

Computing at Fermilab has developed in a unique environment, physically and intellectually close to the needs of experiments. As a result, the Computing Division can offer experimenters outstanding computing resources for acquiring and analyzing data:

- Data-acquisition and online computing via hardware and software support.
- Fast-turnaround computing to support experiments during data taking.
- Batch processing computing for analysis of data acquired at Fermilab and for Monte Carlo calculations.
- General-purpose batch and interactive computing for program development and analysis, project management and tracking, and document preparation.
- Extensive local and wide-area networks to facilitate communication.
- Support of many local workgroup computing activities.

The Memorandum of Understanding

After a proposed experiment receives Fermilab approval, the experiment and the Computing Division reach an understanding about how much and what kind of computing resources and services the experiment will use. The memorandum of understanding (MOU) spells out this understanding, and the Computing Division allocates resources according to their availability and in line with laboratory priorities. Formal meetings or consultations are used to schedule major production activities; frequent consultation between the experiment and the division deals with major development projects. The division also provides some gen-

eral computing resources for smaller efforts on a fair share basis—that is, the division doesn't favor an experiment in the use of computing, except at the level of experiments running versus experiments not running.

The division and the experiment periodically review the MOU. The spokesperson should schedule a review of the experiment's computing status and needs at least every three months.

The Computing Division aims to provide the level of computing your experiment needs. If problems or shortfalls arise, you can assume that the division will help to resolve them within the capabilities of its human and financial resources.

A note for experimenters

At any given time, the Computing Division supports a group of different computing architectures. We don't insist on adherence to any particular coding standard, but we do encourage experimenters to write code and arrange their analysis and production environments so that they can run on a variety of platforms. Experiments that position themselves to take advantage of as many of the supported architectures as possible have the best chance of efficiently meeting their offline computing requirements.

Liaisons

The offline area of the Computing Division, the online area, and the experiment all provide liaisons. The liaisons facilitate communication between the division and the experiment, identifying needs and allocating resources.

Online Liaison. During development of the MOU, the Computing Division assigns one or more online liaisons to the experiment. This liaison provides the primary day-to-day contact between the experiment and the online support arm of the Computing Division. Online liaisons actively connect an experiment to the large body of expertise in online and data acquisition hardware and software in the Computing Division.

Offline Liaison. Many experiments, including all running experiments, have an offline liaison assigned from the ACCESS Liaison Group. The liaison keeps the experiment informed about Computing Division activities, policies, resources, limitations and plans; and communicates to the Computing Division the experiment's needs, plans, problems and concerns. The liaison keeps the experiment and the division working together to accomplish the experiment's offline computing tasks. The liaison reviews and advises on all major requests for resources, passes them for implementation to the relevant departments, and follows up to ensure that they have been satisfied promptly and to good effect.

Experiment Liaisons. For its part, the experiment designates an online contact person to serve as a coordinator for the experiment in matters relating to online computing and data acquisition, hardware and software. In addition, each experiment appoints a person generally available at Fermilab and familiar with the offline com-

puting of the experiment to serve as a liaison from the experiment to the division. The experiment's offline liaison provides information about computing to the experiment and channels feedback from the experimenters to the division. The experiment's major requests for offline computing resources must come through this person.

Liaisons make possible clear and consistent communication. The experiment offline liaison helps the experiment—which may have more than 100 people actively engaged in data analysis—speak to the division with one voice. By the same token, the Computing Division has almost 200 people; and, while experimenters can certainly address their requests to people other than the Computing Division liaisons, we do ask that experiments review any major request for resources with the Computing Division liaison(s) in advance.

Allocating Resources

The experiment offline liaison and the Computing Division offline liaison negotiate major requests for offline resources. If the request doesn't conform to the general groundwork in the experiment's MOU, it may be necessary to write an addendum to the MOU or otherwise come to written agreement. Small requests can go through normal channels, such as request forms; the Computing Division will address any questions about the request to your experiment's offline liaison.

The Computing Division maintains a central pool of electronics and computing equipment (PREP) for use in experiments. All equipment purchased by the Computing Division as part of an experiment's MOU is considered part of this pool.

Experimenters receive equipment either by over-the-counter issue or

on-site installation. The Computing Division issues instruments and small equipment items directly to the experiment's representatives. Note that the division issues over-the-counter equipment only if the MOU calls for it; thus, experimenters should make sure they request enough equipment to prevent shortfalls. Computer systems are usually pre-configured and delivered in place by the various hardware groups. The MOU should specify details of such installations. The Computing Division's MOU coordinator should receive early drafts of an MOU or amendments, so that the coordinator can inform Computing Division liaisons and relevant departments of the experiment's needs and intentions.

Where to Find the Services You Need

Most Computing Division staff offices are on the sixth and eighth floors of Wilson Hall, and the second and third floors of the Feynman Computing Center.

Computer Accounts. To get an account on the central VAX Cluster (FNAL), the CDF central VAX Cluster (FNALD), the D0 VAX Cluster (FNALD0), UNIX development systems, or the Amdahl, fill out a form from the office on the eighth floor crossover of Wilson Hall. This form requires your Fermilab ID number, your signature, and the signature of your supervisor or experiment spokesperson. Return the form to the eighth floor crossover, and you will receive your account on the same working day, or, at the latest, the next working day.

Other forms allow you to make changes in resource allocation (such as FNAL disk quota changes), networking requests (terminal connections, etc.) and PREP equipment requests. If you need to vault mag-

Computing at Fermilab

The Fermilab Central Computing Facility, located in the Feynman Computing Center, comprises VAX clusters (FNAL, FNALD, and FNALD0), an Amdahl 5890, UNIX farms and development systems, ACP (Advanced Computer Program) I computers and media translation equipment such as tape copy facilities. The central facility VAX Cluster runs VMS. It may be used as a general interactive machine for program development, for accessing networks via BITNET, DECnet, TCP/IP, etc., and as a front end to the Amdahl, ACP, and UNIX machines. The Amdahl 5890 runs the VM operating system, and is connected to the network via DECnet and TCP/IP. The farms run the UNIX operating system and are primarily used for long production analysis tasks, for example track reconstruction. Business data processing uses an IBM 4381.

Experiment systems typically consist of a main VAX/VMS-based host, with one or more VAX/VMS workstations, called workgroup clusters. Some experiments also use networked UNIX workstations.

Data acquisition systems supported by the Computing Division include a VAX-based data acquisition system (VAXONLINE) for small test stands and medium rate fixed target experiments, and a VME-based higher rate data acquisition system (PANDA). Data Acquisition interfaces from these systems are supported to CAMAC, FASTBUS and VME.

The Computing Division also provides planning, systems, application software and consulting support for workgroup computing. The division provides support and trouble shooting for Fermilab-purchased computers and promulgates standards for computer configuration, computer backplane configuration, and I/O devices for VAX and UNIX computers and X-terminals.

The division provides electronics and data acquisition interface support for a variety of modules in NIM, CAMAC, FASTBUS and VME, as well as test software and hardware for such modules and repair services for Macintosh and IBM-PC personal computers.

netic tapes, you can obtain a code for external labeling. Some request forms are available online in INFO (see below) on the FNAL cluster.

Help When You Need It. During business hours, the Consulting Office, WH8NE, (ext. 2345) serves as the primary point of contact for general and offline computing issues. After hours, the operations supervisor (ext. 2754) deals with Central Facility operational or emergency issues. The operations supervisor

can page on-call support personnel during off hours.

Call the operations supervisor at ext. 2754 if you need help or information on an operational issue.

Send non-urgent questions, suggestions, or problems by electronic mail to FNAL::GRIPE. GRIPE is read daily on weekdays.

Call your experiment's online liaison (the Computing Division office at ext. 3690 can tell you who it is)

when you have questions or concerns about online and data acquisition systems. Departments within the Computing Division, such as Online Support, Equipment Support, and the Distributed Computing Department, provide diagnostic and repair services and help on detailed technical questions as the need arises. Many Computing Division departments provide on-call round-the-clock coverage during accelerator operation. To reach the appropriate hardware repair, installation or diagnostic service, call ext. 4373 during working hours or the Operations Center (ext. 4538) outside normal hours.

Computing Division Library.

The Computing Division library, WH8NE, has local documentation in self-service cabinets, and a set of operating system reference manuals. The stockroom carries some VAX, IBM, and UNIX manuals and other commercial books. You must order other manuals, including manuals for most proprietary products, from the vendor. In many cases the librarian can provide ordering information. The FNAL VAX cluster, through the software product DOCDB, offers access to many online and data-acquisition documents.

News and Information. The Computing Division publishes a regular newsletter to announce new features, programs, changes, ES&H issues and other timely information, as well as general or educational material. When you get an account, your name automatically goes on the newsletter mailing list.

Each central computer system has a news service, updated frequently, with much of the same information. The FNAL cluster has a screen-oriented product, INFO, with folders for general information, FNAL clus-

ter news, UNIX news, VM news, seminars, users' meetings, Computing Division strategy meetings, on-line version of the newsletter and Computing Division library news. This service also sends information to VMS-based workgroup clusters and to Usenet news groups.

People at Fermilab also make use of VAX NOTES conferences to disseminate information within interest groups and hold live, online discussions of technical topics of interest.

Software and Documentation. Major systems, as well as other special topics of importance, have local user's guides, available in the Computing Division Library:

- GG0001 *Introduction*
- GV0001 *VAX Cluster User's Guide*
- GI0003 *Amdahl User's Guide*
- GU0001 *UNIX at Fermilab*
- GG0009 *Understanding and Using Computer Networks*

The ACCESS Liaison Group supports a large selection of general purpose and physics-related software, and many of the products are supported on all of the major platforms. Users' guides to the various central computers describe how to access the software on that computer. The Computing Division library has a list of the available software and local documentation.

The Computing Division library also distributes online and data acquisition documentation. Online and data-acquisition products can be distributed by the DISTRIBUTE product.

A system named UPS, for "Unix Product Support," supports versions of programs that run on UNIX platforms; you may obtain them by run-

ning UPD (Unix Product Distribute). The document "UNIX at Fermilab" has information about this system.

Connections to Networks. The Computing Division provides and operates an extensive Fermilab local and wide-area network, and regulates its access and use. The Computing Division must approve and coordinate any attachment to the network. Because of the importance of networks to the laboratory's operations, the Computing Division reserves the right to protect the integrity of the network.

If an experiment plans to use the network for intensive local data transfer, such as workgroup computing using local area VAX cluster (LAVC) or YP protocols, or other intensive client/server transactions, the Computing Division will provide and manage an appropriate filtering device (bridge or router). Early consultation allows the division enough time to procure and install appropriate equipment.

The Computing Division maintains network name and routing tables for the laboratory. The division assigns network addresses, to guarantee uniqueness; and node names must be registered with the Computing Division to make them available to other users. You can request a form for this purpose by sending an electronic mail message to FNNET::NETMANAGER.

Completing a connection request form, available at the Wilson Hall eighth floor crossover, starts the process of attachment of systems to the network. The Computing Division online or offline liaison must review major requests. Again, we encourage early consultation with the Computing Division, so that we can procure and install appropriate

equipment and cabling.

Magnetic Tape Management. A new tape retention policy aims to maximize the accessibility of tape data actively being used on systems in the Feynman Center and to provide archival storage for data that may be needed later. To do this, we must get rid of redundant and obsolete tapes. The policy gives a vault quota to each experiment; the number of unique raw data tapes and the number of physicists on the experiment determine the quota, run by run. This quota is halved three years after a given run and goes to zero after five years. For the details, refer to the document MR0002 available from the Computing Division library.

Acquiring PCs and Workstations. If your experiment decides to acquire personal computers and workstations through the Fermilab Purchasing Department, you will find that computing is different from other items procured at the laboratory—it takes more paperwork. The eighth floor crossover of Wilson Hall has the guide you need, "Fermilab Microprocessor Policy and Guide for Acquiring Personal Computers and Workstations," along with the format for the required Abbreviated Implementation Plan required by the DOE.

Workgroup Computing

Members of a workgroup and the Computing Division negotiate support for the workgroup cluster. Support varies from occasional consultation, to system support for upgrades, to very intensive involvement. In all cases, however, the workgroup must provide a local system manager to carry out routine functions such as backups and account management. To take full advantage of the capabilities of the Computing Division,

Experimenters should make sure to request appropriate software tools and licenses in the MOU.

members of workgroups should work closely with Computing Division personnel on hardware, networking and software issues as they develop their systems.

Local systems are bound by the same rules for computer use, security, etc. as the central system. The local system manager has the responsibility to enforce Fermilab rules on the local system. The Computing Division may monitor the local system to ensure compliance.

General Consulting. The Computing Division provides general consulting to all Fermilab experimenters. However, if you need help with system or hardware issues on a distributed platform, the consultant will probably refer you to an appropriate support person.

System Support. As noted above, distributed workgroup systems all have local system managers. They normally also have backup system managers from the Computing Division. If you have a problem that appears to be system- or hardware-related, call your local system manager first.

Software Support. The Computing Division provides support for hundreds of software packages. Many come from vendors, many come from other laboratories, and many are in-house developed. Some are general-purpose; many are specific to the HEP community. If the division supports the product you need, and if licensing allows for distribution to your computer, you can arrange to have it installed.

Hardware Support. The Distributed Computing Hardware Group in the Distributed Computing Department provides hardware support for distributed workgroup computing.

Online and Data Acquisition Support

Online and data acquisition support for experiments covers maintenance and repair of electronics, computer hardware and software installation and support, and development and support of specific hardware and software components, as set forth in the MOU.

The division also serves as a resource of knowledge and expertise for experimenters as they commission their data acquisition and online systems. Many groups in the Computing Division offer outstanding services; you can reach all of them through your experiment's online liaison.

Equipment Maintenance. If the MOU provides for it, Fermilab maintains both instruments and computer systems. Users usually carry malfunctioning instruments into the PREP issue window for exchange and repair by the Equipment Support Group.

Computer maintenance usually comes from the Computing Division, via the Distributed Computing Department's Distributed Hardware Group, an outside contractor, the Online Data Acquisition Hardware group or the Online In-house Computer Maintenance group. You can call a centralized 24-hour computer trouble line at ext. 4373. During accelerator running times, you can get after-hours support as well.

You can get hardware consultation services in support of CAMAC, NIM and FASTBUS devices via the Online Support Department's Data Acquisition Hardware Group.

Software Installation Experimenters should make sure to request appropriate software tools and licenses in the MOU. The experiment has the responsibility to ensure that all neces-

sary software licenses are registered with the division's license coordinator, to meet all legal obligations. Backing up the online liaison, software consultants can help with software and systems areas that the division supports.

Software and System Support. The MOU spells out agreements for software support. The experimental liaison then serves as a channel for this support. The division provides consultation on most software and systems-level products. Experiment representatives usually handle systems management. The extensive networking throughout the laboratory makes most services available via mail utilities or direct contact with the responsible groups.

Proper Use of Fermilab Computers

Federal regulations. The federal government funds computing facilities at Fermilab to support research projects at the laboratory. The government has strict regulations for the use of these facilities, documented in DOE Order 1360.2. "Computer Security For Unclassified Computer Systems."

All files containing data or programs that affect the success of the high-energy physics program must have protection against loss or improper manipulation.

What does the government consider improper computer use? Personal correspondence, outside organization membership lists, poetry, sports ladders and pools, games, programs for personal gain and many more. Certain types of data, including personnel data (Privacy Act of 1974), proprietary data, financial, procurement and inventory data, require special treatment under the DOE order. Before assembling or accessing such data, consult your experiment liaison.

Computer misuse and unauthorized access to government computers is a crime punishable by law. To help prevent misuse, the Department of Energy requires Fermilab (DOE Order 1360.2) to make periodic inspections of user files, including electronic mail, and take appropriate action when misuse is discovered. The rules regulating computing are many and complex. The best rule is, "When in doubt, ask." Your liaison, offline or online, or the consulting office will help you out.

Licensed Software. The laboratory obtains licensed, or proprietary, software for your use. Most of this software carries with it explicit—some-

times implicit—legal restrictions for its use. It is Fermilab's policy to abide strictly by all such regulations. In general, if the software is on the system in libraries supported by the Computing Division and you use it in the advertised way, its use on that local system is unrestricted. You should assume that you may not make or take a copy away with you without permission. Most software now has legal protection under patent or copyright law, as well as local laws concerning property theft.

User's Responsibilities. People with Fermilab IDs may use the computer systems in support of the high energy physics program. We ask users to refrain from actions that may interfere with use of the computer by others. Don't share your computer accounts—you are responsible for any use that others make of them. Assignment of a Fermilab computer account carries with it acceptance of the responsibilities described in this section.

Non-Fermilab-Owned Machines. You may connect computers not owned by Fermilab to the Fermilab network only with explicit permission from the Computing Division. Once you connect such a computer to any Fermilab-owned machine or local network, Fermilab considers it a Fermilab-controlled computer, bound by all rules and restrictions that apply to Fermilab-owned computers. This rule applies to any computer connecting to Fermilab computing over a wide-area network or over phone lines for the duration of the connection. Fermilab has the right to monitor the use of the computer. Special restrictions concerning the use of proprietary software may apply to these computers, and special procedures apply to their removal and return, to ensure that no restricted software leaves the site illegally. •

Passwords

Common sense in choosing and protecting passwords can prevent many hacker penetrations to Fermilab computers. For example:

- Don't make your password easy to guess—not the same as the username, not personal information, even backwards, not dictionary words.
- Use at least six alphanumeric characters. Passphrases are fine, especially if deliberately misspelled, but remember most UNIX systems only use the first eight characters.
- Don't put passwords in files.
- Change your password frequently—at least twice annually—and don't change it back to a previously used password.
- Don't give your password to anyone else. If you find that someone knows it, change it immediately.

The Accelerator Division operates and upgrades Fermilab accelerators, providing to experimenters particle beams with the properties they need for fixed-target and colliding-beam experiments. Accelerator Division headquarters are in the Cross Gallery (ext. 4468).

Accelerator Division Experimental Coordinator

For each Fermilab experiment either the Accelerator Division or the Research Division serves as the host division for coordinating the memorandum of understanding (MOU). Experimenters whose detector apparatus lies within accelerator enclosures work closely with the Accelerator Division during the proposal, design, construction and operation of their experiment. The Accelerator Division experimental coordinator organizes the production of the proposal impact statement and serves as initial point of contact between the division and the experimenters until, early in the course of preparations for the experiment, the Accelerator Division appoints a liaison physicist. As the name implies, the liaison physicist provides the key connection between the experiment and the division and coordinates the division's support for the experiment. The liaison physicist works with the experimenters to develop the MOU, coordinates design and safety reviews, oversees compliance with ES&H rules and procedures, coordinates design and construction of the necessary plant and support facilities (e.g. modifica-

tions of the accelerator enclosures, counting rooms, special power installations and flammable gas houses) and, where necessary, coordinates detector installation and operational support. The Accelerator Division experimental coordinator oversees the efforts of the liaison physicists, paying particular attention to ES&H issues.

Communication on the Beam

Each Monday the All Experimenters' Meeting presents short-range and long-range schedules of accelerator operations and the intensity distribution of beams, as well as the weekly summary of accelerator performance. The meeting provides an opportunity for an open discussion of operations, problems and special considerations.

TV Channel 13 displays the current accelerator status and beam-intensity distribution.

Fixed-target users communicate beam concerns to RD Operations. If the need arises to work with the Accelerator Main Control Room, then RD Operations asks the Main Control Room to call the experiment. Colliding beam experiments (CDF, D0, and small collider experiments) communicate beam concerns to the Main Control Room. Other experiments within the accelerator enclosures, such as Pbar source experiments, also direct beam concerns to the Main Control Room.

Department

Experimental coordinator

Beam communication

Safety

Reviews

Physics Department
resources

Areas for Special Consideration

The Accelerator Division pays particular attention to design and operation of experiments located within accelerator enclosures to make sure they don't harm general accelerator performance. Sensitive areas include:

- violations of environmental, safety and health considerations
- compromising the accelerator beam pipe aperture or vacuum
- physical damage to the accelerator beam pipe or magnets
- producing fringe magnetic fields in the area of the accelerator beam pipe (Normally the accelerator beams must be shielded or corrected.)
- flammable gas operation in the vicinity of the beam pipe
- cryogenic operations
- cables and utility lines within accelerator enclosures
- experimental apparatus interfaced with the Accelerator Division control system, accesses to accelerator enclosures, and the impact of general experimental shielding on accelerator access for maintenance and repairs

Safety Requirements

The Accelerator Division expects experimenters to know and follow Fermilab safety policies. Because of differences in operation, physical plant and requirements, procedures sometimes differ between the Accelerator Division and Research Division. Experimenters operating in both divisions should expect minor differences in policies and practices; we try to keep these differences to a minimum.

Controlled Access. Only specifically authorized people who have received appropriate training can enter "controlled access" areas, and they may enter only under specifically prescribed conditions. Experimenters make all requests to enter accelerator enclosures and collision halls through the Main Control Room. Requests to enter beam-line enclo-

sure and experimental halls go through Research Division Site Operations.

Experimenters who need to enter Accelerator Division beam enclosures must take the "Controlled Access for Accelerator Division" training course. This training, given by the Accelerator Division, applies specifically to the Accelerator Division and does not address controlled access into Research Division enclosures. The training is valid for the duration of the accelerator run period for which it is received. After training, and before authorization for Accelerator Division controlled access, experimenters must have approval by the Accelerator Division radiation safety officer. Experimenters may enter only areas relevant to their experiments. A Fermilab employee approved by the Accelerator Division as an "experimenter escort" must accompany all experimenters making controlled access.

Radiation Safety Training. Experimenters who work with radioactive materials or enter any radiation areas (which includes all Accelerator Division beam enclosures) must have appropriate radiation safety training and annual retraining. Experimenters can get the required training from the Research Division or the Accelerator Division; training by either division satisfies the requirements for radiation safety training in both divisions.

Radioactive Waste Handling. Experimenters who work in Accelerator Division beam enclosures (not including the collision halls at B0 and D0) must receive training in Accelerator Division radioactive waste handling procedures. The Accelerator Division Safety Group provides copies of the procedure. (The procedure does not address radioactive waste handling in Research Division enclosures. The Research Division has responsibility for waste removed by experimenters from the collision halls at B0 and D0.) The spokesperson for the experiment has responsibility for experimenters' training on the procedure. After training, and before permitting access to enclosures, the Accelerator Division Safety Group gives a written test to make sure experimenters understand the waste-handling procedures.

Oxygen Deficiency Hazard. Experimenters who need to enter Accelerator Division Oxygen Deficiency Hazard (ODH) areas (such as the Main Ring/Tevatron tunnel) must receive ODH safety training, and annual retraining, from either the Research Division or the Accelerator Division; training by either division satisfies the ODH training requirement in both divisions. Entry into

ODH areas requires medical approval from the Fermilab Medical Office.

Hazard Communication Training. Everyone, including all experimenters, at Fermilab who works with or could be exposed to hazardous chemicals must have hazard communication training. Both the Accelerator and the Research Divisions have information on this training.

Drills and Emergencies. Experimenters must participate in any emergency preparedness drills and tests, such as fire or tornado drills. The Accelerator Division expects experimenters to become familiar with the local emergency plans for the areas they occupy. The Accelerator Division ES&H staff furnish emergency plans for Accelerator Division areas.

Training. The nature of the experimental work often dictates additional training for experimenters. The spokesperson has the responsibility to determine that experimenters receive all appropriate training and retraining.

Reviews

Before operating equipment, the experiment's spokesperson must submit the equipment and operating procedures for review. The head of the Accelerator Division has the responsibility to review equipment for safety in the design, in the installation and in the operation of the experiment. *Review Procedures for Experiments* presents all Fermilab review protocols.

In all cases, the Accelerator Division Flammable Gas Committee must review flammable gas systems. The initial review should take place while the system is in the design stage. Detailed reviews follow throughout construction, installation and operation. Before flammable gas can be

used in an accelerator enclosure, the system must pass a required safety review and the head of the Accelerator Division must sign a flammable gas system operating permit. Flammable gas system operating permits are required for the startup of each flammable gas system.

The Physics Department

The Physics Department, WH10W, (ext. 3201) provides support for the experimental high-energy physics research of Fermilab staff. The department also includes all experimental HEP research associates (postdoctoral fellows), and most Lederman and Wilson Fellows.

For approved experiments, the Physics Department takes responsibility for providing apparatus, technical support and operating expenses of the subsystems supported by the Fermilab part of the collaboration. In this way, experiments—including CDF and D0—have access to Physics Department engineering and technician supported facilities.

The department assigns technicians to an experiment to help prepare and maintain the detectors; and provides data aides to process data tapes through the analysis program chain once this chain has been developed.

The Physics Department can also help Fermilab physicists with smaller research and test projects that may not yet have matured to the stage of formal approval.

Physics Department services include:

- a cluster of computers, the PLAC (Physics Local Area Cluster), currently comprising DEC, Silicon Graphics, and IBM workstations and Macintosh PC's.

- an electronic design group
- an electronic shop for prototyping, development, modifications and repairs
- a mechanical engineering and design group
- a small machine shop
- a plastics and scintillator fabrication shop
- space to assemble and test experimental apparatus before installation
- a thin-film vacuum coating service with reflectometer
- an area for assembling many types of proportional wire chambers. A winding facility includes ample fabrication space, a crane, a small, a medium and large winding machine and a precision wire placement table. This facility also repairs chambers used in experiments.
- services for development and prototyping work on calorimeters, including scintillating fibers, tile/fiber calorimeters and new technology projects
- a numerically controlled routing service that houses two large precision routers. These routers can machine many types of complex work pieces such as scintillator tiles. There is also space for the cleaning, coating and lamination of large copper-clad boards.
- a service for helping produce graphics for publications

The departmental office serves as a focus for the organization of conferences and organizes such events as the Academic Lecture Series, Saturday Morning Physics and the monthly "Food for Thought" presentation and dinner, open to all post-docs on site. •

Other chapters of this handbook present selected environmental, safety and health (ES&H) information: "The Basics" in Chapter Two, for example, and Research Division policies in Chapter Seven. Here in Chapter Ten, we bring together in greater depth information about safety and the environment for experimenters at Fermilab.

Fermilab has a clear policy to conduct research so that people's safety and the protection of the environment receive the highest consideration, while at the same time making the best use of laboratory facilities. To make sure we follow this policy consistently, we have developed a comprehensive safety and environmental program, published in full in the *Fermilab ES&H Manual* (reference copies in the ES&H Section and all division and section offices). Failure to conform to the procedures and regulations of the safety program may mean denial of use of Fermilab facilities.

ES&H Resources for Experimenters

Each Fermilab division and section has its own environmental and safety staff—including senior safety officer, radiation safety officer and environmental protection officer. They provide support and expertise in matters that affect the environment and safety; they also regulate and monitor operations.

In addition, the Fermilab ES&H Section audits the implementation of the laboratory safety program and provides technical support, special services and consultation. The Radiation Physics Technical Support Group maintains radiation monitoring instruments and the laboratory's radioactive waste disposal and transportation programs. The Health and Safety Group monitors conven-

tional safety hazards and manages the prescription safety eyewear and safety shoe programs. The Environmental Protection Group manages non-radioactive hazardous waste disposal. The Radiation Physics Staff Group manages the laboratory film badge program, the program for distributing and managing radioactive sources, and operates the Activation Analysis Laboratory (AAL). The AAL not only provides the service of counting samples to characterize any radioactivity around the site, but also helps calibrate beam lines' secondary emission monitors and other beam current monitors.

Protecting the Environment

Division, section or laboratory safety staffs must review all purchases of chemicals or transport of chemicals to the laboratory. To reduce the chance for environmental harm, bring to the laboratory only the quantities of chemicals you actually need. Always choose the least toxic alternative. Consult the environmental protection staff not only about acquiring chemicals, but also about storage and disposal of regulated chemical wastes; for help in spill prevention, control and countermeasures in case of accidents; and to investigate work that might affect the environment. You must arrange disposal of chemicals with your division or section environmental protection officer.

The *Fermilab ES&H Manual* sets forth the requirements of the Fermilab Environmental Protection Program in detail.

Safety Training

Spokespersons of experiments have the authority and responsibility to make sure that members of their experiments receive all requisite training at the appropriate time. Users, in

Environmental

Occupational

Radiation safety

Oxygen deficiency hazard

Fire safety

Electrical safety

Personal protective equipment

Hazard communication

Scaffolding

OSHA requirements

Experiment safety

turn, have the responsibility to determine and arrange for the training they need. For help in determining safety training requirements and arranging for training, consult your experiment's liaison physicist or the host or section safety staff.

Radiation Safety

The Radiation Physics Staff and Radiation Physics Technical Support Group of the ES&H Section provide expertise and consultation about radiation; they also regulate and monitor activities. Radiation safety procedures, regulations and other information appear in the *Fermilab Radiation Guide* (reference copies from the area radiation safety officers and the ES&H Section). Both the Research and Accelerator Divisions issue their own radiation safety guides, available from their respective radiation safety officers, covering all operations in their areas.

Radiation Training. Everyone who works in radiation areas or with radioactive materials must have current training in the basic principles of radiation safety. Users must consult the radiation safety officer of the area where they work to schedule the required training. Controlled access to radiation areas requires further specific radiation training, as does the use of radioactive sources. The Research Division and the Accelerator Division both provide radiation training. The source physicist in the ES&H Section gives specific source training when issuing sources.

Film Badges and Pocket Dosimeters. Any area where the exposure rate can exceed 2.5 mrem/h is defined as a radiation area. All beam enclosures of the system of accelerators and of the external experimental areas, as well as major parts of the experimental areas themselves, are designated radiation areas.

Everyone must wear film badges and, in some cases, other personnel radiation monitoring devices within radiation areas, even in the absence of significant radiation. Film badges serve as the legal record of radiation exposure at Fermilab. Only Fermilab-supplied film badges are acceptable for use at Fermilab.

Apply for permanent film badge service through the film badge manager in the ES&H Section. Users who stay less than six months can obtain temporary badges at many points throughout the laboratory. Users with permanent badges should notify the film badge manager if they leave Fermilab for longer than three months, in order to discontinue their permanent film badge service.

Return film badges to their racks or boxes at the end of each calendar month (or work period or visit, whichever terminates first). Return a film badge or other dosimeter left or found in a radiation area to the ES&H Section with a note telling when and where it was found. Report damaged or lost badges immediately to the film badge manager or to your area radiation safety officer.

Wear a pocket dosimeter when you anticipate any possible risk of significant radiation exposure. Your area radiation safety officer will tell you which conditions require one.

Radioactive Sources. The Radiation Physics Staff Group maintains a collection of radioactive sources, many of them loaned upon request, for testing and calibrating detectors. Chapter Five of the *Fermilab Radiation Guide* lists typical sources in the laboratory inventory. Consult the source physicist to discuss your needs, to arrange a loan, to obtain source training and to sign the loan forms.

Everyone who works in radiation areas or with radioactive materials must have current training in the basic principles of radiation safety.

Chapter Five of the *Fermilab Radiation Guide* also lists the rules and regulations that govern the use of radioactive sources at Fermilab. People who borrow sources must signify that they understand and will follow these rules. Sources not permanently installed in the user's experimental apparatus must be kept in a locked cabinet bearing a sign "Caution-Radioactive Material." Don't store sources in a toolbox, because toolboxes are not secure.

The ES&H Section must approve the transfer of sources from the user's institution to Fermilab before the sources arrive on site. Note also that the ES&H Section must approve any requisition for the purchase of a radioactive source delivered directly to Fermilab. The memorandum of understanding (MOU), or a later amendment, must discuss any source for an experiment that involves a substantial impact on the laboratory.

Classification of Radioactive Material. Externally detectable exposure rates determine the classification of radioactive materials. Chapter Nine of the *Fermilab Radiation Guide* describes the classification levels and their meaning. Equipment inside a beam enclosure during beam-on conditions must be surveyed and the appropriate radioactivity class label applied before the item leaves the enclosure. Most beam enclosure exits have specific information, detectors and labels. If you are taking an item to Wilson Hall or off site, you must follow further restrictions. Consult your radiation safety officer for instructions.

Radioactive Material in Wilson Hall. Because Wilson Hall contains offices and eating facilities and is open to the public, more restrictive procedures apply to radioactive materials

in that building. See Chapter Eight of the *Fermilab Radiation Guide* and your area radiation safety officer before bringing any equipment from beam enclosures into Wilson Hall. You must have the approval of the source physicist in the ES&H Section before bringing radioactive sources into Wilson Hall, even if they have been approved for use elsewhere on site.

Handling, Shipping and Storing Radioactive Material. You must label any radioactive item that must be left exposed in an uncontrolled area to indicate the radiation level at 1 foot. If necessary, rope off the area so that the dose rate at the boundary is less than or equal to 2.5 mrem/h.

Before working in the vicinity of a primary beam target, you must arrange for a radiation survey. Consult the area radiation safety officer for instructions.

People who must work with radioactive materials with dose rates over 100 mrem/h at 1 foot must first discuss their work with the area radiation safety officer to determine the precautions required to minimize the dose. You may work in areas where dose rates are greater than 1000 mrem/h at 1 foot only under continuous supervision of the radiation safety officer or radiation protection technicians from the area safety group.

No one may perform machining, filing, welding, drilling or grinding on radioactive material without prior consultation with the area radiation safety officer.

Only divisional or support services personnel may move or store radioactive materials outside the user's beam enclosure, and only as approved by the area radiation safety officer. No one may ship radioactive

material on or off site until the ES&H Section has approved the shipment and the shipper has met the applicable Department of Transportation rules and regulations.

Generating, Managing and Disposing of Radioactive Waste. Users must manage and dispose of all radioactive waste according to division, section, Fermilab and DOE regulations. The experimenter who generates the waste has the responsibility to take steps to minimize the radioactive waste produced. Remove any equipment not needed in beam areas before startup. Consult your radiation safety officer about proper disposal procedures.

Except when necessary in targets and experimental apparatus, users must not irradiate or contaminate with radioactivity toxic, ignitable or reactive materials such as lead, mercury, beryllium, and halogenated and non-halogenated hydrocarbons such as acetone, Freon, and methanol. These substances, when radioactive, become mixed waste and the laboratory cannot presently dispose of them. If you aren't sure whether or not a material is hazardous, consult your radiation safety officer.

Interlocks and Controlled Access. Because of potentially lethal dose rates inside primary proton beam areas, Fermilab has developed and maintains an elaborate search-and-secure procedure and system of electronic interlocks to keep people out of such areas while the beam is on. Secondary beams generally have similar systems, to prevent accidental injury or large radiation doses that can result from exposure to the beams. Tampering with any part of the interlock systems is forbidden.

Before beam is brought into any enclosure the area is searched and se-

cured by the Research Division or the Accelerator Division Operations crew, sometimes with the assistance of experimenters. Experimenters who participate in such procedures have a very serious responsibility, since failure to perform an adequate search could result in injury or death to anyone left in the enclosure. After an area is searched and secured, but before the beam is brought in, a loud evacuation whooper horn sounds, (followed, in Accelerator Division enclosures, by a broadcast voice warning). If you are in an enclosure when the whooper horn sounds, get out as fast as you can.

Radiation Exposure for Women.
Because it grows so fast, a fetus has

Experimenters who participate in "search-and-secure" procedures have a very serious responsibility.

particular sensitivity to radiation. Fermilab's policy provides that radiation exposure to pregnant women be maintained as low as reasonably achievable.

Fermilab subscribes to the recommendations of the National Council on Radiation Protection that state: "During the entire gestation period the maximum permissible dose equivalent to the fetus from occupational exposure of the expectant mother should not exceed 0.5 rem." The *Fermilab Radiation Guide* has further information on radiation procedures for women; also consult the area radiation safety officer and the ES&H Section staff.

Oxygen Deficiency Hazard (ODH)

Air normally contains 21% oxygen. If the concentration at normal atmospheric pressure falls below 18%, harmful effects such as dulled senses, poor reasoning ability, dizziness, loss of consciousness and even death can occur. The nature of the effects and how long it takes for them to occur depend on how far below 18% (at normal atmospheric pressure) the oxygen concentration falls. For instance, at 13% it may take several hours to lose consciousness, while at 6% or less it takes less than 15 seconds.

Certain operations at the laboratory have the potential for exposing people to atmospheres deficient in oxygen. Those occurring near cryogenic systems pose particular risks; because, if a leak occurs in these systems, the escaping liquefied gas expands about 700 times and pushes out the air near the system.

Fermilab restricts entry to areas that contain less than 18% oxygen. In addition, operations in which the oxygen concentration may drop below 18% require special precautions.

Controlled Access

Only specifically authorized people who have had appropriate training may enter controlled access areas, and they may enter only under specifically prescribed conditions. Controlled access—entry without breaking the interlocks—is possible in most of the beam enclosures. Controlled access is accomplished by removing keys from their interlocked position in a key tree. Since in the access the interlocks are not broken, these keys provide the only assurance that beam cannot return. You must therefore have a key in your possession at all times. *Only people specifically authorized by training through the area radiation safety officer may make a controlled access.*

Fermilab denies and will continue to deny the use of its facilities to individuals who violate these safety regulations.

These precautions follow a five-step graduated scale, matched to the level of the hazard, with steps, designated Oxygen Deficiency Hazard (ODH) Classes 0, 1, 2, 3, or 4, increasing with the Class number. With Class 0, there is no significant hazard, and no special precautions need to be taken.

Classes 1-4 require special precautions. ODH warning signs must be posted. These signs state the minimum requirements an individual must meet in order to participate in an operation. Those who meet these requirements are called "ODH qualified persons." Personnel must receive training appropriate to the operation; they must obtain medical approval from the Medical Department; and they must use personal oxygen monitors. In addition, breathing apparatus (self-rescue supplied atmosphere respirator or self-contained breathing apparatus) or job surveillance (multiple personnel in communication or unexposed observer) may be needed.

Alternatively, individuals may enter Class 1 and Class 2 areas as "ODH restricted persons" (access to Classes 3 and 4 not permitted). Such limited access requires only a briefing on the hazards, a self-rescue supplied atmosphere respirator, a personal oxygen monitor, and the presence of at least one ODH qualified person per ODH restricted person (at least two ODH qualified persons for Class 2).

The *Fermilab ES&H Manual* (Chapter 5064) explains the Fermilab ODH policy and gives a detailed description of the minimum required procedures.

Fire Safety

The growing density of equipment and people in experimental areas

raises the potential hazards in case of fire. All users must follow the fire rules:

If you see or smell a fire, call 3131. If you hear the steady klaxon that signals a fire, evacuate the building according to the plan, with which you should be familiar.

Before starting any operation involving welding, brazing, flame cutting, or confined space activity, obtain a "Hazardous Operations Permit" by calling the Fermilab Fire Department.

Obey all "No Smoking" signs.

Keep experimental areas neat. Don't hoard boxes or crates; instead store them in specified storage areas.

Review modifications to existing facilities and new equipment installation early in the planning stage of an experiment, to ensure adequate fire suppression and detection and to limit possible fire consequences.

No one may use highly flammable urethane foam or styrofoam without authorization by the ES&H Section. You may arrange for installation of approved non-flammable foam for penetration sealing from the Facility Operations Department of the Facilities Engineering Services Section.

Electrical Safety

Electrical hazards represent some of the greatest safety challenges in the laboratory. Fermilab rules allow only those people with a thorough knowledge of the hazards involved to work with potentially dangerous equipment. The Research Division's Operational Readiness Clearance (see Chapter Seven) includes electrical reviews of experimental equipment.

The latest edition of the National Electrical Code provides the basic laboratory standard for electrical installations. You can borrow copies

of this code from the library, and the ES&H Section also has a reference copy.

Many people at Fermilab can give competent advice on electrical hazards, and the user should seek guidance through the appropriate division or section safety staff.

Experimenters must outline their power requirements in advance to allow for preparing appropriate portable power distribution racks and cable tray runs.

Only Fermilab personnel may make electrical power connections for operation at 208 V or above. Only authorized laboratory personnel may maintain and repair Fermilab-owned electrical equipment.

The only approved coaxial connector for low-current HV applications is the SHV connector. Its use is required for all equipment.

Requirements for the use of low voltage/high current appear in Chapter Five of the *Fermilab ES&H Manual*.

Direct all requests for powering European equipment, designed to operate at 208 V, 50 Hz to the appropriate division or section safety group.

Personal Protective Equipment

People often require personal protective equipment (PPE) when it is not otherwise possible to eliminate or isolate a hazard. Eye protection constitutes the minimum PPE for nearly all personnel—even Fermilab office workers have sustained eye injuries. You can get non-prescription eye and face protection from the stockroom and some divisions and sections. The ES&H Section arranges for prescription safety eyewear.

Respirators sometimes provide protection from atmospheric contami-

Everyone who works at Fermilab, including all experimenters, must have hazard communication training.

nants. Disposable dust respirators typically protect against non-toxic particulates. Reusable respirators protect against exposure in excess of limits for a protracted period. Reusable respirators require medical approval, quantitative fitting, and training before use. You can get respirators from the ES&H Section and division and section safety groups.

Fermilab provides other types of personal protection equipment. Wear safety shoes when you might injure your feet. You can get safety shoes from a "shoemobile" parked one day a week in the Industrial Area. Wear a hard hat under overhead work, where you might bump your head or in a "hard hat required" area. Wear hearing protection where daily weighted exposures exceed 85 dBA. You may need barrier clothing, such as gloves, lab coats and coveralls, to lower the risk of injury or contact or transfer of radioactive or chemically hazardous materials. Fermilab provides a variety of barrier clothing; take care to match the type to the application. You can get hard hats, hearing protection and barrier clothing from the stockroom. The ES&H Section and division and section safety groups also provide some types.

Hazard Communication (HazCom or Right-to-Know)

The Occupational Safety and Health Administration (OSHA) Hazard Communication standard aims to ensure that manufacturers evaluate the chemical hazards of their products and that workers receive this information, along with information about appropriate protective measures. The standard applies to all chemicals that may cause adverse effects.

Workers receive information from training, container labelling and

Material Safety Data Sheets (MSDSs). Everyone who works at Fermilab, including all experimenters, must have hazard communication training. Each user receives initial training shortly after obtaining an identification card, and must repeat the training every two years.

All containers of hazardous chemicals must have labels. Containers of nonhazardous materials must also have labels if they might be confused with hazardous materials. If a container has no label, *do not* use the material until you know what it is and how to handle it. Labels must show the names of the primary hazardous ingredients, as well as appropriate hazard warnings and precautionary handling information. You can get warning labels for industrial chemicals commonly used at Fermilab from the stockroom.

A product's MSDS has detailed information about its hazards. Fermilab is required to maintain an MSDS for each hazardous chemical on site. These sheets contain technical information, usually divided into nine categories: chemical identification, hazardous ingredients, physical data, fire and explosion data, health hazards, reactivity data, spill or leak information, special protection and special precautions.

Some information provided on MSDSs may not be fully accurate, particularly in regard to health hazards, spill or leak information and special protection. Local right-to-know stations, division and section safety groups, or the ES&H Section can provide guidance on interpretation of MSDSs and copies of the sheets. If you need an MSDS that is not on file, inform the appropriate division or section safety group, who will order an MSDS from the manufacturer and send copies to you.

Elevated Work Platforms and Scaffolding

The large size of many particle physics experiments often requires scaffolding to permit work at heights. People can get hurt falling from scaffolds or when things fall from scaffolds and hit them. To prevent such injuries, scaffold construction must comply with OSHA regulations. Please consult your host division safety group for direction.

Experiment Safety Requirements

Department of Energy facilities, including experiments, must comply with all OSHA regulations. Consult the safety group of the appropriate division or the ES&H Section for information needed to design and install apparatus in compliance with these requirements.

Users must design, install and operate equipment in compliance with applicable safety codes. Consult Fermilab during the earliest stages of experimental design to identify requirements and potential problems.

In many cases Fermilab has adapted portions of OSHA standards to create internal policies that may be more conservative or prescribe specific procedures. In particular, the appropriate division requires in-depth reviews of various aspects of experimental apparatus. The spokesperson has the responsibility for satisfactory completion of all relevant safety reviews. The document *Review Procedures for Experiments* contains review protocols.

Cryogenic and Hydrogen Safety. No one may bring to Fermilab any liquid hydrogen target or "large" system that presents significant pressure vessel hazards or potential for atmospheric oxygen reduction without prior review of the design and plans

DOE Standards that Apply to Experiments

- Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment (ACGIH)
- National Electrical Code (NFPA 70)
- Crane Safety (ANSI B-30 Series)
- Safety Requirements for Working in Confined Spaces (ANSI Z117.1)
- Safe Use of Lasers (ANSI Z136.1)
- Boiler and Pressure Vessel Code (ASME I-XI)
- Radiation Protection for Occupational Workers (DOE 5480.11)
- Safety Requirements for Packaging and Transportation of Hazardous Materials... (DOE 5480.3)
- USDOE General Design Criteria (DOE 6430.1A)
- Standard on Fire Protection of Portable Structures (DOE EV-0043-8/79)
- Toxic Substances Control Act (EPA)
- National Environmental Policy Act (EPA)
- Resource Conservation and Recovery Act (EPA)
- National Fire Codes (NFPA, all)
- Occupational Safety and Health Standards (29 CFR 1910)
- Safety and Health Regulations for Construction (29 CFR 1926)

for installation. Consult the appropriate division head at an early stage in planning for such a device in order to start the review before making critical design decisions.

Bubble chambers require extra precautions to minimize users' exposure to the special hazards they present. Experiments that use bubble chambers receive a special review of such equipment.

Pressure and Vacuum Vessel Safety. The *Fermilab ES&H Manual* provides detailed requirements for pressure vessels, based on an ANSI standard. It gives users the information they need before designing or using pressure vessels at the laboratory. Requirements apply to vessels purchased from code and non-code

shops, and exceptional vessels including pressure or vacuum vessels with thin windows, or those that use non-code material components such as glass, mylar, beryllium, etc. In general, pressure vessel reviews are required unless each vessel is "U" stamped, indicating it was built to ASME codes; the operating pressure difference is <15 psi; or the maximum inside cross-sectional dimension does not exceed 6 inches with no limitation on length. Vacuum vessel reviews are required unless each vessel is the underground portion of a beam pipe; contains insulating vacuum for cryogenic service; contains a volume <50 ft³; or the maximum inside cross-sectional dimension does not exceed 12 inches (with no limitation on length).

Experimenters should use the fewest possible toxic materials and take care to limit on-site personnel exposures and releases to air, water or ground.

Mechanical Safety. Reviews may be required for unusual support structures, "custom" lifting apparatus, building modifications, and devices capable of motion, rotation or rapid release of stored energy.

Flammable Gas Safety. Particle detectors use a variety of flammable gases. They require review if the total energy available for combustion exceeds that contained in 0.6 kg of hydrogen. The *Fermilab ES&H Manual* sets forth the policy governing the use of such gases at the laboratory and gives the review procedures.

Built-in Radioactive Sources. No one may bring to or remove from the laboratory experimental apparatus with radioactive sources built in or permanently affixed without prior authorization from the source physicist in the ES&H Section. Users must register all such sources with the ES&H Section upon pre-approved arrival.

Radiation Shielding and Protective Barriers. The experimental group has the responsibility to design an experimental arrangement that takes into account the radiation hazards involved in the normal running of the experiment, as well as hazards that might arise from abnormal situations. The division safety staff and the Radiation Safety Staff Group in the ES&H Section will help prepare the design.

The division involved has the responsibility to establish and limit the range of collimator openings and secondary particle momenta permitted to an experiment for a given shielding configuration. To do this, they often install interlocked radiation monitors to turn off the beam

if radiation levels become excessive, or interlock the current range on a magnet.

The experimental set-up must include appropriate barriers to prevent people from accidentally getting into the beams. No one may remove, alter or cross these barriers without the authorization of the area radiation safety officer; doing so may result in a beam being shut down. In case of a suspected personnel exposure to the beam *call 3131* immediately.

Toxic materials commonly used in experiments

- Toxic metals (beryllium, lead, lithium)
- Oils (PCB, mineral, scintillator)
- Solvents/halocarbons (Freons, ketones, alcohols)
- Coatings/adhesives (paints, epoxies)
- Heat transfer media (ethylene glycol)
- Corrosives (acids, bases)

Toxic Chemicals. Experimenters should use the fewest possible toxic materials and take care to limit on-site personnel exposures and releases (intentional or accidental) to air, water or ground. Learn and follow the specific requirements limiting exposures, releases and proper disposal. As noted earlier, division and section safety personnel must approve toxic materials, such as those on the list below, for use in experiments to assure compliance with standards. •

Airline Tickets Travel Office, WH1E, ext. 3397

Cafeteria WH1SX, Mon.-Fri., 7:30-10:15 a.m., 11:30-2:00 p.m.,
5:00-7:00 p.m.; Sat.-Sun., 8:00-10:30 a.m.,
11:30-1:30 p.m.

Car Rental Travel Office, WH1E, ext. 3397

Cashier WH4E (just outside elevator), ext. 3045,
Mon.-Fri., 12:30-4:15 p.m.
Personal checks to \$200 with Fermilab ID

CERN *Courier* Sign up for mailing list in Users' Office.

Chez Leon Village, Users' Center, Wednesday lunch, 12:30 p.m.,
Thursday dinner, 7:00 p.m. By reservation only, ext. 4512

Computer Accounts WH8NX, ext. 3205

Copying Users' Office, WH1E

Cultural Activities Atrium Reception Desk, WH1NX, ext. 3353. Program
announcements and tickets

Cultural Calendar Guest Office, WH1E, bi-weekly list of on- and off-site
events. Sign up for mailing list.

DOE/BAO The Batavia Office of the Department of Energy, ext. 3281

Day Care 28 Shabbona. Ext. 3082 or 3762 for info.

E-Mail WH8NX, ext. 3205

EMERGENCY **Call 3131. Fire, Ambulance, Security. Stay on line to
answer questions.**

Fax Communications Center, WH1NE, (708) 840-4343.
Check Fermilab Phone Book for other Fax numbers.

Fermilab Report Users' Office, WH1E, sign up for mailing list. Extra copies
in Publications Office, WH6W

Ferminews Publications Office, WH6W, ext. 3278. Newsletter,
published every other week

FIRE **Call 3131. Stay on line to answer questions.**

Guest Office WH1E, ext. 3440. Information for visitors: maps, services,
schools

Gym Membership Activities Office, WH1E, ext. 4544

Housing Information Aspen East, Village, ext. 3777

ID Cards Required for all experimenters, obtained through Users'
Office

Key Requests Keys and IDs Office, WH1E, ext. 4506. Key requests must
go through the appropriate division or section office

Library WH3SX, ext. 3401.

Lost and Found Communications Center, WH1NE, ext. 3000

Mailing Lists Users' Office, WH1E, ext. 3111

Mailroom WHGNW, ext. 3210. Mon.-Fri., 1:00-4:00 p.m.

Maps Guest Office, WH1E, ext. 3440

Medical ClinicWH1NW, ext. 3232

Meeting Rooms Director's Office, WH2E, ext. 3211 for scheduling

NALRECFermilab recreation organization, ext. 4305

Notary PublicArgonne Credit Union, WH1W, ext. 3293

PagerDial 72, wait for tone, dial pager number, wait for 3 beeps, give message.

Pay PhonesWH1E, WH1W, WHGSW, other pay phones in Fermilab Phone Book

Post CardsPublic Information Office, WH1W, ext. 3351. Fermilab post cards, books and posters for sale

PublicationsPublications Office, WH6W, ext. 3278

Radiation BadgesES&H Section, WH7E, ext. 3642

Residence IDHousing Office, Aspen East, ext. 3777, for identification of users' family members

Social SecurityApplications and maps in Users' Office, WH1E, ext. 3111. Call 1 (800) 234-5772 for information.

StockroomsWHGNX, ext. 3730; Site 38 (main stockroom), ext.3825. Mon.-Fri., 8:00 a.m.-11:45 a.m., 12:30-4:30 p.m.

TaxiCall HACK, 8:00 a.m.-4:30 p.m. weekdays, on-site transportation only.

Telephone NumbersOn the VAX network, type "setup tele" at the \$ prompt, then "tele" at the next prompt.

TelexCommunications Center, WH1E, Telex number 373-6609

Tickets, EventsAtrium reception desk, WH1NX, ext. 3353, 8:30 a.m.-12:00, 1:00-4:00 p.m.

T-shirtsAtrium reception desk, WH1NX, ext. 3353

ToursPublic Information Office, WH1W, ext. 3351, for reservations for group guided tours; Atrium desk has material for self-guided tour.

TravelTravel Office, WH1E, ext. 3397

Users' Center10 Che Che Pinqua, Village, Mon.-Fri., 5:00 p.m.- midnight; Saturday, 7:00 p.m.-midnight. Bar, snacks, recreation

Users' OfficeWH1E, ext. 3111. The user's resource for Fermilab info

Vehicle StickersKeys and ID Office, WH1E, ext. 4506

Weekend ServicesCommunications Center, WH1NE, ext. 3000. Dispenses pre-arranged housing contracts, airline tickets; dispatches Security to handle stockroom withdrawals, PREP exchange/withdrawal, help for housing lockouts, library keys and *emergency* on-site transportation.

Yellow PagesFermilab Telephone Directory, good source of info

| | | | |
|-------------|---|-------------|---|
| AAL | Activation Analysis Laboratory of the ES&H Section | ODH | Oxygen Deficiency Hazard |
| AD | Accelerator Division | ORC | Operational Readiness Clearance from Research Division |
| ANSI | American National Standards Institute | OSHA | Occupational Safety and Health Administration |
| ASME | American Society of Mechanical Engineers | PD | Physics Department |
| BSS | Business Services Section | PPE | Personal Protective Equipment |
| CD | Computing Division | PREP | Computing Division central pool of electronics and computing equipment (Physics Research Equipment Pool) |
| CDF | Collider Detector at Fermilab | RD | Research Division |
| CH | DOE Field Office, Chicago | RSO | Radiation Safety Officer |
| DOE | U.S. Department of Energy | SAD | Safety Assessment Document |
| D0 | Collider Detector at D0 interaction region | SDC | Solenoidal Detector Collaboration for the SSC |
| EPO | Environmental Protection Officer | SSC | Superconducting Supercollider |
| ES&H | Environment, Safety and Health | SSO | Senior Safety Officer |
| FES | Facilities Engineering Section | T&M | Time and Materials contracts |
| FN | Physics Notes, Fermilab physics papers for limited distribution | TeV | Trillion Electron Volts |
| FNAL | Fermi National Accelerator Laboratory | TM | Technical Memo, internal Fermilab technical document |
| FTS | Federal Telephone System | TSS | Technical Support Section |
| G&A | General and Administrative costs | UEC | Users' Executive Committee |
| GeV | Giga Electron Volt | URA | Universities Research Association, Inc. |
| HEP | High Energy Physics | WH7NE | Northeast corner of seventh floor of Wilson Hall. Other floors correspondingly indicated, as WH6W, Wilson Hall sixth floor west. |
| HVAC | Heating, Ventilating and Air Conditioning | WH8NX | Wilson Hall eighth floor north crossover. Other crossovers correspondingly indicated, as WH2SX, Wilson Hall second floor south crossover. |
| ID | Fermilab Identification Card | WHGNW | Wilson Hall Ground Floor Northwest. The ground floor is beneath the first floor and is sometimes called the basement. |
| LSS | Laboratory Services Section | | |
| MOU | Memorandum of Understanding | | |
| MS | Mail Station | | |
| MSDS | Material Safety Data Sheet | | |
| NALWO | National Accelerator Laboratory Women's Organization | | |
| NFPA | National Fire Protection Association | | |

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