Safety Basics

General Safety: It is the responsibility of all employees, visitors, users, and contractors to be aware of and to comply with ES&H policies while performing work at SLAC (this includes both written and verbal safety instructions). Examples of safety procedures include:

- **Before beginning any work, take a few minutes to think about potential hazards, apply common sense** and **comply with all applicable safety policies.** In many cases, you first need to receive appropriate training or authorization (note: a permit must be obtained from Safety, Health and Assurance Dept. before entering a permit required confined space).
- Do not exceed the maximum speed limit on SLAC roads which is **25 mph** (reduce speed limit in construction zones, when pedestrians are present, and in parking areas).
- Wear a **helmet** when operating a moped or motor scooter.
- Wear i**nsulated gloves and safety glasses** (personal protective equipment or PPE) when transferring cryogenic liquids to avoid injury from the extreme cold.
- When **working with lead**, understand how to obtain, wear, and safely use personal protective equipment; wash your hands after handling lead, even if wearing gloves; and refrain from eating, drinking or smoking in or around any areas containing lead.
- Anyone who works with **Class 3 or 4 lasers** must be trained and medically monitored.
- Follow **Lock and Tag procedures** around electrical energy sources, hydraulic energy sources, and hazardous chemical sources.
- When entering the SLAC accelerator housing zone under **"Controlled Access**," each person must take a key; exit through the same door they entered; and call the SLAC main control center at X2151/2150 to give the location and name of each person entering.
- If you are in the accelerator housing or SPEAR ring when magenta lights begin to flash and an audio announcement informs you that **beam is about to come on, press the beam emergency shut off button, leave the area, and then report this occurrence to SPEAR main control center (MCC) at X2751/2396.**
- To minimize potential for activation, **remove tools and equipment brought into accelerator housing areas when work is completed.**
- If uncontained and unattended radioactive material is found (such as radioactive material in a trashcan or building corridor), **contact OHP at X-4299 to handle the material.** Do not touch or handle material and warn others to stay away until OHP arrives. Also, contact OHP to survey any other potentially radioactive material.
- After an injury and prior to returning to work, you must bring a "Release to Work Form" from the treating physician to the Medical Department.
- During an **earthquake**, take cover under heavy furniture or against an inside wall.
- **In the event of a fire or life-threatening emergency, immediately dial 9-911.**
- For non-life threatening situations, call SPEAR control at X2751, then Safeguards and Security at X2551.
- When you hear the fire/evacuation alarm, **immediately evacuate the building and go to the assembly area** in the parking lot outside of Bldg. 274.

Radiation Safety: Simply defined, radiation is energy transferred through space and matter. Radiation is emitted as waves or particles from unstable atoms. **Non-ionizing radiation (e.g., visible light, ultraviolet, infrared, microwaves, radio waves, heat) does not have enough energy to disrupt atoms and is not a radiological concern.**

Radiation that has enough energy to eject electrons from electrically neutral atoms leaving behind charged atoms, or ions, is known as ionizing radiation. Ionizing radiation is a human health and safety concern because damaged atoms in living cells interfere with the normal processes of cells and can lead to increased risk of cancer. Four basic types of ionizing radiation

are: Alpha Particles, Beta Particles, Neutrons, Ionizing Photons (Gamma and X-ray). **X-rays from an operating klystron are an example of ionizing radiation.**

Everyone is constantly exposed to ionizing radiation from natural background sources such as radon (a naturally occurring gas), cosmic rays, and radioactive elements found in the human body (such as potassium-40) or in the earth (radioactive elements present in the earth's crust such as thorium and uranium are also referred to as terrestrial radiation). The **average annual radiation dose from these natural sources of background radiation is ~300 mrem.**

Human-made examples of ionizing radiation include: diagnostic medical x-rays and nuclear medicine; nuclear reactors for power generation; fallout from nuclear weapons testing; consumer products such as smoke detectors, lantern mantles, and tobacco. **The average annual dose from these human-made radiation sources is ~60 mrem. The average annual dose to the general population from both natural and human-made sources of radiation combined is ~360 mrem.** In addition, people who smoke or undergo some medical procedures may receive a higher annual radiation dose than those who do not (average radiation dose from smoking estimated at ~1,300 mrem/year). Factors affecting biological damage of ionizing radiation are the area of the body exposed, the dose rate, and the total dose.

In addition to natural background radiation, individuals can be exposed to ionizing radiation from their occupations. The occupational radiation exposure working at a facility like SLAC is extremely low; average annual radiation doses is much higher from other daily life experiences such as smoking, traveling, etc. and risks are much higher in many other occupations such as airline flight crew, nuclear power plant worker, Grand Central Station worker, medical personnel, miners, construction workers, and truck drivers. **The annual occupational radiation dose limit set by the DOE is 5,000 mrem, while the annual SLAC dose limit is much lower at 100 mrem (1,500 mrem for radiological workers).**

Prenatal radiation exposure should be reduced to a minimum since the developing embryo is sensitive to ionizing radiation and is at increased risk of slower growth, reduced mental development (IQ), or cancer as a result of exposure. Women are encouraged to **notify their supervisor and the Medical Dept. if they are, or think they may be, pregnant**.

SLAC is dedicated to keeping radiation exposures **As Low As Reasonably Achievable, known here as "ALARA." ALARA is a practice to minimize radiation dose.** While working at SLAC, you should be aware that the three best ways to minimize exposure to radiation are to:

1) Reduce or limit **Time** spent in radiation areas.
2) Increase **Distance** from radiation sources since the further away from a radiation source the less radiation exposure you will receive.
3) **Shield** radiation sources to reduce exposure from that source.

General Employee Radiation Training (GERT) training and a radiation dosimeter badge are the minimum requirement for unescorted access into an "Radiologically Controlled Area" (RCA). (Employee Orientation for Environmental Safety and Health (EOESH) is a pre-requisite to complete GERT. The SSRL Experimental Area has been designated as an RCA while the SPEAR3 radiation shielding is being monitoring and validated. During this time, everyone entering the area must wear an ID badge and dosimeter on the front of the body, outside of clothing, between the waist and chest. The dosimeter monitors your radiation exposure and is the radiological record of your work at SLAC. It does not protect you from nor warn you of radiation areas. Follow these rules regarding the treatment of the dosimeter badge:

1) Do not leave your dosimeter in a vehicle.
2) **Return your dosimeter to the User Administration Office before leaving SSRL.** Do not wear your dosimeter off-site where you may encounter radiation exposure, such as traveling by airplane, other job sites or during medical and dental X-rays.
3) **Pick up your new dosimeter when you return to SSRL during the run.**
4) After returning your dosimeter, your radiation dose will be reported to you upon written request.

Exposure to radiation does not result in contamination. Radioactive contamination only occurs when radioactive material such as radioactive dust and particles disperse and adhere to individuals.

All employees, visitors, users, and contractors must follow radiological safety procedures; however, **in the event of an emergency, under typical conditions, do not hesitate to perform first aid or rescue procedures within your expertise**. The radiation levels typically present create far less of a life, safety, or health threat than a situation requiring rescue or first aid.

Radiological Postings

GERT-trained individuals are qualified for unescorted access to Radiologically Controlled Areas, but are only allowed to enter Radiation Areas with managerial approval for each entry. Only Radiological Workers (RWT) are qualified to enter High Radiation Areas or Contamination Areas (see postings below). Become familiar with these radiological postings which you may encounter while at SLAC. SSRL users with GERT training are not allowed to handle radioactive materials at SLAC without prior approval. Radioactive materials are always identified with radioactive identifying labels. Common to all radiological postings and labels is the standard tri-foil symbol in Yellow and **Black** or Yellow and **Magenta**.

EOESH and GERT training can be completed on one of the computer based training (CBT) terminals at SLAC during regular working hours. SSRL users should contact Jackie Robleto at 650-926-2079 (jackie@slac.stanford.edu) to arrange an appointment.

For additional information on safety, the following training study guides are available on the web:

http://www.slac.stanford.edu/esh/training/study_guides/GERT.pdf
http://www.slac.stanford.edu/esh/training/study_guides/EOESH.pdf

In addition, anyone who feels more comfortable attending a live class to learn this material can register for the full day classroom training at: http://www.slac.stanford.edu/esh/training/registration.html

NOTE: If the CBT training and test is not completed after two attempts, the user will be shut out of the CBT training system, and he/she will be required to register for and attend the full day classroom training.

If EOESH and GERT training have been completed at another DOE facility, please forward a copy of the GERT training certification to the SSRL User Administration Office (Fax 650-926-3600). Assuming the training is comparable, training at another DOE facility can be transferred to SLAC so that the courses do not need to be repeated. Training is valid for 2 years from the testing date. A brief SLAC-specific safety orientation is still required.

We also ask all on-site users to review and complete the SLAC safety agreement annually as well as the hutch authorization agreement if this has not been done within the last 2 years.

A hutch authorization training class (Safety talk) is required for new users, and this training is usually held weekdays at 2 pm.