SPECIAL AGS USER'S TRAINING

Safety Associated With The
Primary and Secondary Experimental Areas
&
Rad Worker II Module For AGS High Radiation Area Training

STUDY GUIDE

AUGUST 1999

INDEX

SPECIAL AGS USER'S TRAINING

LEARNING OBJECTIVES OR WHY TAKE THIS COURSE?

This Course is required if you want unescorted access into secondary AND primary areas associated with AGS experiments. AGS primary areas are often synonymous with High Radiation Areas and thus require you to have facility specific knowledge apart from the normal AGS Users Training.

This course covers:

1. the physical design features and administrative controls that are used to prevent accidental exposures in primary areas, and
2. the conventional safety issues normally reviewed in AGS Users Training.

Thus, this course spans the information normally covered in two separate courses at AGS. Annual retraining in Special AGS Users Training is required.

You will learn about the posting and access controls for AGS High Radiation and Very High Radiation Areas. The requirements for entering and working in these areas will be covered. The response to emergencies and the guidelines for control of emergency exposure will also be presented.

A pre-requisite for this course is Radiation Worker 1.

Please be aware that successful completion of this course does not allow you to work in AGS Contamination Areas. Further training in "AGS Contamination Worker" is required.

Successful completion of this course does not allow you to remove activated materials from AGS primary areas and place them in uncontrolled areas without the assistance of HP Technicians. Further training in "Activation Worker" is required. Arrangements for additional training may be made by contacting the AGS Training Manager (x5800).

This course does not cover experiment-specific training such as the g-2 Magnetic Safety Plan or the g-2 ODH issues. Your Experiment Spokesperson is responsible for ensuring the collaboration is qualified in experiment specific training.

Question: if an area is improperly entered; for example, by climbing over a shield block or by slipping through a hole in a gate, could you be killed by direct exposure to the beam?

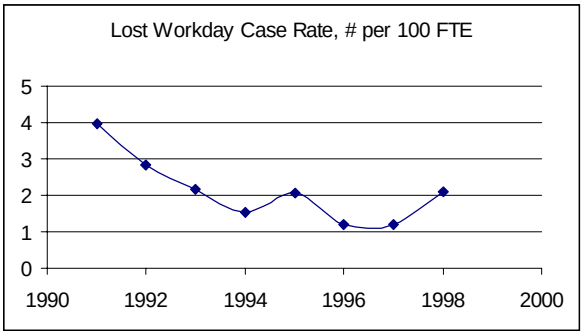
Answer: yes. The beam is intense enough to deliver a lethal dose.

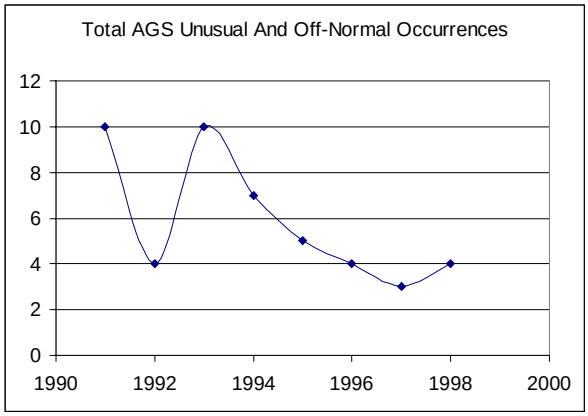
In addition to ionizing radiation hazards, primary areas and experimental areas may contain hazards posed by:

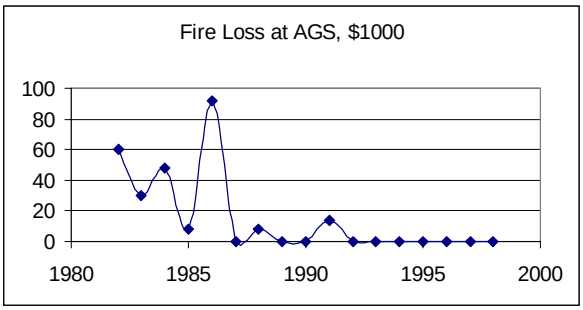
1. heavy objects,
2. mechanical equipment,
3. overhead cranes,
4. heights,
5. high magnetic fields,
6. hot and cold surfaces,

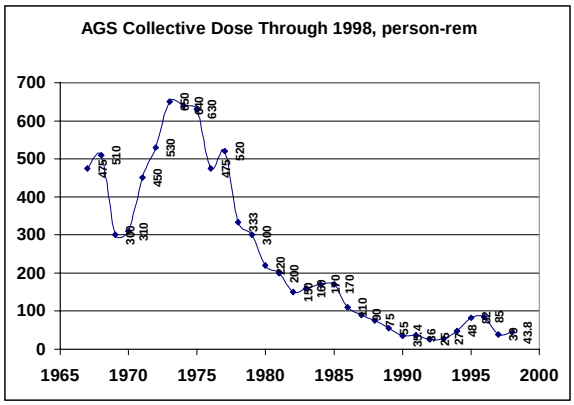
7. steam,
8. high-voltage and high-current electrical systems,
9. noise hazards,
10. radiofrequency radiation, and
11. contamination and oxygen deficiency from smoke and fire.

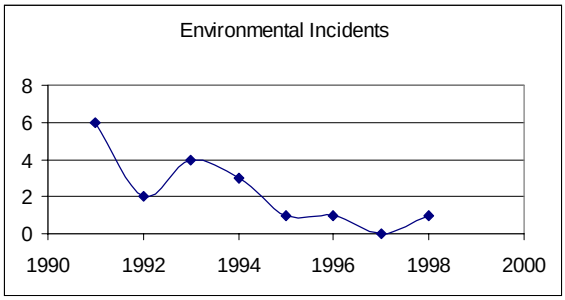
We strive to maintain an excellent safety record in such a complex environment without undue inconvenience to the AGS Users. With your help, over the last few years we have significantly reduced fire losses, radiation dose, unusual occurrences, environmental releases and injuries.











We can assure the continuity of this safety record only by having the active cooperation of each individual who has access to the primary and secondary experimental areas. Each of you should familiarize yourselves with all applicable safety regulations and experiment procedures.

WARNING:

Willful or flagrant disregard of Federal radiation-protection rules may result in disciplinary action, monetary penalties, and / or criminal prosecution.

Question: does Special AGS User's Training, the training given here, permit you to work in a primary area that is also a Contamination Area?

Answer: no. In order to work in a primary area that is also a Contamination Area, you must be trained in AGS Contamination Worker Training.

PRICE ANDERSON ACT (PAA)

It is important to make you aware of the absolute requirement to follow all radiation safety rules at AGS facilities. Federal law (PAA) provides for criminal and monetary penalties if you do not follow the rules fully. Persons have been the subject of criminal investigations when found to willfully remove a radiation barrier. Thus, we request that you pay particular attention to the radiation safety rules that follow.

Are Users at AGS accepting additional legal liabilities under the Price-Anderson Act when signing documents related to compliance with radiation safety rules? The short answer is that the User incurs no personal liability under the provisions of the Act unless he/she intentionally acts to violate the radiation safety rules.

The Price-Anderson Act sets up a regulatory scheme for enforcement of radiation safety rules, including radiation protection standards (10 CFR 835). Failure to comply with those rules, or to identify and report non-compliance to DOE, subjects the Laboratory, not an employee, to an enforcement action. This could include a legal Notice of Violation and a civil penalty up to $100,000 per violation.

When signing documents related to radiation safety, such as the training documents associated with this course, a User is essentially confirming that he/she will do his/her assigned experiment according to the rules. The signature does not mean that the User is guaranteeing that the experiment will be carried out perfectly or that there is no potential for a violation. It does mean that the User is performing his/her duties to the best of their ability and has made a good faith effort to comply with the radiation safety rules. A "good faith effort to comply with the rules" means that the User has familiarized him/her-self with the requirements of regulations that fall within his/her area of responsibility. Having done so, he/she should be in a position to approve or sign-off on procedures or training to carry out work involving radiation safety.

WARNING

It should be understood that any User who intentionally violates any regulation, regardless of whether the User signs any document related to compliance, is subject to criminal prosecution or other disciplinary action.

DELIVERIES TO AGS FACILITIES

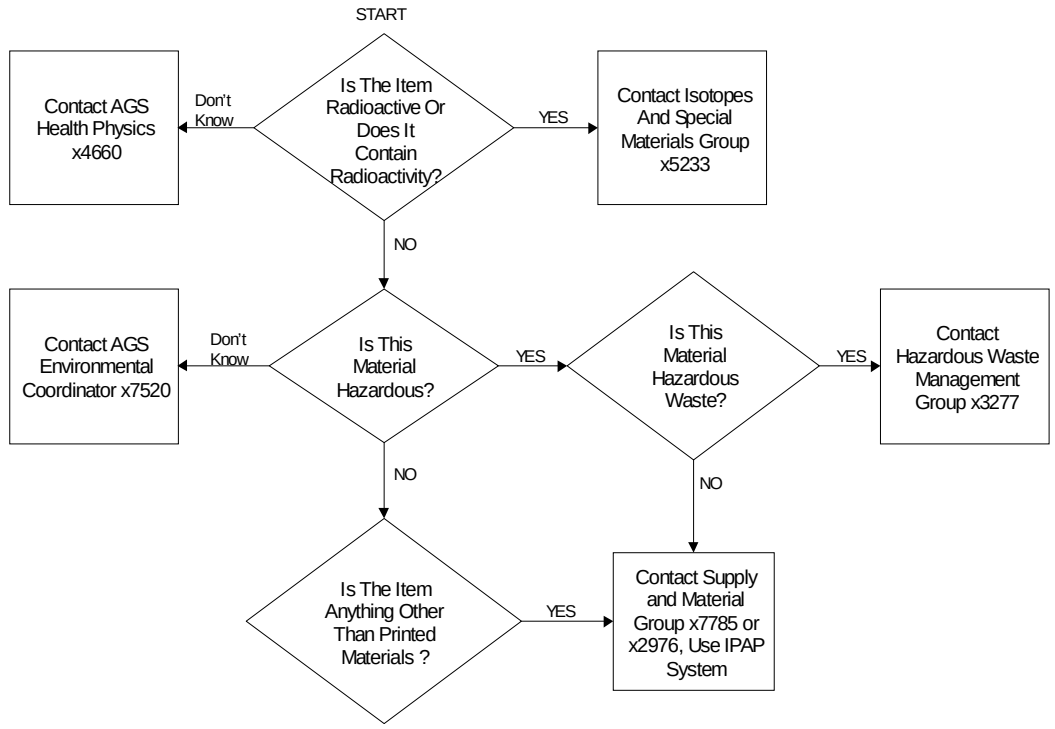
In recent years, the delivery of materials to AGS has become complicated due to our attempt to comply with Price Anderson Act Amendments. Under Price Anderson, we are required by Federal law to obey all radiation safety rules or face stiff penalties if we do not. All persons, including delivery people, who enter Radiation Areas either must be wear a TLD and be escorted by a trained Radiation Worker or they must be a Radiation Worker.

To ensure that DELIVERY PEOPLE DO NOT ENTER RADAITION AREAS, the department requires that all deliveries to the AGS complex be made to Building 911. The Main Office , ext. 4619, located on the second floor of building 911, will sign for packages during normal business hours. The secretarial staff will then notify the addressee of its arrival by phone or a note in mailbox. Arrangements can be made with

the Main Control Room, ext. 4662, for off-hour deliveries. When the delivery is made to the MCR, personnel there will then contact the addressee. Under no circumstances are deliveries to be made to other buildings in the AGS complex without approval of the Head of Safety Section, Bill Sims.

WHEN PLACING AN ORDER, INFORM VENDORS TO PUT YOUR NAME ON THE PACKAGE (packages arriving without a NAME will be sent back) AND STATE THAT DELIVERIES ARE TO BE MADE TO **BUILDING 911.**

IF YOU ARE SHIPPING FROM AGS TO OFF-SITE, THEN ASK YOURSELF THESE QUESTIONS AND FOLLOW INSTRUCTION PRIOR TO SHIPPING



HANDLING LEAD (Pb)

You will encounter Pb in the primary areas. Please be aware that handling Pb may be hazardous. You are required to contact the AGS Head of the Safety Section (HOSS) (x3271) before you handle lead.

EXPERIMENTAL FACILITIES DESCRIPTION

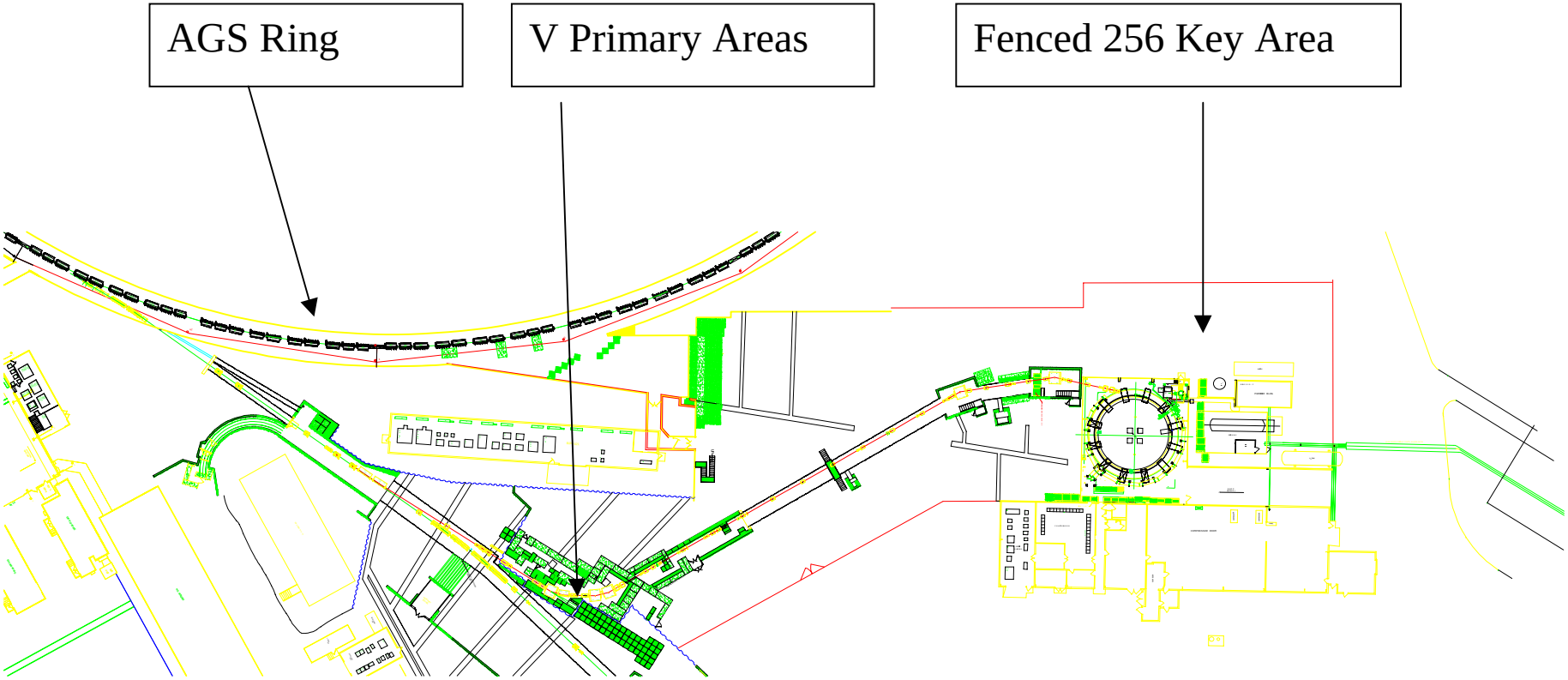
PRIMARY AREAS are areas where beam is fully enclosed. For experimental areas at this time, this includes:

1. the muon storage ring,
2. the A3 line, and
3. the U line.

For heavy-ion running, primary areas include the tube-like enclosures that directly surround the beam whenever it traverses the experimental areas.

Primary areas are fully enclosed by shielding or fences and have a barrier on the roof. With the exception of tube-like structures for heavy ion beams, they are generally arranged as shielded areas with interlocked gates.

Several views of AGS experimental areas that are also primary areas are given on the following pages. The overall radiological areas that surround the AGS complex is also pictured.



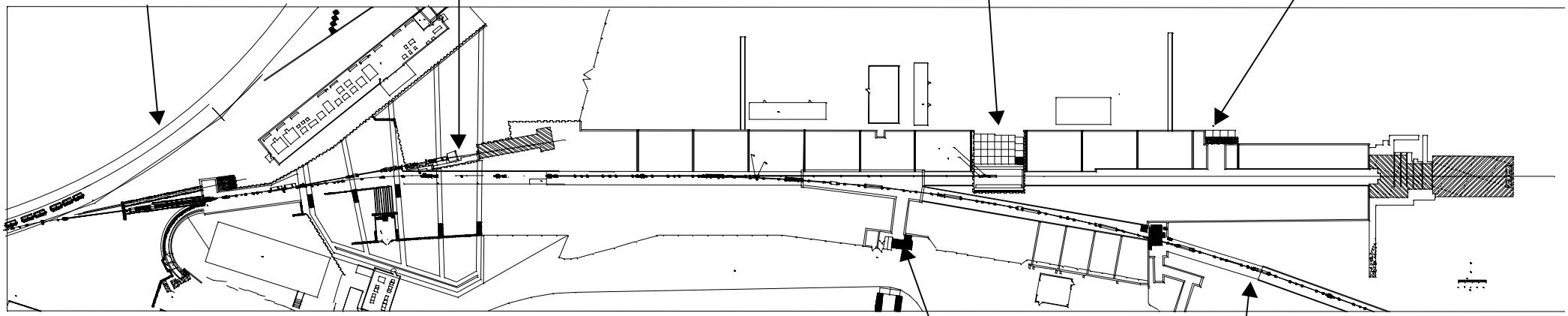
Fast Extracted Beam Areas, g-2 Experimental Area

Former FEB Gate 5,
Currently UGE3

V Target and Dump

AGS Ring

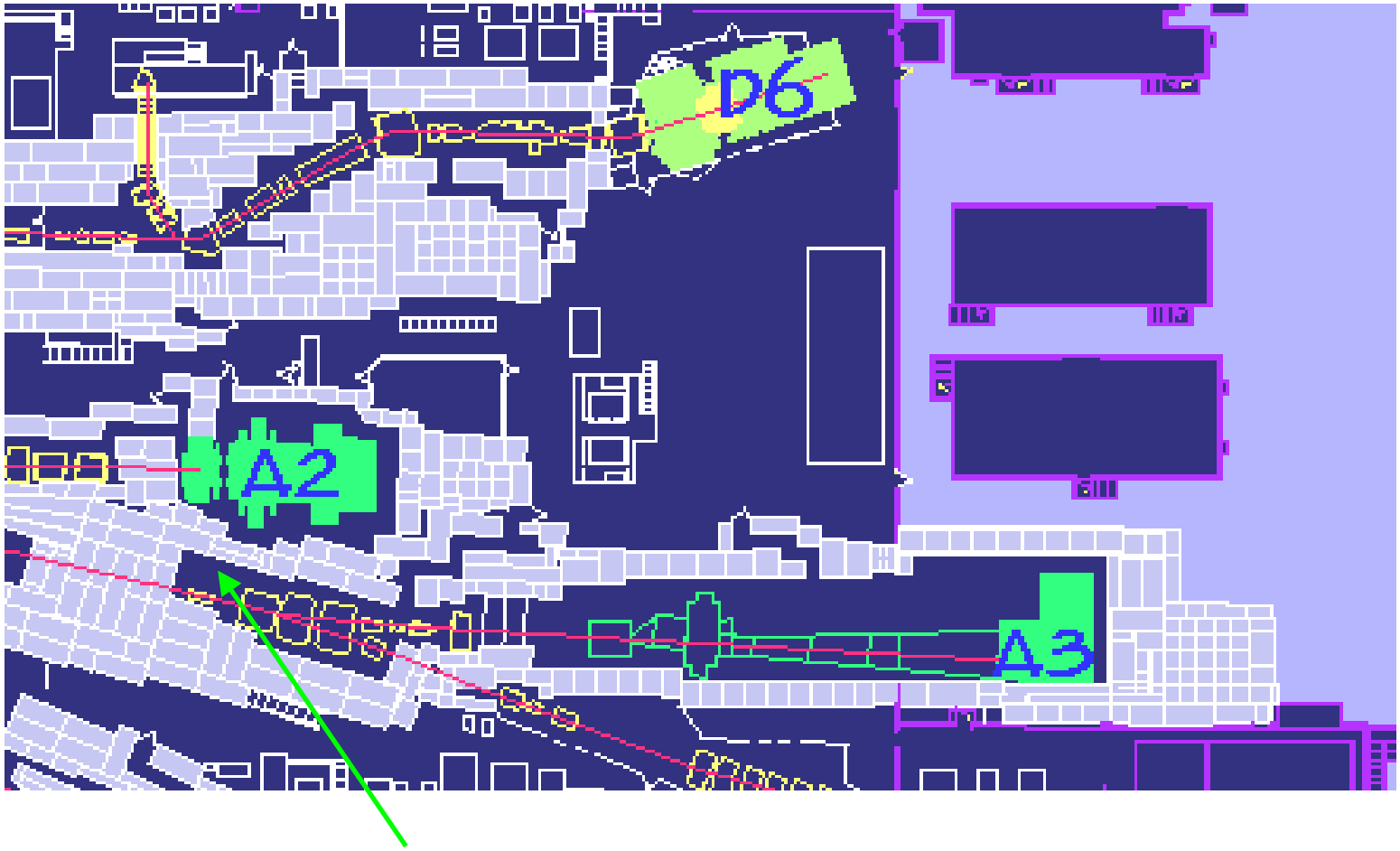
U Primary Areas



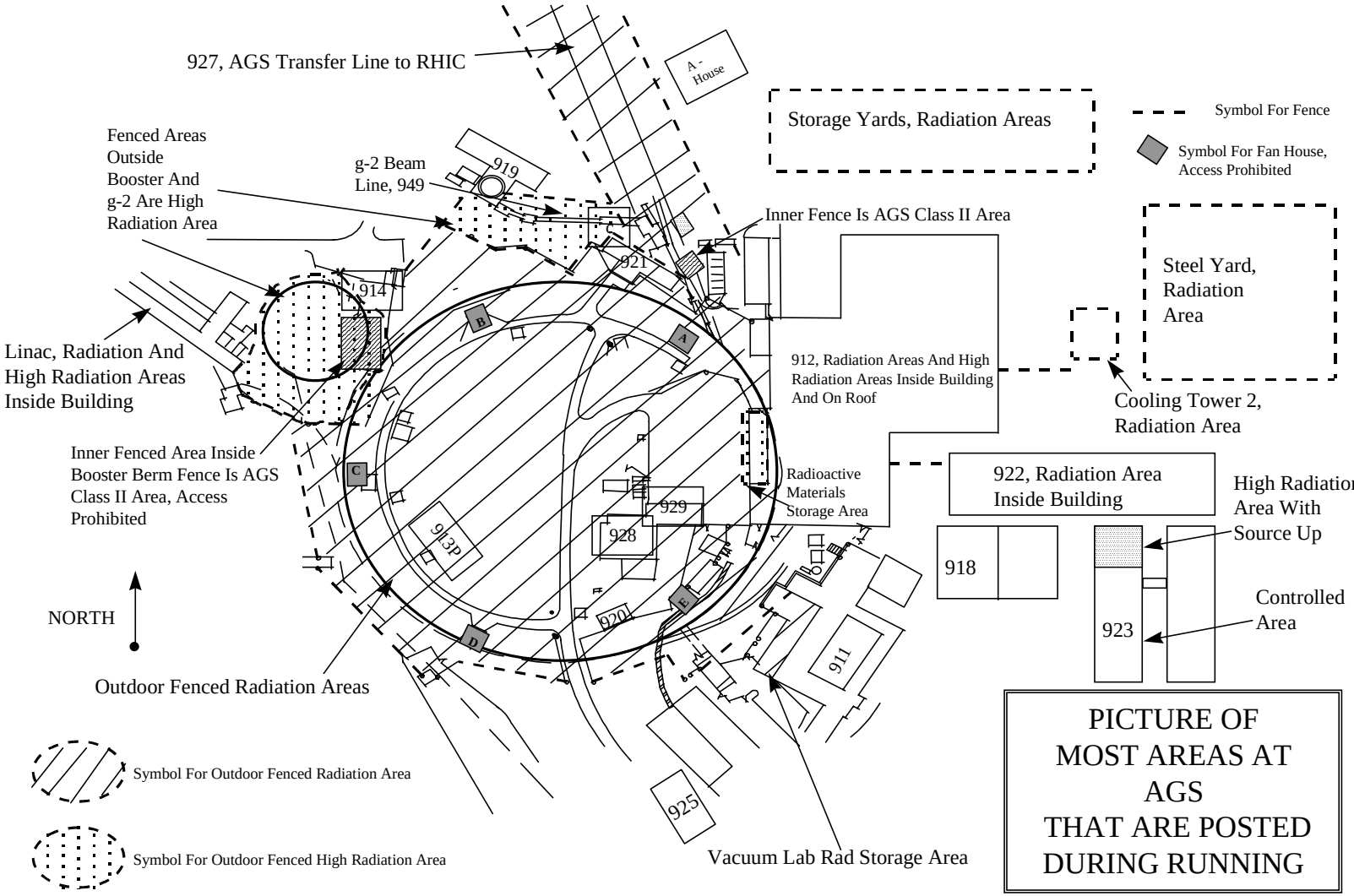
Building 927, AGS to RHIC Transfer Line

W Line to RHIC

Former FEB Gate 3,
Currently UGE2



AGS Radiobiology Station In Building 912


927, AGS Transfer Line to RHIC
A - House
Storage Yards, Radiation Areas
Symbol For Fence
Symbol For Fan House, Access Prohibited
Fenced Areas Outside Booster And g-2 Are High Radiation Area
g-2 Beam Line, 949
919
Inner Fence Is AGS Class II Area
921
914
Steel Yard, Radiation Area
Linac, Radiation And High Radiation Areas Inside Building
912, Radiation Areas And High Radiation Areas Inside Building And On Roof
Cooling Tower 2, Radiation Area
Inner Fenced Area Inside Booster Berm Fence Is AGS Class II Area, Access Prohibited
Radioactive Materials Storage Area
922, Radiation Area Inside Building
High Radiation Area With Source Up
929
928
913P
918
Controlled Area
923
NORTH
920
911
Outdoor Fenced Radiation Areas
925
Vacuum Lab Rad Storage Area
Symbol For Outdoor Fenced Radiation Area
Symbol For Outdoor Fenced High Radiation Area
PICTURE OF MOST AREAS AT AGS THAT ARE POSTED DURING RUNNING
E. Lessard 9/96

EXPERIMENTAL AREA HAZARDS

Under no-beam conditions, primary and secondary experimental areas normally do not present a radiation hazard. However, neutron, beta and gamma sources are occasionally stored in these areas. Some detectors contain uranium or other radioactive materials. A few shield blocks on the experimental floor are activated; that is, they have been made radioactive by the beam, and these blocks are marked with radiation symbols and the word "RADIOACTIVE."

Posted instructions associated with radiation hazards must be followed. **Even with beam off, violating security gates or other security systems, or moving shielding or barriers will result in prompt administrative action.**

Contact with energized electrical circuits may not kill but can knock you off a ladder or cause you to bump your head. Additionally, the short circuit capacity of the 120/208 and 480 volt systems is much above that encountered in most industrial and/or research facilities. All connection and disconnection to these systems must be made by BNL personnel only. You must use caution on any equipment connected to these systems since a short circuit can produce a large arc with a resultant molten metal spray.

You should be aware of the requirements for fusing and other protective circuitry for your equipment. Working on de-energized electrical equipment requires you to be qualified in BNL Electrical Safety Training and BNL LOTO Training unless:

1) the AC voltages are less than 50 volts rms.,
2) DC voltages are less than 50 Vdc, or
3) the system is incapable of an instantaneous release of 10 Joules or more of energy.

Contact the AGS Training Manager (x5800) to arrange for additional electrical safety training. **You are forbidden to work on energized electrical systems (working 'hot') unless you receive authorization from the Head of the AGS Safety Section, x3271.**

Label your equipment. Be familiar with your equipment and do not use anything that seems unsafe. **IF you do not know from whence it came, THEN DO NOT use it.**

Recently, Users found an extension cord near their experiment, and decided to use it. This unknown cord had the hot and neutral reversed and the ground had been cut or corroded away. Aside from damaging a computer and a measuring device that cost several thousand dollars, this hazardous cord was potentially lethal since the safety ground was energized. The bottom line is DO NOT use homemade extension cords; USE the molded type.

You should know the location of the emergency-off controls for power to your equipment. There should be no exposed electrical terminals in your equipment that present a hazard to yourself or other Users.

All cryogenic devices must be reviewed by the Laboratory's Cryogenic Safety Committee. All cryogenic targets must be fabricated and operated by the AGS Cryogenic Group in the Experimental Planning and Support (EP&S) Division. Cryogenic devices present the hazards of extreme cold, asphyxiation, or explosion.
Many experiments involve the use of flammable gases, and flammable liquids.

The gas distribution and gas mixing systems must meet the requirements of BNL Environmental, Safety and Health (ES&H) Standards. These standards are issued to liaison physicists, liaison engineers and Experiment Spokespersons. Additionally, Users occasionally collect wood, plastic, paper or other combustible matter in significant quantities near experiments. We must strive to remove these materials where possible, and we should strive to meet the life-safety code by not blocking exits or aisle ways with these materials. Metal sheds to the north of Building 912 are assigned to Users for the purpose of storing experimental equipment, cables, packing materials and other combustible items.

Use extreme caution with iron and steel objects when working around magnets, especially those with large gaps. Follow all magnetic safety plans that are specific to your experiment. **Please note that lockout of a magnet for magnetic safety is NOT to be substituted for a lockout for electrical safety.** Be sure you do not inadvertently energize a magnet before the area is clear. Remember the field may be effective at a surprisingly large distance. Aside from possibly pulling ferrous objects from your grasp, your credit cards may be damaged if you get too close.

The American Conference on Governmental Industrial Hygienists (ACGIH) recommend exposure limits for static magnetic fields. Exposure of the whole body should not be allowed in fields greater than 600 gauss on a daily basis (8-hour time-weighted average), and extremities like your arms and legs should be exposed to less than 6000 gauss (8-hour time-weighted average). Cardiac pacemaker wearers should not be exposed to fields greater than 5 gauss. DOE has adopted ACGIH recommendations as its own standards and has indicated this through DOE Orders. Thus, you should limit your own personal exposure according to these rules.

Materials such as oil and toxic chemicals may harm the environment if released inadvertently. Any unauthorized release should be brought to the attention of the on-shift Operations Coordinator as soon as it is discovered.

The AGS Department must evaluate the potential consequences of a planned release to air, ground water or the sanitary sewer. Experimental detectors may release a variety of gases. Some experimental magnets may require coolant that may need to be changed at times or that may begin to leak. Thus, you must contact the Liaison Physicist to determine if release permits are required for your planned liquid and airborne effluents.

The use of solvents and other toxic materials may require protective clothing and special handling. Consult with your Liaison Physicist when in doubt. The AGS Safety Section Head may also be consulted for information on handling hazardous materials (x3271).

All chemicals require approvals before they enter the waste stream. DO NOT pour any chemicals down the sink. The AGS Department has an Environmental Coordinator (x 7520) who will assist you with all waste disposal issues.

Do not continue to stand under objects being handled by the cranes. Occasionally a crane may move overhead and a hard hat is not required. IF you find you are working under continuous crane activity that is taking place overhead, THEN you must wear a hard hat.

Experiments may have:

1. equipment surfaces greater than 125 ^{O}F,
2. radio frequency or microwave radiation greater than 25 W in an occupied space,
3. lasers greater than 1 mW,
4. equipment that generates sound pressures greater than 85 dBA,
5. or ultraviolet lamps.

Be sure to obey posted signs that warn of potential hazards from these devices.

There are mechanical hazards associated with pressure vessels and vacuum vessels. Large, thin windows (several ft^2 in size) on large vessels under vacuum (larger than 350 ft^3) have enough potential energy to exert a tremendous pulling force should the window break. The pull would be the equivalent to falling off a three-story building. IF there is no protective cover in place, or IF there is not sufficient distance between you and the window (10 feet), THEN DO NOT work in or around a large window when it is under vacuum. Additionally, the noise from an inadvertent window implosion may cause permanent hearing loss. You should obey any postings related to the use of hearing protection. You must follow all procedures that require you to put a protective shield in-place before entering areas that have vacuum window hazards.

There are many large material-handling devices on the floor, and many structures are supporting heavy loads. Additionally, there are mechanical hazards associated with compressed gas systems that could result from improper line pressures and malfunctioning regulators. Be aware of these hazards. Report any suspicious-looking structures or compressed-gas systems to your Liaison Engineer or Liaison Physicist.

Question: while working on your equipment, you encounter exposed conductors and you are not certain they are live, what would you do?

Answer: warn your collaborators and contact your Liaison Physicist.

RESEARCH SUPPORT SERVICES

A Liaison Engineer is assigned to coordinate and assist in the setting up and running of the experiment. Your Liaison Engineer is the primary contact for the experimental team during the construction phase. The engineer will make a detailed design layout of the experiment, including a time estimate, and will arrange for rigging, survey, safety reviews, and such requirements as electrical work, plumbing, carpentry and air conditioning. Items that require a safety review or other advance approvals are listed in AGS Operations Procedure Manual (OPM), Chapter 9. After the experiment is running, all operating problems are handled by the Experimental Area Group (EAG) Watch. The Liaison Engineer must be consulted regarding special requirements or modification of the experimental set-up.

A Liaison Physicist is assigned to your experiment. The Liaison Physicist is a consultant to the Liaison Engineer. The Liaison Physicist is your primary contact for safety-related information associated with your experiment. Generally, the Liaison Physicist is responsible for a specific target station as well as the experiments. Your Liaison Physicist provides expert assistance in beam tuning during the first stage of a beam turn-on. He also optimizes the beam during sharing conditions. He should be consulted to help solve ionizing radiation

problems, and to solve other problems of this general safety character.

An Experimental Spokesperson is a person who will act on behalf of all the collaborators on the experiment. His/her specific safety responsibilities are as follows:

- Experiment Spokespersons are responsible for all transient personnel visiting the experiment. The Experiment Spokesperson must ensure that visitors are wearing the appropriate TLD badges or dosimeters, and that visitors are accompanied by a person who is thoroughly aware of the hazards and safety requirements.

- Experiment Spokespersons are responsible for ensuring that all personnel involved with the experiment apparatus are trained in the emergency procedures, and other safety-related procedures assigned by the AGS Safety Committees. These procedures may be associated with mixing flammable gases, moving protective shields into place or enforcing magnetic safety plans.

- Experiment Spokespersons are responsible for ensuring that the experiment as a whole and certain types of equipment, such as pressure vessels and cryostats, are not operated before undergoing appropriate safety reviews. The Experiment Spokesperson must inform the Liaison Physicist prior to the introduction of a new hazard. Sufficient time must be allowed for review of modifications prior to planned operations.

- Experiment Spokespersons are responsible for ensuring radioactive sources are inventoried and leak checked as required by Federal Law. The Experiment Spokesperson is the person responsible for all radioactive sources brought into the AGS, no matter the size of the source or the origin of the source. That is, even if the source comes from another BNL Department, THEN it must be inventoried at AGS. These sources are typically used to calibrate or check the response of experimental detectors. The Experimental Spokesperson shall ensure the source is checked by HP (x4660) for leakage every six months, and he/she shall enforce the AGS Sealed-Source Inventory Procedure. Source inventory forms are available in the AGS Training Office.

- It is an Experiment Spokesperson's responsibility to ensure that all work by the collaboration is properly planned and reviewed for ES&H issues.

After the reviews by appropriate AGS safety committees, the Liaison Physicist, Liaison Engineer and the Experiment Spokesperson are made aware of safety requirements for your experiment. Either the Liaison Physicist, Liaison Engineer, or the Experiment Spokesperson can provide safety information specific to your experiment, however, the **Liaison Physicist** should be considered your primary contact.

Question: who is the primary contact for safety information regarding a modification to your experiment?

Answer: the Liaison Physicist.

USING MACHINE TOOLS TO SUPPORT RESEARCH

If you need to use tools that are available at several AGS machine shops, then you must contact the Building Manager for that shop prior to use. Building Managers are identified on placards near building entryways. Machine tools are considered drill presses, lathes, etc. In addition to employing the standard machine guards while you do the work, you must be trained in machine tool safety. This half-hour safety video may be viewed by contacting the AGS Training Manager, at x5800.

AGS CONTACTS LISTS

The following list of contacts provides you with a brief reference, which should be placed near your telephone in the experimental areas. Additionally, a listing of liaison physicists, Liaison Engineers and Experimental Spokespersons is given for FY98 running period.

AGS CONTACTS LIST	EXT.
Access Controls Group	2053
AGS Associate Chair for Safety	4250
AGS Department Chair	4611
Building Manager 912	2046
Building Manager 919	4498
EAG Maintenance Coordinator	2046
EAG Watch	2042
Environmental Coordinator	7520
g-2 Control Room	3627
Health Physics Office	4660
Industrial Hygiene	7036
Main Control Room	4662
Operations Coordinator	4662
Safety Section Head	3271
Safety Inspection	7934
Training Manager	5800
Training Office	4772

Listing of Liaisons and Experiment Spokespersons

Facility /Target	Beam No.	Exp. No.	Facility / Spokesperson	Phone No.	Liaison Physicist	Liaison Engineer	Approximate Start Date	Accelerated Species
A	A	SEB	A Target Station	3959	D. Lazarus	D. Phillips		protons
B	B	SEB	B Target Station	4714	A. Carroll	E. Schwaner		protons
C	C	SEB	C-Target Stations	4770/7903	J. Glenn / I-H. Chiang	A. Pendzick		protons
D	D	SEB	D-Target Station	7903	I-H. Chiang/ P. Pile	C. Pearson		protons
U	U	933	King / Hanson		R. Prigl	J. Scaduto	8/99	protons
	U	945B	Greene		R. Prigl	J. Scaduto	8/99	protons
V	V	FEB	V-Target Station	4773	G. Bunce	C. Pearson		protons
RHIC			RHIC AGS Studies				5/99	Au
RHIC			RHIC Test Run				5/99	Au
RHIC			RHIC Commissioning				6/99	Au
RHIC			RHIC Program				12/99	Au

RADIATION HAZARDS

- PRIMARY BEAM: in-beam dose rates up to 10^{14} mrem/h from hadrons.
- SECONDARY BEAM: in-beam dose rates up to 10^{11} mrem/h from hadrons, and leptons.
- FAULTS: radiation penetrating through shielding from unplanned beam losses may lead to doses of several tens of mrem from neutron and gamma radiation near shielding or fences. Faults may last up to a period of about nine seconds before machines are interlocked off.
- NORMAL OPERATIONS:
    - About 1 to 2 mrem/h or less in continuously occupied areas from neutron, and gamma radiation that penetrates the shielding.
    - Cooling water lines are 100's mrem/h during running periods and for several minutes post shutdown (gamma).
    - Cooling water towers are up to 30 mrem/h at base of tower and this continues for several minutes post shutdown. Cooling water plumes are 0.01 mrem/h or less.
    - Air activation: 100's mrem/h from airborne radioactivity in target caves for several minutes post shutdown (beta, gamma).
    - Short-lived contamination (30 minutes) from air activation in primary beam lines. Up to 5000 dpm/ 100 cm^2 of floor surface for several hours post shutdown (beta, gamma).
- RESIDUAL RADIATION:
    - Primary beam components are up to 10,000 mrem/h (gamma).
    - Targets are up to 50,000 mrem/h (gamma). V target may be 100,000 mrem/h or more immediately after shutdown.
    - Primary shield blocks inside target caves are 100's mrem/h (gamma).
    - Long-lived contamination in C3 beam line (beta, gamma).
    - Long-lived radioactivity created in soil near targets, beam stops, and beam scrapers (100's of mCi of tritium and ^{22}Na).

The principal radiation hazard associated with the AGS primary areas derives from the high-level residual-radiation. If possible, the primary areas that are selected for experiments are chosen to be areas where little activation has occurred.

Direct exposure to the beam is not possible if areas are entered in the correct way. However, exposure to radiation from unplanned beam losses in adjacent primary areas is possible. This may result from brief excursions lasting a few seconds such as during a beam crash due to loss of a steering magnet power supply.

RESIDUAL LEVELS IN PRIMARY EXPERIMENTAL AREAS WHEN BEAM IS OFF

AREA	LOCATION	RESIDUAL LEVEL, mrem/h
A3 Primary Line	Radiobiology Station	0.5
Muon Storage Ring	Near Inflector	0.5
	Shield Block Wall	1
U Line	Block House	50
	Beam Stop	90

The approximate dose rates shown in the previous table are based on radiation surveys taken shortly after operations.

RADIOLOGICAL AREA DEFINITIONS

Controlled Area -- any area where access is controlled due to the presence of radiation above natural background levels or due to the presence of man-made radioactive materials. As a minimum, these areas are posted "Controlled Area."

Radiation Area -- any accessible area where an individual may receive a whole-body dose greater than 5 mrem in one hour at 30 cm (1 ft). As a minimum, these areas are posted "Radiation Area, TLD Badge Required."

High Radiation Area -- any accessible area where an individual may receive a whole-body dose greater than 100 mrem in one hour at 30 cm (1 ft). As a minimum, these areas are posted "Danger, High Radiation Area, TLD Badge and SRD Required."

Very High Radiation Area -- any accessible area where an individual may receive a whole-body absorbed-dose greater than 500 rad in one hour at 1 m (3 ft). These areas are not posted at AGS since they are not accessible.

RADIATION LEVELS, AREA NAMES, AND TRAINING REQUIRED

Allowable Radiation Level	Area Name	Training Course(s) Required
< 5 mrem in one hour < 100 mrem in one year	Controlled Area	General Employee Radiological Training (GERT)
> 5 mrem in one hour < 100 mrem in one hour	Radiation Area	Rad Worker I Training
> 100 mrem in one hour	High Radiation Area	AGS Facility Specific Training Such as This Course

The ion accelerator complex has many Radiation Areas, and dose rates may be greater than 5 mrem in an hour. These areas are marked-off by ropes, fences or building walls. All entrances, every twenty feet of fence or rope, and many Hot Spots are posted with Radiation Area signs. In order to work in or pass through Radiation Areas without an escort, you must complete Radiation Worker 1 training.

In primary areas, the radiation level may be greater than 100 mrem per hour and up to 50,000 mrem per hour. In order to work in these areas, you must complete Radiation Worker 1 training plus facility specific training such as this course.

TRAINING SCHEDULE			
Course	Place	Time	Challenge Exam Option
Rad Worker I Training (RW I)	Bldg. 129 Training Room or Berkner Hall Consult w/ E. Auerbach (x5800)	Every Tuesday 9:00 a.m. to 3:00 p.m.	Contact Elliot Auerbach (x5800) or Letesha Smith (x4772)
AGS User's Training For Access To Primary Areas	Contact Elliot Auerbach (x5800)	Scheduled as Needed	Contact Elliot Auerbach (x5800)

ACCCES CONTROL FOR PRIMARY AREAS

At the AGS, the Access Control system is the major design feature used for your protection and it has two states, Access Prohibited and Access Allowed. In the Access Prohibited state the machine is either operational or it is "cocked and ready to fire." Radiation hazards may be at their extremes in this state and are lethal. Thus, no one is allowed.

To prevent entry, the electric key-strike on each access gate is disabled from the Main Control Room, and gates will no longer work with a single access key. If a gate is forced open, then two sensors will detect the door's open position and cause at least two critical devices, such as beam stops, to intercept the beam before one can penetrate the area to any significant degree.

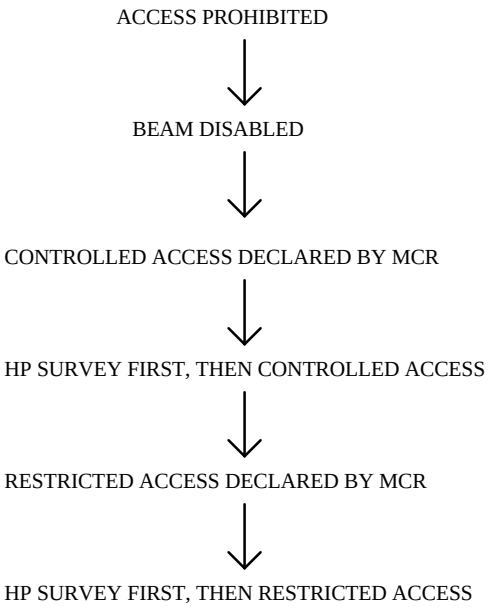
ACCESS PROHIBITED TO VERY HIGH RADIATION AREAS

The following is true whenever the primary areas are in the Access Prohibited state:

- All electric strikes on access-gate doors are disabled; thus, preventing entry.
- All access gates have a minimum of two sensors to detect an open door.
- Two critical devices will stop the beam if interlock occurs.

In the Access Allowed mode, two major sub-states have been defined, Restricted Access and Controlled Access, and each has a number of significant features and requirements that are described in detail on the following pages.

A flow diagram shows the steps the AGS Department takes in going from the highest level of restriction to the lowest:



ACCESS TO CONTAMINATION AND HIGH RADIATION AREAS

To provide Radiation Workers with a method to review tasks in High Radiation or Contamination Areas, and that the personnel are cognizant of the prerequisites to enter such areas, a sign in form is used prior to entry. All Radiation Workers intending to enter such areas must complete the Contamination Area and High Radiation Area Signoff List. This list is designed to act as a checklist for entry requirements .

Contamination and High Radiation Area Signoff List Located at South Gate

ACCESS ALLOWED TO HIGH RADIATION AREAS

One of either of the following sub-states exist whenever the primary area is in the Access Allowed state:

- Controlled Access
- Restricted Access

Question: true or false? - the primary means of ensuring that people are not in primary areas before turning on the beam is by conducting a manual sweep of the areas.

Answer: true. All primary areas are swept exclusively by Main Control Room Operators prior to going from the Restricted Access state to the Controlled Access state.

CONTROLLED ACCESS

- The conditions, requirements, hazards and restrictions that apply to Restricted Access apply to Controlled Access.
- While all systems have a barrier and most have been turned-off, only 5 to 7 electrical systems have been locked out and tagged.
- A gate watch with AGS operators, Experimental Area Watch or Health Physics Technicians will be established at a single gate.
- Access is accomplished by entering and exiting through this one and only gate.
- Entry requires simultaneous key release at the gate and at the MCR.

Under Controlled Access, only a few electrical systems associated with the accelerators are locked out and tagged. Most electrical systems in experimental areas may simply be turned off. The 256-Key or 0-Key alone do not work. Access is achieved by entering or exiting through one gate, and by a sign-in / sign-out system.

Entry through the gate requires simultaneous key release by AGS personnel at the gate plus an Operator stationed in the Main Control Room.

In the FEB areas, exiting the primary area also requires simultaneous key release by AGS personnel at the gate plus an Operator stationed in the Main Control Room. In the near future in FEB areas, a video camera may take the place of the gate watch during Controlled Access. If there were no Gate Watch, a User would be able to determine if the primary area is on Controlled Access by observing an amber light at the entry gate box.

A public-address system announcement is made when going from Restricted Access to Controlled Access in the SEB areas. In the FEB areas where Users perform experiments, a PA announcement is also used to alert personnel of the change in status. If you are present in the area when going from Restricted Access to Controlled Access, you will be asked to leave. The area is then swept by Main Control Room Operators and you may re-enter under Controlled Access conditions. Most high-power electrical systems will be on or under test when you re-enter. Additional Public Address System announcements will be made regarding the status of equipment as it changes during Controlled Access.

In the experimental areas that are also primary areas, going from the Access Prohibited state to the Controlled Access state does not require the AGS HP technicians to enter and survey the primary area for recent activation.

Generally, at least one 15-minute delay is required before entering primary areas after a beam-off condition. This is done to allow airborne radioactivity to decay. In primary areas where experimenters are located, a 15-minute delay is generally not required. These experimental areas have been set up to reduce the likelihood of short-lived air activation.

Question: true or false? - Controlled Access means you must log in with a Gate Watch and enter and exit through the same gate.

Answer: true. The Gate Watch must know where you are so Operators do not have to re-sweep the area.

RESTRICTED ACCESS

NOTE:

Entry is not controlled by a gate watch during Restricted Access. All who are issued a 256-Key or 0-Key may enter and exit at will.

Many electrical systems are locked and tagged during Restricted Access. This pertains only to beamline equipment not controlled by Users.

During Restricted Access to primary areas associated with experiments:

- There is no beam.
- Radiation Worker 1 Training and Special AGS User's Training are required for entry.
- A 256-Key or 0-Key, and TLD badge are required.
- A Self-reading dosimeter and alarming dosimeter are required - read the posting.
- You should be aware of your dose for the year-to-date.
- Dispersible activated debris such as leaking pump oil or broken vermiculite bags may be present.
- High-voltage electrical hazards such as Wood's metal wiring, vacuum pumps, and security-system wiring will exist.

- Escorting of untrained Users is not allowed.

All persons meeting the training requirements for access to primary areas are listed on an on-line database known as AGS Permit C. In order to enter the primary areas during Restricted Access you require a 256-Key or a 0-key. All keys are issued from the AGS Training Office (A-128). Loaner keys may be obtained from either the Training Office or the AGS Main Control Room. In most cases, Users will not be issued a key on a permanent basis.

POWER FAILURE DURING ACCESS PROHIBITED MODE

From time to time, the battery back-up system for the access-control system fails during a power failure. If the backup system fails, then the access-controls system in the SEB areas (A3 Line for example) immediately inserts beam stops and drops to the Restricted Access state. It will not remain in Access Prohibited or drop to Controlled Access since these states in SEB areas require power. If the SEB areas have dropped to Restricted Access following a power failure, **then DO NOT attempt to enter primary areas with a 256- or 0-key immediately following a power failure; CONTACT the MCR first.**

ACCESS CONTROL FOR SECONDARY AREAS

The Controlled and Restricted Access features of the access-control system do not apply to secondary areas. Secondary areas are considered Radiation Areas when the beam is off.
Full enclosures around the secondary area; that is, enclosures with roofs in addition to side fences, are used when "in-beam" dose rates are greater than 2,500 rem in an hour. The Radiation Safety Committee has determined that the lateral dose rate many feet away from such a beam, even if it is enclosed in a beam pipe, could be unacceptable.

Lateral dose rates at 3 feet from a "crashed" beam are typically $2x10^4$ times less than the in-beam dose rate pictured here. Therefore, a 2500 rem/h "in-beam" dose rate is about 100 mrem/h at 3 feet to the side of a crashed beam. Thus, fencing at 20 to 30 feet along the sides of secondary beam lines is adequate to reduce dose rates to acceptable levels. These low-level dose rates at secondary area fences may either exist in a fault or routinely at some lateral distance from a secondary area beam stop.

Down-stream dose rates are increased over lateral dose rates due to the presence of a very penetrating muon beam. The muon beam is eliminated by increasing the length of the beam stop, and rendering the secondary beam incapable of being swept-off the beam stop by a magnet.

The bottom line is that you must respect these physical features of access control. Do not move fencing or beam stops or barriers. Contact the MCR if you notice breaks in the fencing or shielding around secondary beams.

Significant construction activity occurs in experimental areas prior to re-setting the area for beam. Whenever a new area is initially reset for a new beam, significant

Liaison-Physicist manipulation of the beam controls occurs.
It is important to emphasize that during beam tuning, the Liaison Physicist has the authority to reset secondary areas and to ask that Users follow established procedures for access to their equipment. These procedures may be new to the User who has previously been involved in the construction phase of the experiment only. Construction is a time when entrance gates and fences may have been removed or at the very least may not have been posted. Beam tuning is a critical transition period when beam may not be present for hours or days. Communication between the Liaison Physicist and the multitude of anxious Users may be brief. However, after a secondary area is fenced and reset, it is "cocked and ready to fire." During this period, it is important that you clearly understand and follow the instructions of the Liaison Physicist.

Question: can secondary beam-line fences be climbed over when beam is off?

Answer: no. All fences and barriers must be observed by Users regardless of the status of the beam. Always use the designated gate for entry into a secondary-beam area. Entry through the gate ensures that beam cannot be transported through the secondary area while you are inside.

GATES ARE LOCKED AND EXIST FOR RADIATION PROTECTION

- The 256-Key and the 0-Key are the main keys that allow personnel to access AGS primary areas unescorted. NEVER let another person use your key or tailgate.
- You are the person most responsible for your safety. Use common sense. Never assume you know all the hazards.
- When in doubt, consult an expert. Your Liaison Physicist or the Health Physics Office (x4660) can assist you in all your radiation problems and concerns.

The SOLE reason the AGS Department has fences, gates and other barriers at AGS is to prevent radiation accidents. You may be asked to show proof if you wish to enter certain AGS areas on Controlled Access. In most cases, the Gate Watch will have your training record available.

We know from national accident statistics that 10% of accidents result from unsafe conditions and that 90% result from unsafe acts. At AGS, our experience has also been that accidents and unusual occurrences are largely due to unsafe acts. We can and will continue to engineer hazards out of the AGS facilities. However, you are the person most responsible for your safety, and your attitude with regard to following the rules will always have the greatest impact on safety at AGS.

Question: what is the main purpose of the locked gates around the AGS?

Answer: to protect persons from radiation hazards.

Question: the 256-Key and 0-Key are the main keys to access High Radiation Areas associated with what facilities?

Answer: the AGS Department accelerators, the SEB and FEB primary beam-lines, and the AGS to RHIC transfer line.

Question: are there any circumstances under which you may lend your 256-Key or 0-Key to others or allow tailgating?

Answer: no. Only you may use your own key. You may not let any other person through the gate by holding it open unless you are a qualified AGS escort, or unless you are certain the other person is currently qualified to enter a primary area.

ARE ALL HIGH RADIATION AREAS POSTED?

A few primary areas are less than 100 mrem/h during shutdown. For example, A3 line (radiobiology station) and the g-2 muon-storage-ring. These areas may be posted as a Radiation Area or as a Controlled Area during shutdown. The bottom line is to read the posting before you enter the primary area in order to determine the appropriate radiological requirements.

With regard to posting, the AGS Department experience has been that too many signs allow information to go unnoticed. This was the case during an unusual occurrence at the Linac. An area in the Linac had been changed over to a Contamination Area, and an additional sign was added to the door next to the original High Radiation Area sign. Both radiation signs had similar markings, however, the newer sign had the words "Contamination Area." This sign was overlooked and contamination was spread outside the area.

On the other hand, too few signs may not provide enough of an alert. This was the claim several years ago when a User jumped a radiation barrier in the experimental areas. The User claimed the sign that indicated "ONLY USE THE GATE FOR ENTRY" was not apparent to him although it was posted at two different locations on the barrier. **The bottom line is to always enter through a gate since this is where signs are always posted.**

Radiation field data are normally posted using maps at the entrances to primary areas, and an appropriate number of measurements are normally indicated.

The ion accelerator complex contains a variety of radiological areas. The most common are Radiation Area and High Radiation Area. These areas are posted with a variety of signs that must be read before entering. These signs must be obeyed as they indicate training requirements, TLD requirements, and self-reading dosimeter requirements necessary to enter the area properly. These areas are also separated by a variety of barriers including fences, shield blocks and building walls. **DO NOT CLIMB OR DEFEAT THESE BARRIERS.** Always access these areas according to the rules.

The AGS Department imposes additional fence and lock requirements near most primary targets. Users are not allowed to go beyond these additional barriers.

Question: true or false - posting all hot spots at the AGS by health physics is <u>reasonably</u> achievable ?

Answer: true, but some spots are missed and signs may fall off.

GOLDEN RULES FOR RADIOLOGICAL AREAS AT AGS

- Do not climb over or defeat barriers
- Do not ignore signs, labels, alarms or warning tags

Question: true or false? - the following may be ignored whenever you know the AGS is off: fences, barriers, signs, warning tags and alarms in radiological areas.

Answer: false. The AGS radiation protection program can only work if postings and barriers are obeyed at all times regardless of the status of the accelerators. Otherwise confusion occurs.

ACUTE RADIATION SYNDROME

When describing the biological effects of very high, acute doses of radiation, it is the practice to use measuring units of rad instead of rem. Animal studies used high doses of x-rays or gamma rays in a short period, and 1 rad equaled 1 rem for these studies. The following will result from a large dose over the whole-body in less than a day:

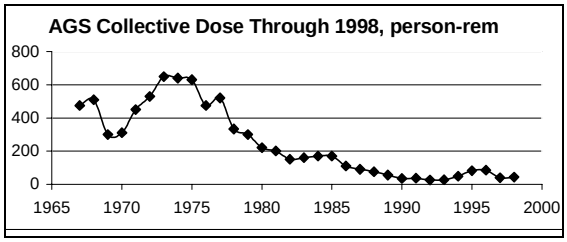
- 25 rad - temporary blood changes that can be detected by a physician using appropriate instruments
- 150 to 200 rad - observable symptoms such as diarrhea, vomiting, nausea, fatigue and hair loss
- 450 rad - lethal dose to 50% of exposed population within 30 days if medical attention is not given to fight infections

Small beams may interact with only a small part of the body if one is directly struck by the beam, leaving most of the body intact. Significant tissue damage may occur along the beam path as the beam penetrates the body. An acute, high-level, whole-body dose produces different biological effects in humans such as nausea, vomiting, hair loss and death. If you are directly struck by a small beam, then the beam is likely to destroy a single organ or extremity such as an eye or a hand. In effect, high-intensity small beams behave like a bullet.

AGS EXPOSURE PHILOSOPHY

Radiation Exposure At AGS Must:

- Have A Net Benefit
- Be As Low As Reasonably Achievable (ALARA)
- Be Within Limits



Annually, about $70,000,000 are expended to operate accelerators and refurbish beam lines for experiments at the AGS. Once an experiment is configured, invaluable scientific information is obtained. Estimates of the economic worth of this information are difficult to enumerate, but it is assumed that this research has a net benefit. Obvious things that do not have a net benefit are:

- Radioactive toys
- Radioactive jewelry
- Eating, drinking or smoking in radiation areas

Eating, drinking or smoking in a Radiation Area increases the time spent in the area, and correspondingly the dose, without increasing the net benefit. In addition, taking a shortcut through a Radiation Area in order to save time or to avoid inconvenience is not ordinarily an appropriate practice.

The collective dose, which is the sum of dose to all radiation workers at AGS, has declined in recent years. Based on experience from 1993 through 1996, the annual collective dose for AGS staff approximately equaled the product of 4 person-rem and the number of weeks of high-intensity SEB operation. The most up-to-date prescription for dose accounts for FEB experience with high-intensity beam in 1997, a year in which the collective dose fell to about 40 person-rem. We have used this new prescription and we anticipate about 70 to 80 person-rem for the 1998 calendar year.

We feel there was a pronounced ‘badge board’ effect in 1997. That is, significant dose reduction was achieved simply by re-locating badge boards to low-background areas. Also, there were fewer beam-line component failures involving significant collective dose in 1997 when compared to prior years.

The consensus is that the majority of collective dose in 1997 came from working on thousands of small jobs that did not trigger the use of a mini-RWP or Job-Specific RWP. Thus, in order to offset increased collective dose due to a longer running period in 1998, each of us must look for new ways to reduce our own dose.

ALARA STRATEGIES

Basic ALARA strategy on the part of the User revolves around effective use of time, distance and shielding. Time tends to have a linear impact on dose reduction, distance a linear to quadratic impact, and shielding an exponential impact. ALARA may also be incorporated into design and operations. The following are examples of ALARA at AGS:

ALARA STRATEGIES

- Locate Counting Houses Away From Primary and Secondary Beam Lines
- Hold Discussions In Areas Where The Radiation Level Is The Lowest
- Use Locked Remote Areas For Storage Of Hot Equipment Or Calibration Sources
- Track And Reduce Unnecessary Beam Loss In Air
- Add Temporary Shielding
- Shield Water Pipes and Cooling Towers or Add Heat Exchangers
- Limit Occupancy Near Secondary Beam Line Fences
- Use Solid Doors On Gates To Primary Areas To Limit Movement Of Short-Lived Air Activation Products

Our greatest dose reduction has come by way of Accelerator Improvement Projects. We have improved the reliability of the vacuum system, injection system, and extraction system. We have re-designed targets and collimators for higher intensity. This has resulted in fewer repairs which in turn reduces the dose burden because we are working less frequently on broken activated equipment. Additionally, new accelerator systems have been installed to achieve better control of beams, which results in less activation of equipment.

Information on collective dose associated with specific jobs or specific experimental areas is collected by the AGS ALARA Committee and AGS management. The AGS Department learns which jobs or experimental areas are associated with the highest dose. This in turn may lead to a future Accelerator Improvement Project.

Many upgrades from prior years live on and help reduce the dose over the long-term. Thus, the general perception has arisen over the last twenty-five years that machine improvements go hand-in-hand with dose reduction. This is still true.

Question: true or false? - ALARA applies to anywhere it is reasonably achievable to reduce radiation dose.

Answer: true.

Question: how is ALARA achieved?

Answer: ALARA is applied most effectively at the design stage. It is accomplished through planning, job proficiency, shielding, and ALARA committee review and past experiences of staff and Users.

ADMINISTRATIVE DOSE LIMITS

Administrative dose limits are an integral part of the dose reduction scheme employed by the AGS Department. These limits are LESS than the dose limits set by DOE and Federal Regulations.

AGS ADMINISTRATIVE LIMITS FOR VISITORS, UNTRAINED USERS AND MINORS

Untrained visitor or untrained User has a dose limit of 25 mrem per year. A limit of 100 mrem per year is allowed with written permission from ES&H Representative and AGS Associate Chair for Safety

Minor (<18 years) dose limit is 25 mrem per year. Minors are not allowed to work in radiological areas but are allowed to visit or tour radiological areas.

AGS ADMINISTRATIVE LIMITS

Period of Interest	Maximum Individual Dose Limit, mrem	Individual Dose Limit With Line Authority Approvals, mrem
Calendar Year	1000	1000 to 1250 (AGS Chair Approval) 1250 to 2000 (Lab Director Approval)
Day	100	100 to 200 (Approval authority will be on the RWP)
Lifetime	N rem Where N Is Age of Person in Years	Laboratory Director Approval To Exceed N rem

The maximum daily dose to Radiation Worker 1 trained persons is 100 mrem. An experiment spokesperson may approve a dose between 100 and 200 mrem. The ES&H Representative must be notified that such an approval was given. The maximum calendar year dose is 1000 mrem. A formal approval must be obtained ***prior*** to going beyond 1000 mrem.

After a female RWI-trained person voluntarily notifies the AGS management that she is pregnant, she is considered a declared-pregnant radiation-worker for the purpose of fetal and embryo radiation protection. The dose to the fetus during the gestation period is to be no greater than 200 mrem. We limit the rate to no greater than 20 mrem per month. **Given that there is marginal sensitivity to detect low-level**

neutron dose, Experiment Spokespersons shall not employ declared-pregnant radiation-workers around beam lines during high-intensity proton operations.

After a person voluntarily notifies the AGS management that she is pregnant, she must follow-up and notify management when she is no longer pregnant.

Untrained Users or visitors are limited to no more than 25 mrem per year. Written permission must be obtained from the AGS Associate Chair for Safety and the AGS ES&H Representative to go beyond this; however, training is preferred. **During the high-intensity proton run, the AGS management DOES NOT ALLOW untrained persons into the experimental areas since exceeding the 25-mrem limit is possible in one day.**

The annual dose limit to minors and students under age 18 years is 25 mrem. A visitor badge may be issued to a minor who plans to visit or tour an AGS radiological area. Minors are not allowed to ***work*** in radiological areas.

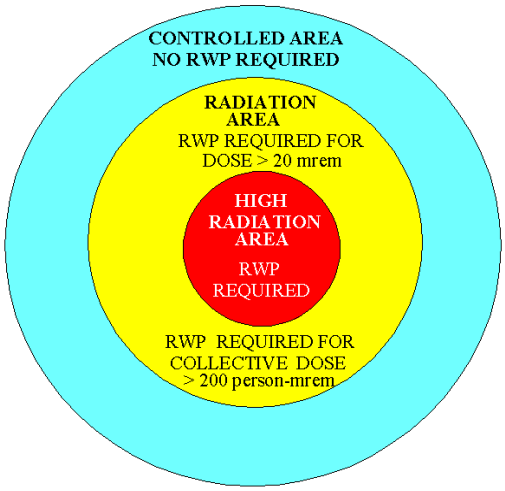
The following are DOE dose limits as prescribed by law. The federal law is known as 10 CFR 835 and is considered the law of the land. That is, these limits are similar to those set for other radiation workers such as those working at commercial nuclear power plants or at hospitals. Note that the BNL and AGS Administrative Limits are less than the legal limits.

ANNUAL DOE LIMITS		
Dose of Interest	Annual Limit, mrem	Annual DOE Administrative Limit, mrem
Whole Body	5000	2000
Declared Pregnant Worker	500 in 10 months	-
Lens Of The Eye	15,000	-
Hands, Forearms, Feet, or Lower Legs	50,000	-
Any Individual Organ (Not Lens of Eye) Or Skin	50,000	-
Minors, Students, Untrained Visitors, and Public	100	-

RADIATION WORK PERMIT (RWP)

All personnel entering any radiological area at the ion accelerator complex must follow the requirements of the AGS Radiation Work Permits (RWPs) for work in radiological areas. Attendance at this course is intended to make you familiar with these permits. Permits should be reviewed when you first enter the area. RWPs are used to control operations or work in areas with changing radiological conditions.

- Radiation Work Permits apply to specific individuals for all jobs in High Radiation or Contamination Areas.
- All Jobs in a Radiation Area predicted to cause greater than 20 mrem to an individual shall require a RWP.
- All Jobs in a Radiation Area predicted to cause greater than 200 person-mrem to the work crew shall require an RWP.
- Persons named on the job-specific RWP must read and sign that they are aware of the requirements.



WORK PLANNING AND SCREENING AT AGS

All jobs at AGS must be screened for ES&H hazards. The hazard levels for screening work are as follows:

Low-Hazard Work is work requiring the attention of the average performer to prevent minor injury. Failure to correctly perform low-hazard work would not damage equipment or structures or release potentially hazardous materials to the environment, except as a result of gross negligence.

Moderate-Hazard Work: Work requiring coordinated actions to prevent any injury to personnel, minor damage to equipment or structures, or release of hazardous materials to the on-site environment.

High-Hazard Work: Work requiring coordinated actions to prevent serious injury to personnel, significant damage to equipment or structures, or releases of reportable quantities of potentially hazardous materials to the off-sight environment.

Jobs involving Users are normally screened during formal reviews and walk-throughs by the AGS Experimental Safety Review Committee. However, last-minute changes to experiments that require Users to perform jobs that fall in the moderate to high hazard category must be brought to the attention of the liaison physicist. **It is an Experiment Spokesperson's responsibility to ensure that all work by the collaboration is properly planned and reviewed for ES&H issues.**

CONDUCT OF OPERATIONS

OPERATIONS

COORDINATOR

X4662

The main control room (MCR) is the focal point of beam control and status. While the accelerator is operational, the MCR is staffed. Call x4662 for immediate assistance on any problem. The execution of the overall HEP and HIP programs from the MCR is the primary function of the Operations Coordinator (OC).

The OC is authorized to enlist the support necessary to maintain or restore the accelerator or experimental support system to operational status. The OC is responsible for providing beam that is satisfactory to the experimenter. The OC keeps current on the status of all experimental groups in the experimental areas, and in case of operational conflict or incompatibility, attempts to effect a resolution. For assistance in carrying out his/her duties, the OC consults with the scheduling physicist, technical specialists, and departmental managers.

The AGS Department urges you to communicate with the OC via the MCR whenever you need assistance on any matter. This is particularly important on the shifts that occur during non-standard work hours. The OC may not be able to answer questions directly or provide the assistance directly, but he will make use of the operational groups who report to the MCR.

After the experiment is running, all operating problems are directly handled by the Experimental Areas Group (EAG) Watch.

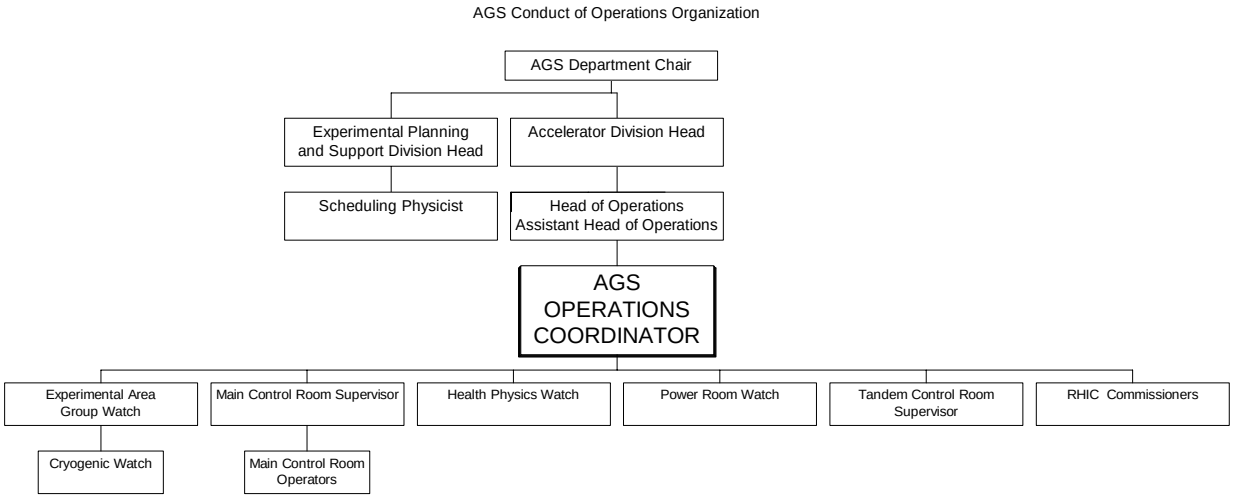
You may contact the Watch by calling the Target Desk at x2042 or by calling the OC x4662. Problems involving collimators, power supplies for beam-line magnets, Hall probes, beam separators, cryogenic targets, vacuum systems, vacuum window shutters, air conditioning, electrical equipment, and requests for emergency rigging should be reported to the EAG Watch.

You only need to remember one telephone number, x4662, in order to get assistance on any matter. That is, IF you have any problems or questions, THEN contact the MCR (x4662). The OC will assist you or direct you to the appropriate safety or operations professional.

REMEMBER:

During AGS operations, contact the AGS Operations Coordinator (x4662) regarding any problem; he can make all the necessary notifications or arrange for assistance.

The AGS operates under a formal Conduct of Operations and the operating organization is pictured as follows:



TLD BADGE RULES

- You May Not Wear Someone Else's TLD Badge
- Unless Otherwise Arranged, Users Are Reissued TLD Badges Each Month And Must Sign For Each New Badge At The AGS Training Office
- Return TLD Badges To The TLD-Badge Board Next To The AGS Training Office In Building 911 When Not In Use
- There Is A Separate Board For User's Badges And Badges Are Arranged Alphabetically
- Wear TLD Badges In "Radiation Areas"
- SECONDARY AREAS Labeled:

"*High Radiation Areas With Beam On*"

Revert To:

"*Radiation Areas*"

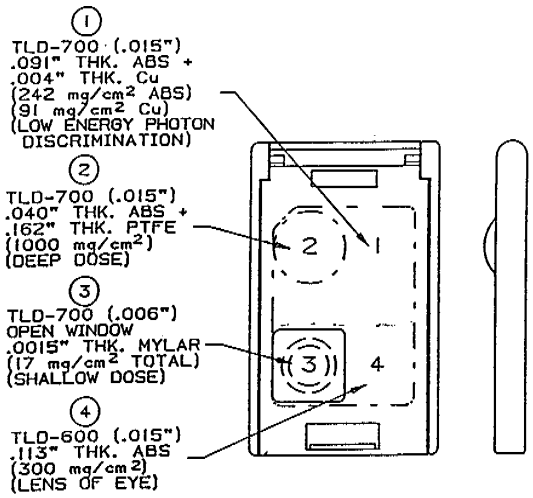
When The Gate Is Opened --
Since Beam Is Off, You May Enter The Area If You Wear Your TLD Badge

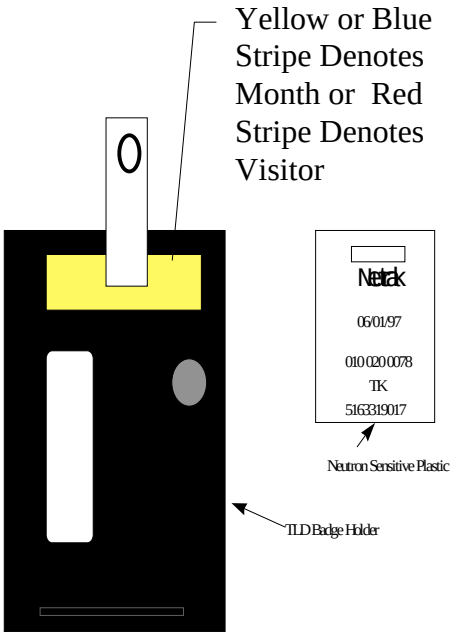
TLD RULES CONTINUED

- If You Lose A Badge In A Radiation Area, Even For A Few Hours, Then Notify The AGS HP Office Immediately
- Return TLD Badges Before TLD-Badge Change Day Which Is The First Saturday Of The Month

TLD badges detect exposures and verify the effectiveness of the AGS radiation protection program. Currently, TLD badges are read by the BNL ESHS Division and results are back after a few weeks. The neutron-plastic packs attached to the TLD badges are read by Landauer Corporation and results are back after 8 weeks.

Wear TLD badges on your torso and outside of your clothing. TLD badges are changed the first Saturday of the month. Emergency TLD-badge read-out can be turned around immediately.





Two neutron-sensitive plastic-badges are attached to the TLD badge-clip during running periods. These plastic badges record another estimate of neutron dose by interacting with a broader spectrum of neutron energies, which is different from that seen by the TLD. TLDs are set up to record low-energy neutrons and tend to overestimate the neutron component of dose at AGS. The neutron plastics from Landauer record the high-energy neutrons AGS; thus, one can interpret the neutron dose accurately.

TLDs record >5 mrem per month, and neutron-plastic record >30 mrem per month. The accuracy is ± 20% for gamma and worse for neutrons. Do not expose the badge to heat, get it wet, take it home, wear it under your clothes or tamper with the TLD or plastic badges from Landauer. Hang the TLD up on the badge board when you are not wearing it. The accuracy of the exposure data is dependent on proper care and use.

The entire AGS Experimental floor is a Radiation Area. TLD badges must be worn at all times. Shield tops and secondary areas on the experimental floor are labeled "High Radiation Area With Beam On," and you are not allowed entry even if you wear your TLD.

You may not remain inside a secondary area gate IF the enclosure is labeled "High Radiation Area With Beam On" AND the gate is closed AND the area is reset for beam.

IF secondary areas are labeled "High Radiation Area With Beam On." AND the gate is open, THEN the area is a "Radiation Area" similar to the rest of Building 912. The use of a single sign with the words "With Beam On" allows AGS to efficiently control access to the area without having to change signs each time a secondary area is opened.

Question: Building 912 is the major experimental area at AGS, it is posted as what type of area? What must be worn in this area?

Answer: Radiation Area is the posting and a person must wear a TLD badge.

TLD BADGES FOR VISITORS

- Visitors Are Those Persons Who Are Visiting – They Are Not Expected To Work
- A Red-Stripe TLD Is Issued To Visitors For A Limited Period AND Cannot Be Re-Issued
- An Escort Is Required At All Times For Red-Stripe TLD Visitors

A visitor's badge is obtained from the AGS Training Office or from the MCR during off-hours. In order to obtain non-escort status, attendance at Radiation Worker 1 Training and Users Training or Special AGS Users Training are required.

A visitor TLD can be issued to untrained people with the approval of the Head of the AGS Safety Section, and it is good if the exposure is planned to be less than 25 mrem. A visitor with a red-stripe TLD is required to be escorted by a trained Rad Worker at all times.

Question: two students have just arrived from off site and you need them to help unpack equipment in Building 912. What do you do?

Answer: contact the Head of the AGS Safety Section to help them obtain red-stripe visitor TLD from the AGS Training Office. You must escort them at all times they are inside a Radiation Area. It is best to get the person trained as soon as possible. Training materials are available in the AGS Training Office.

LOST AND UN-RETURNED BADGES

Please report a lost badge to the AGS Training Office or the HP Office. If a badge leaves the site inadvertently, please mail it back to the ESHS Division, Building 535A, Upton, NY 11973.

Recently a lost badge belonging to a User who worked inside a secondary beam line had results as high as 7,000 mrem. The badge was later determined to have fallen off the User's shirt and to reside for several hours on top of a spectrometer magnet while the beam was 'on' but without any person present.

After the running period was over and the User left for his university, the badge results were reported to AGS. The User later recalled that one-day during the run, he found his TLD badge on top of a spectrometer magnet when he moved across it in order to reach his detectors. He put the badge back on and performed his work; not aware the badge had likely fallen off during a recent prior entry. He indicated his badge was likely to have been missing for only a

few hours during his three-month stay at AGS.

The Access Security computer records for the running period showed that this User had indeed made multiple entries during any given shift. This gave credence to his explanation that the badge fell off and was recovered a few hours later. Dose rates at the top of the spectrometer magnet where he was working were several rem per hour during normal running, but were zero when the beam stops were inserted.

The AGS computer records showed the User employed a secondary area gate for each entry, that the beam stops were closed for each entry, and that a specific gate was used for each entry.

The bottom line was that the User followed the rules and entered the area safely each time; thus, ensuring the beam stops were closed. The only problem was the badge had fallen off between entries.

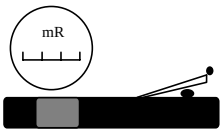
IF you think you may have lost your badge in a Radiation Area, even for a brief period, THEN please notify the HP Group (x4660). This information will help if we have to reconstruct events following an abnormal badge reading, although computer records of security system actions and area dose rates are also available to us.

In the past few years, the AGS HP office has conducted several hundred investigations for un-returned badges. The work-force cost of these investigations was estimated at $10,000.

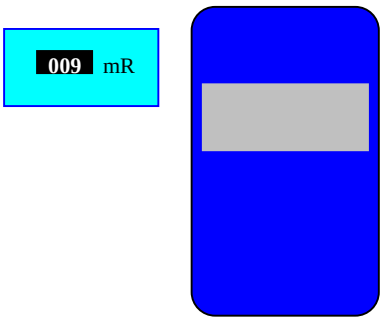
These investigation costs have been substantially lower than those of prior years, and we feel it was due to your cooperation. However, it could be reduced to zero cost. Please continue to leave badges at the assigned station or rack at the end of your workday or shift. Do not take them outside the Laboratory. Most un-returned badges are the result of AGS Users taking them off-site. Often they are not returned at the conclusion of an experimental run. Your continued cooperation in eliminating this practice is appreciated.

SELF READING DOSIMETERS

The following information applies if the primary area you are entering is also a High Radiation Area.



Pencil Dosimeter



Digital Dosimeter

Always:

- Log all measured dose.
- Wear on your torso outside of clothing.

Pencil dosimeters are:

- Relatively inexpensive.
- No batteries required.

- Usually fine.
- Required in order to work in High Radiation Area.

Digital dosimeters are:
- Easy to read.
- Chirping function warns of dose rate.
- Alarming function warns of high dose rate.
- Required in order to work in High Radiation Areas.

The purpose of self-reading dosimeters is to allow personnel to monitor their own exposure and compare it to the daily AGS Administrative Limit of 100 mrem. Self-reading dosimeters have ± 20% accuracy for gamma. They only respond to neutrons. They are not calibrated to measure neutrons.

- Check the dosimeter before using it.
- Read it out and zero it before going into a High Radiation Area.

Pencil and electronic dosimeters ONLY RECORD PHOTON DOSE, THEY RESPOND POORLY TO NEUTRONS. Dosimeter response to neutrons must be multiplied by 5 to get a good estimate of the dose. This adjustment should be made when working on or near shielding during accelerator operations. Normally, the factor of five adjustment is NOT made when working inside accelerators or in beam lines since neutrons are NOT present when the accelerator is off. Consult HP if you need to adjust your dosimeter result and are not sure how to report the results.

If the dosimeter shows an unexpected high or full-scale reading, notify HP (x4660). Your TLD badge should be read-out immediately.

A pencil dosimeter and a chirping electronic dosimeter are required to work in radiation levels greater than 100 mrem/hour. Alarming dosimeters are useful in High Radiation Areas since they have threshold alarms, which can be set to warn the wearer if he or she is approaching an Administrative Dose Limit.

Question: does a self-reading dosimeter always give the correct measure of dose?

Answer: the dosimeter does not respond accurately to neutrons and the reading must be increased by a factor of five whenever you are working around a shield with the beam on.

Question: is an alarming dosimeter required whenever you work in radiation levels greater than 100 mrem per hour?

Answer: yes.

Dosimeter logs are at various locations throughout the AGS complex. The logs are returned to the AGS Safety Section and reviewed by supervisors and by HP each week. Make sure you enter ALL your exposure for the day into the dosimeter log. . The AGS Safety Section will notify your supervisor (Liaison Physicist) if you are approaching an AGS Administrative Dose Limit.

CONTAMINATION

Contamination problems develop from time to time at the AGS; however, successful efforts have been made to design-out target problems and air activation. The past two years have seen the successful operation of

high intensity targets. The AGS is also monitoring the target temperature, and the air near the target itself for airborne radioactivity. Contamination events from target failures seem to be under control. However, contamination from working with dispersible radioactivity is still possible if you are cutting or grinding an activated item, or if you encounter smoke or liquid spills in an Activation Area.

Radiation instruments are placed at target cave gates that are known to have modest levels of contamination. If you are not trained as a Contamination Worker, then you should not *work* in areas that are labeled "Contamination Area." However, you may be escorted by a trained Contamination Worker under certain circumstances.

Inadvertent skin or clothing contamination is a reportable DOE occurrence. The total number of reportable occurrences is a performance indicator that AGS must track as required by contract with DOE. We are obligated by contract to try to reduce the annual number of occurrences. Contamination incidents involving ingestion, inhalation, skin or street clothes are avoidable if you follow the rules that are posted in these areas.

ACTIVATED MATERIALS RULES

Labels For Equipment

- A tag or label is placed on all radioactive equipment or hardware indicating its residual radiation level, the surveyor's name, and date.

Labels For Shielding

- Large concrete and steel blocks: colored radiation symbols with the word "RADIOACTIVE" are painted on blocks and plates to indicate the maximum level of radiation 12 inches (30 cm) from any surface:

Green	< 5 mrem/h
Yellow	5 to 100 mrem/h
Red	>100 mrem/h

- Lead bricks, small concrete and steel blocks: the ends of these items are painted with the appropriate color.

At the AGS, Users might encounter areas that contain activated materials: 1) the primary areas, 2) Radioactive Materials Work Areas; for example, the block yard. Radioactive materials that cannot be labeled

are painted with the word "RADIOACTIVE" in a variety of colors to denote the radiation level. Red is greater than 100 mrem per hour, yellow is 5 to 100 mrem per hour and green is less than 5 mrem per hour.

ALARA dictates that personnel are aware of ambient radiation levels, but the AGS does not label all materials that enter the radioactive waste stream. Instead, the general radiation-level reading from a pile of waste is appropriate and is the usual posting used prior to packing it in waste bins. The Department tries to repair, remove or downgrade labels on activated items whenever appropriate.

Targets, flags, target holders, or any other objects that are exposed to primary beam may become highly radioactive and may have to be handled with special care in order to avoid excessive and unnecessary exposure.

ACTIVATION CHECK REQUIRED

- This posting means you **must not** release items from the area without checking for activation.
- Contact the HP Office to perform the activation check.
- Activation check has nothing to do with checking yourself for contamination.

In order to remove activated items from the AGS primary areas, a User must be certified in Activation Worker Training, check the item for radiation above background levels, and label the item if it is found to be radioactive. In place of Activation Worker Training, the HP Office must be contacted to do the Activation Check before removing the object from the primary area or from your control. Activated equipment must be properly checked and tagged before it is handled by others at BNL.

NOTE:

Only you can prevent unlabeled radioactive materials from leaving the primary areas. Ordinary-looking items inside primary areas do not bear labels and could find their way into offices, experimental areas, or ordinary waste streams unless you follow the rules.

Any shipments of material off-site must be checked in order to ensure proper packaging and labeling if it is radioactive. Off-site shipping of radioactive materials must be coordinated with the IS&M Group (x4051).

Question: you wish to remove equipment from a primary area to a Radiation Area and then ship it to your home institution. What do you do?

Answer: call HP (x4660) for an activation check, and coordinate with the IS&M Group (x4051) for shipping of radioactive materials off-site.

Question: what does the posting "activation check required" mean?

Answer: upon exiting a primary cave, personnel must check each piece of equipment that they remove from the cave for "activation." Do not confuse this with "contamination check required" which means each person must "frisk" his or her hands and feet to check for loose radioactive material.

RADIOACTIVE MATERIAL CONTROL AREAS

- IF you did not bring it into a Radioactive Material Control Area and you want to bring it out, THEN you must have it checked for activation; e.g., tools you may find.

Generally, Radioactive Materials Work Areas are NOT primary areas. However, many small radioactive parts may be generated inside these areas and they will not bear any labels, although the original assembled item would have a label. Thus, as with primary areas, only trained workers may release items from these areas.

Question: true or false - only people with "Activation Worker training" may monitor, label and remove items from Radioactive Materials Work Areas.

Answer: true. Contact the RCT (x4660) to make these measurements and apply labels for you if you are not trained.

RADIATION SOURCES

Beta, gamma and neutron sources produce radiation levels that may travel many feet in air. The radiation level drops rapidly as the inverse square of distance. This is because most sources are point-like objects. Sources may be stored in shielded containers. Many secondary areas have two or more source boxes since several different Users groups may employ the same beam-line in their studies. If you are using a source in your work, then the following rules apply even if you obtained the source from another BNL Department or Division:

- Please have all sources leak-checked every six months by the AGS HP Office.

- Notify BNL's Isotopes and Special Materials Group prior to shipping a source to or from BNL (Contact the BNL IS&M Group at 516-344-5233).

- Complete the sealed-source inventory procedure and keep it with the source.

If you are responsible for a sealed source, then DOE Orders and Federal Law require you to keep track of it in a way that can be audited by the Federal government. Additionally, you must be a trained and qualified "Source Custodian." Contact the HOSS for training. The Federal rules define sealed sources as any radioactive item manufactured for the sole purpose of using the emitted radiation. A common example of a sealed source is an instrument calibration source. THE FOLLOWING ARE NOT SEALED SOURCES: smoke detectors, exit signs, activated beam-line components, activated shields, radioactive materials in-process such as targets or cooling waters, and keep-alive sources inside instruments.

If you are not sure about the definition of a sealed source, then contact the HP Office (x4660) in order to make a determination regarding the rules.

AGS Site-Specific Sealed-Source-Inventory Procedure

NOTE: IF you are responsible for a radioactive sealed-source at AGS, THEN you are a SOURCE CUSTODIAN and you must notify HP (x4660). Keep the source locked in a cabinet or box when in storage. Keep this log with the source.

IF at some future time you no longer keep the source at AGS, THEN sign the log at the appropriate space and turn this log sheet into the HP Office (x4660).

A common example of a sealed source is an instrument calibration source. THE FOLLOWING ARE NOT SEALED SOURCES: smoke detectors, exit signs, activated beam-line components, activated shields, radioactive materials in-process such as targets or cooling waters, and keep-alive sources inside instruments.

Sealed Source Custodian: _____
Print Name Phone Date

List of Source Nuclide(s) and Radioactivity, μCi (e.g., 7 μCi Ru-106): _____ _____ _____
_____ _____ _____ _____ _____ _____ _____

Locked Source Storage Location: _____

Leak Check Record (To be completed by AGS HP Office):

Date of Leak Check	Performed by (Print Name)	Performed by (Signature)	Result (OK or Leaker)	Date of Next Leak Check

Source Movement Log (To be completed by the Source Custodian):

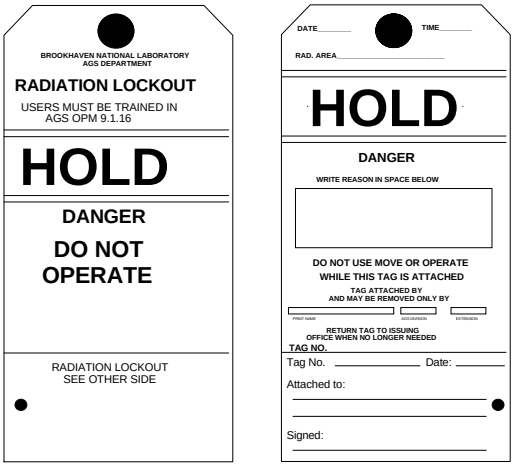
Sealed Source ID From Above List (e. g., Cs-137)	Date of Movement Within AGS Facilities	Individual in Control of Source	Date Returned to AGS Storage Location	Comment

Source removed from AGS premises: _____
Source Custodian Signature Date

The HP Office has custody of a limited number of beta and gamma emitting sources. These are available to be loaned as needed.

Care should be taken to ensure that sources are not lost or damaged, as this might result in unnecessary exposure and widespread contamination. Sources may not be moved into an uncontrolled area or away from the ion-accelerator complex. The HP Office must be contacted if sources are to be moved.

RADIATION SAFETY LOCK OUT AND TAG OUT (RS LOTO)



COLOR OF TAG IS RED

Liaison Physicists, Liaison Engineers, and members of the Radiation Safety Committee must follow a specific procedure in order to lock out and tag out equipment or beam lines for radiation protection. Equipment or beam lines are generally locked out during barrier modifications or removals, or whenever the security system alone does not provide the required protection. This lockout is required in order to limit beam parameters such as polarity and intensity, or whenever a beam line is not authorized to operate.

DO NOT alter or otherwise tamper with equipment that bears the RS LOTO tag.

SECURITY SYSTEM ORANGE TAGS

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- Program disruption and/or electrical shock may occur by overlooking an orange warning tag.
- Tags and signs are often placed only on the front of equipment.
- Look at the front of equipment before starting work.

The devices sensed by the security system must remain correctly connected. In order to help ensure that Users do not disconnect or alter these devices without following the approved procedure, the Access Controls Group has identified about 150 devices with an ORANGE WARNING TAG. Additionally, most of the Security System

wiring is maintained at 120 VAC and is an electric shock hazard.

In the experimental areas, these tags alert personnel that the device is critical to safe operation of the Security System. Scintillation detectors called NMCs (Nuclear Measurements Corporation) and chipmunk radiation monitors are part of the security system. DO NOT MOVE these devices since relocation will compromise their effectiveness.

Question: a power supply switch must be replaced and you want to disconnect all power to the supply. You encounter a circuit labeled with an Orange Tag and you want to disconnect it. What do you do?

Answer: follow instructions on the tag and get authorization to disconnect the circuit.

INTERLOCK BYPASS

- Do not take it upon yourself to bypass any interlocked system.

Interlock bypassing can only be done at the discretion of the AGS Radiation Safety Committee. Proper authorizations must be obtained prior to the bypass. The protection offered in lieu of the interlock must be equivalent, and this requirement is met by having the pertinent Liaison Physicist and the Radiation Safety Committee Chair review and approve the bypass.

ELECTRICAL SAFETY TRAINING

If you work on electrical circuits that are powered through circuit breakers, disconnect switches and / or fuses, then you must LOTO the circuits. OSHA, BNL and AGS require that all workers performing these tasks be trained.

The AGS has three courses covering electrical safety that you may be required to take and pass:

- Electrical Safety,
- Lockout / Tagout and
- Working Hot.

Electrical safety training is required if you plan to work with:

- AC voltages greater than 50 Vac,
- DC voltages greater than or equal to 50 Vdc,
- systems with greater than 10 ma of available current, or
- systems that are capable of releasing 10 joules or more of energy instantaneously.

If you have questions regarding the electrical safety training requirement for your specific situation, then please contact the AGS HOSS (x3271).

RED TAGS

Lockout/tagout (LOTO) is used everywhere at the Laboratory for personnel safety for energy sources other than ionizing radiation. You recognize it by the presence of a red tag and a lock, and you must obey specific OSHA requirements. In some cases, the

equipment cannot be locked and only the red tag is used. In most cases, however, LOTO boots or other commercially available locking devices can be added to the device to enable complete LOTO. Contact the AGS HOSS for more information.

To prevent accidental radiation exposure, electrical shock or other hazards from different sources of energy, the LOTO shall only be removed by the individual who attached it. When the individual who attached the LOTO is not available, a committee of three employees must be formed, and the membership of the committee is designated by procedure. These persons will be familiar with the area or equipment under the LOTO and they shall determine if it is safe to remove the red tag and lock. Contact the MCR or the HOSS (x3271) if you need to remove someone else's LOTO. A similar procedure is used for Radiation Safety (RS) LOTO.

All personnel that work on electrical circuits that have been powered and are controlled by circuit breakers, disconnect switches and/or fuses must LOTO the circuits. OSHA, BNL and AGS require that all workers performing these tasks be trained in LOTO. If you or members of your collaboration fall into this category, then contact the AGS Training Manager (x5800) for training.

Question: a red tag is on a piece of equipment. You need to operate the equipment, what do you do?

Answer: contact the AGS ES&H Coordinator / HOSS and ask for assistance.

CHIPMUNKS AND RADIATION SURVEYS

During a running period, radiation surveys are updated daily, and continuous area monitoring is performed by instruments, called Chipmunks, which alarm in the Main Control Room. In addition, during running periods, daily radiation surveys of the experimental floor are made by HP technicians. During shutdowns, surveys are done initially, and whenever an RWPis used. Records of the surveys are maintained by the AGS Health Physics Office. Survey data is normally attached

to the permits and copies are maintained at the job site.

Chipmunk readings are also recorded continuously and maintained in a database for later retrieval and review. Chipmunks are capable of alarming locally and are stationed at fixed locations in order to monitor high occupancy areas and other areas of interest.

Retrospective exposure rates for any area of interest can be determined by the staff at the AGS HP Office.

The Chipmunk is set up like a street light with red, yellow and green indicators. A chipmunk will display a red blinking light for radiation levels greater than 20 mrem/h, and a yellow blinking light for levels greater than 2 mrem/hr.

There are approximately 100 chipmunk-monitoring devices in use at this time. They have pre-designated alarm levels established by the Radiation Safety Committee. Main Control Room Operators are trained to respond to alarms and investigate the cause, even if it means interrupting the physics program. Drawings that show chipmunk locations are posted in the lobby near the AGS HP Office.

RADIATION SAFETY SERVICES

- Contact HP Office.
- Pager 6189 (Digital Pager).
- Phone 4660.

The ES&H Division provides the AGS with services that encompass several operational aspects of safety including radiation safety. They provide dose records and radiation surveys, HP coverage for high-dose jobs, and review of RWPs for ALARA. They also assist in re-setting secondary beam lines, and assist in interpreting abnormal radiation levels.

During running periods, HP coverage is provided on all shifts. During shutdown, services are provided from 8:30 a.m. to 4:30 p.m., Monday through Friday. Assistance is obtained by contacting the HP Office (x4660), or pocket pager 6189 (digital pager), or by contacting the AGS MCR (x4662).

Special shifts for RCTs may be pre-assigned allowing for specific round-the-clock coverage when needed during a shutdown. A few weeks advance notice should be sent to the ES&H Representative (x4882) for special HP coverage.

STOPWORK - IMMINENT DANGER PROCEDURES

This procedure provides a policy and process to stop work at BNL to mitigate ***imminent danger*** to personnel, equipment or the environment. ***Imminent danger*** exists when there is a hazard that could result in death, serious injury, environmental impairment or significant damage, and when **immediate action is required**. The person issuing the stop-work order makes determination of the need for immediate action.

Anyone who will be given unescorted status in a facility must first be trained in this procedure. Only persons trained in this procedure have stop-work authority. For example, casual visitors to BNL and other untrained individuals do not have this stop-

work authority. Persons who are not trained for unescorted access are still expected to call attention to any questionable or unsafe act or condition. Management shall take such notification seriously and make an evaluation.

Laboratory managers and supervisors shall not allow hazardous work to be started unless the involved worker(s) are trained and qualified in this stop-work procedure.

BNL functional organizations on the BNL Organization Chart (e.g., Departments, Divisions, Offices, Projects, etc.) shall be referred to as Departments for the purpose of this procedure.

Persons trained in this procedure are responsible for and expected to issue a Stop-Work order for ***imminent danger*** whenever it is observed. Each Department shall train all staff under their direct supervision in the provisions of this procedure. If an employee is reassigned to work for another supervisor for a period of time, the new supervisor must ensure facility specific stop-work training is conducted prior to allowing work to commence. Each Department is responsible to integrate and document stop-work training for employees, guests, and users who will be granted unescorted access within facilities under their purview. The training shall include discussion of applicable Department-specific stop-work examples of ***imminent danger***.

Requests to change this procedure must be forwarded to the BNL Laboratory Director.

This procedure is used to stop work when conditions that are interpreted to constitute imminent danger occur. **Other procedures shall be used to prevent people from taking unnecessary risks with lesser hazards or for stopping radiological work.**

Any person who reasonably concludes that an ***imminent danger*** exists and that immediate action is required to mitigate the danger is obliged to take action to stop work. An ***imminent danger*** exists if proceeding with work could result in death, serious injury, or significant unexpected environmental or equipment damage. A person who concludes that an ***imminent danger*** exists must consider whether stopping work immediately or proceeding to a safe stopping point constitutes the greater danger.

Procedure

1. The initiator of a Stop-Work order for ***imminent danger*** shall state the following:
   "Stop work! You are in imminent danger because…"
2. Any person receiving a Stop-Work order shall stop work immediately, if that can be done safely, or at the first opportunity to stop safely.
3. The person issuing a Stop-Work order MUST NOT verbally or physically interfere, whether or not the recipients of the Stop-Work order continue to work.
4. After the work is stopped, the recipient of the Stop-Work order shall notify his/her supervisor (Liaison Physicist) and his/her ES&H Coordinator that a Stop-Work order was issued, and of the nature of the ***imminent danger*** that exists.

Notifications

The person initiating a Stop-Work order shall identify him/herself to the affected workers as soon as it is safe to do so. In turn, the supervisor of the involved work shall notify his departmental management.

If the person issuing the Stop-Work order feels that the recipient(s) of the order failed to take appropriate action, then the initiator of the Stop-Work order shall notify his/her own supervisor (Liaison Physicist) and the

AGS ES&H Coordinator (x3271, pager 4210). If more than one Department is affected by the Stop-Work order, then the person initiating the Stop-Work order shall notify the AGS ES&H Coordinator and the ES&H Coordinator of the other Department.

The supervisor and the ES&H Coordinator shall investigate and evaluate the need for further action or internal or external reporting. Management shall resolve appropriate issues in cases where the recipient of a stop-work order is not compliant with this procedure. There will be no reprisals by anyone for issuance of a stop-work order.

Following a stop-work order, the AGS Department Chair or his designate shall determine, with advice and counsel from ES&H personnel, the conditions that must be met before work may resume. Input into conditions for restart shall also be sought from the person who initiated the stop-work. Work shall not be resumed until appropriate corrective actions and safety reviews are completed and the responsible manager authorizes restart.

RADIOLOGICAL STOP WORK PROCEDURE

This procedure provides a mechanism for trained Laboratory employees, guests, and contractors to stop radiological work that does not meet Laboratory requirements or creates the threat of radiological exposures or releases. The Laboratory has previously issued a procedure for stopping work when conditions constituting "Imminent Hazard" exist. This radiological stop-work procedure utilizes the requirements and process established in the imminent hazard procedure fully, except that different criteria are described for the conditions under which a radiological stop-work order may be given. Because of the nature of radiological work, stop-work criteria are provided for certain situations that would not be considered "Imminent Hazard."

Improvement of radiological performance is a high priority at BNL. All workers trained in the radiological stop-work procedure have the responsibility to improve performance by providing careful attention to his/her performance and to that of co-workers. In support of this procedure:

- Each worker is expected to point out and insure correction of poor radiological work practices whenever they occur. In most cases, all that should be necessary is calling attention to the problem.
- All workers are expected to respond positively to radiological cautions provided by a co-worker.
- There may be situations where a formal stop-work is necessary. Any worker trained on this procedure is authorized to stop radiological work when the conditions defined in Section IV are met.
- All personnel are expected to immediately abide by a stop-work instruction.

It should be noted that the supervisors do not need to invoke a Stop-Work Order in exercising their normal responsibilities to monitor work in progress and to ensure proper adherence to BNL practices.

Whenever poor radiological performance is observed, workers should provide immediate advice to correct the problem**.** In most situations, a formal stop-work is not needed. The concern should be addressed quickly without participation and review by other

than the involved workers. The imminent occurrence of the following examples are the types of situations that should be immediately corrected with a cautioning:

- Entry into a Controlled Area without proper training or escort.
- TLD worn on the wrong location on the body.
- Work about to begin without observing expected requirements.
- Removal of material without observing exit survey requirements from a location controlled as a Contamination or Activation Area.
- Beginning work without adequate Work Planning or training qualification.
- Touching the face or other exposed skin while working in a contamination area.
- Survey for radioactivity performed in a hasty manner.
- Disturbance of radiological postings or barriers.

Each of these activities, if not promptly addressed, could lead to a violation of federal and BNL radiation protection requirements.

IV. Stopping Radiological Work

1. Many poor practices can be quickly corrected through the cautioning process before violations occur. There may be occasions when an employee observes a practice that is most likely a violation already, or possesses the potential to result in significant radiological exposure or release of radioactive material. In these situations, the work should be immediately stopped through a formal "Stop-Work" instruction; and follow-up reviews conducted to correct the problem prior to work continuing.

   Examples of this type of situation are:

   - Discovery of work that is being conducted without adequate Work Planning, such as work in a High Radiation Area or a Contamination Area without a RWP.
   - Blatant or repeated disregard of established radiological requirements or direction from a health physics technician.
   - Operation of radiation-producing equipment with interlocks bypassed without prior review and approval.
   - Radiological controls that are inadequate for work in progress as evidenced by:
     - Unplanned exposures greater than 50 mrem to a visitor or minor, or greater than 100 mrem to a worker.
     - Two or more skin contaminations during any single phase of the work.
     - Any single skin contamination >50,000 dpm/100cm^2 .

2. In these situations, the work should be stopped by any trained individual using the following language. "**Stop work. You are in violation of radiological requirements because ……**"

3. When a stop-work order has been given, the following actions shall occur:

- All work in the affected activity shall stop as soon as possible.
- The work place shall be placed in a safe condition.
- All workers shall report to the responsible line manager.
- Work shall not resume until appropriate safety reviews are performed and restart is authorized by the AGS Department Chair or his designate, subject to the advice and counsel of the affected ESH Coordinator(s) and the BNL Radiological Control Manager.
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REMOVING DAMAGED EQUIPMENT FROM SERVICE

If any equipment presents an immediate hazard that could reasonably be expected to cause serious injury or environmental harm, then you must remove it from service (e.g., broken ladders, frayed slings, defective power cords, leaking tanks).

ACCOUNTABILITY FOR NOT FOLLOWING THE RULES

Perform exactly the requirements in AGS procedures or cause those requirements to be officially changed to what the AGS Department needs. This policy applies to all Users and will be enforced everywhere. You will be held accountable to follow rules and procedures for which you have been trained.

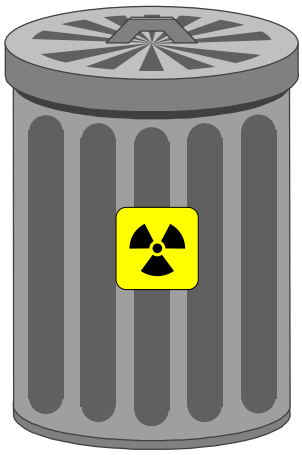
STAFFING LEVELS AND SAFETY

Rules shall be followed even when you are short-handed. Do not violate safety rules to get the job done. For example, do not go down one-way streets the wrong way even if you get to the beam-line quicker. Do not climb cable tray because it takes more time to ask for a man-lift. Do not use a procedure that you have not been trained on even if you feel it will please your Experiment Spokesperson. IF you were called in unexpectedly and you were not physically or mentally ready to work, THEN you must request the next person on the call down list be contacted. In short, there are no economics for safety. It will always be cheaper to do the job right the first time. There is only a cost for failure, and experience shows this cost can be spectacular.

WASTE DISPOSAL

CAUTION:

Improper disposal of radioactive or hazardous waste may result in fines, criminal prosecution, and facility shutdown. Contact the AGS Environmental Coordinator (x7520) prior to establishing any airborne, liquid or solid radioactive- or hazardous-waste-stream. The AGS Environmental Coordinator is familiar with rules, permits, authorizations and analysis requirements necessary for proper disposal



Removing waste from the Laboratory is complex and costly. Your cooperation is necessary in order to control waste according to Federal, State, and Suffolk County regulations. Additionally, the regulations of States where waste from AGS is ultimately disposed of must also be followed.

- Do not place clean materials in the radioactive waste bins.
- Do not place radioactive materials in the green 3-yard bins used for clean waste.
- Substitute reusable materials where possible.
- Use minimum quantities of materials.
- Segregate wastes.
- Do not leave unnecessary items in primary areas.

Each person is responsible to ensure that they handle, accumulate or dispose of waste by using adequate controls and documentation. Waste generators at the AGS must check all waste to ensure that it is not radioactive. Generators of hazardous or radioactive waste at the AGS should minimize the amount of waste they generate by substituting re-usable materials where possible, irradiating or using minimum quantities of materials, and segregating different wastes to allow for reclamation.

For example, we re-use radioactive lead whenever possible since it would become a mixed hazardous and radioactive waste.

Activated lead is an example of mixed waste. It is both hazardous and radioactive. Do not put mixed waste in radioactive waste cans. Aside from activated Pb, another example of mixed waste is activated oil.

Do not throw clean metals into waste cans used for ordinary clean waste. Non-radioactive metals should be re-cycled. Metals in our clean waste stream are a problem since the Brookhaven Town Landfill will refuse BNL's clean waste if they find metal in it.

The AGS wishes to minimize radioactive waste, which is currently between 3000 and 4000 ft^3 per year. Packaging materials, coffee cups and the like should not be thrown into the radioactive waste cans. Do not put ordinary clean waste in the radioactive waste stream. This increases the radioactive waste cost. The current cost is about \$150 per ft^3.

Question: you have to throw out empty cans of a liquid chemical, which you have used, to clean equipment. You realize the liquid itself may require special handling, but the containers are dry. What do you do?

Answer: initially treat the container as hazardous waste and contact the AGS Environmental Coordinator (x7520) to learn the proper disposal technique.

SPILLS

The AGS is mandated to report spills should that be necessary. The AGS must always report quickly to outside agencies on events that deal with impacting the environment, even on minor events such as spilling any amount of oil in an outdoor area. The rules are such that we must *consider* reporting spills of any type or size. IF you spill any liquid, either inside or outdoors, THEN contact the AGS Main Control Room, the AGS HOSS or the AGS Environmental Coordinator (x7520) as soon as you can. DO NOT leave a message on an answering machine.

IF you cannot contact the above personnel, THEN call x2222 or 911. Report the spill giving your name plus information on the location of the spill and the type of material involved if you know it.

RESPONSE TO ABNORMAL RADIOLOGICAL CONDITION:

CRASH BUTTONS / CRASH CORDS

- IF the lights go out while you are in the primary areas, THEN hit the crash button since beam is imminent.
- Crash buttons are red and mushroom shaped. Doors have crash bars.
- Orange crash cords are mounted on the tunnel walls in the U-V, V Target and upstream W lines, BUT the lights DO NOT go out when beam is ready. INSTEAD an alarm will sound for 30 seconds and red-flashing strobe lights will illuminate the area.
- IF you observe a visual warning, THEN, start for the nearest crash button, or start for the crash cord, or start for the exit.
- If the lights go out, then do not assume it is a power failure.
- DO NOT PANIC, you have time, 30 seconds minimum.

- Hitting crash buttons or opening doors will turn lights on.

Pressing crash buttons causes the beam stops to insert, lights to go on, and interrupts electrical energy to the main magnet bus and RF devices. Crash buttons are located at several locations in the muon-storage-ring area of Building 919, and along the primary beam lines. There are also crash buttons located in several secondary beam lines. They are labeled with a red sign.

Orange crash cords are in use in the AGS to RHIC Transfer Line (AtR). Pulling a crash cord causes the beam stops to be inserted.

One can always crash into or out of any primary area. Pushing the crash bar on primary gates in Building 912 will cause the lights to go on and beam to be inhibited. After pushing a crash button, crash cord or crash bar, call the MCR and notify them where you are located.

Question: if the light goes out in an AGS primary area, should it be assumed that loss of electrical power occurred?

Answer: it should be assumed that the lights have dimmed in order to signal that lethal hazards are imminent. You should press the nearest crash button in order to turn the lights on and disable beam.

ABNORMAL RADIATION LEVEL

IF you encounter either of the following conditions:

- Radiation levels not anticipated on your RWP.
- Unexpected high or full-scale dosimeter readings.

THEN stop work, alert your liaison physicist or Experiment Spokesperson and contact Health Physics (x4660) as soon as possible.

EMERGENCY DOSE FOR RESCUE OR RECOVERY

All persons must follow the instructions of the Department Emergency Coordinator (DEC) who is the Operations Coordinator during operations. During shutdown periods and maintenance periods, the AGS HOSS is the DEC. IF an emergency requires rescue of personnel and involves substantial risk, THEN volunteers may be selected based on their age, experience and prior dose history. These rescues are to be pre-planned activities and are not to be "heroic efforts to save a friend." The DOE and BNL emergency dose limits are:

- 10 rem for protecting major property where the lower dose limit of 5 rem is not practicable.
- 25 rem for life saving or protection of large populations where the lower dose limit is not practicable.
- 25 rem or greater is allowed only on a voluntary basis and only when a person is fully aware of the risks involved.

FIRE OR OTHER EMERGENCY

IF you work in a primary area, THEN make a mental note of:

- Exits.
- Fire Alarm Pull Boxes.

- Crash buttons.
- Crash cords.
- Inter phones.
- Emergency exhaust, if any .
- Phones (MCR x4662, Fire/Rescue x2222, x911).

Question: you need immediate help in an emergency. What do you do?

Answer: pull a fire alarm box, call x2222 or x911, or call the MCR x4662. All of these are OK but your best response is to pull a fire alarm box since it will be easier to quickly determine your location, and you simultaneously alert the AGS MCR and the BNL Fire/Rescue Group. Once pulled, you should also try to call x911 to alert them as to the exact nature of the emergency.

Question: there is a fire near your detectors and they contain isobutane, what do you do?

Answer: warn others, pull the fire alarm box and evacuate the building.

In any emergency, one can and is encouraged to pull a fire alarm box; it does not have to be a fire. Fire alarm boxes are located through out the accelerators and at the entrances to target caves. They are the best method to simultaneously alert MCR and the ES&H Fire/Rescue Group. Pulling a fire alarm box brings the Fire/Rescue Group to your specific alarm-box location within two minutes, and appropriate additional personnel can be summoned right away. We note that if it possible to follow up with a phone call, then you should do so.

Rings and caves are confined spaces. If fire should break out, then smoke could quickly impair visibility, and asphyxiation from smoke is a possibility. If fire breaks out, then get out immediately. Emergency exit signs will point you to the nearest exit.

Once outside a smoky area, report to the Local Emergency Coordinator (LEC) or the Department Emergency Coordinator (DEC) if they are present. They will be wearing baseball-like caps marked DEC or LEC. Do not chat with the Fire Captain or other emergency response personnel in the area. Obey the directions of the Fire Captain, DEC or LEC.

AGS SIGNALS

Even if you are inside an AGS primary area, then you must obey the emergency signals as follows:
If you hear a Pulsating AGS Klaxon, Intermittent or Continuous Fire Alarm Bell, evacuate the area after placing equipment in a safe operating mode. The Main Control Room Personnel, Operations Personnel, and Hydrogen Target Watch Personnel must remain on station if they have emergency duties, but will evacuate during imminent danger situations. Personnel will then assemble in the lobby of building 911 (Synder Seminar Room Area)

BNL SITE SIRENS

- IF you hear a continuous site-wide siren for five minutes, THEN leave the area and assemble in the lobby of Building 911.
- IF you hear a pulsating site-wide siren, THEN evacuate the BNL site.

The site evacuation plan covers other facilities on-site including reactors. The site sirens are tested each Monday at noon. If

you hear a continuous site siren for a five-minute duration, then assemble in the Building 911 lobby near the Snyder Seminar Room. If you hear an intermittent site siren, then evacuate the BNL site immediately.

Question: if you hear the intermittent fire alarm or a pulsating AGS klaxon, then what should you do?

Answer: assemble in the lobby of Building 911.

Question: continuous sounding of the site sirens for five minutes means what?

Answer: proceed to the lobby of Building 911.

ACTIONS FOLLOWING AN INJURY/ILLNESS

- IF there is an emergency involving an injury or an illness such as a heart attack, THEN pull the fire alarm box, and follow up with a call to x2222 or x911 if you can.
- IF you are injured, THEN report as soon as possible to the BNL Industrial Medicine Clinic, which is located in Building 490.

COMPRESSED GAS SAFETY

ALL COMPRESSED GASES ARE HAZARDOUS DUE TO HIGH PRESSURE.

COMPRESSED GASES **MAY ALSO** BE HAZARDOUS **BECAUSE THEY *ARE*:**

TOXIC: Gases that are poisonous in varying degrees ranging from extremely dangerous to life to only an irritant. Exposures to the more toxic gases can cause severe illness or death. Typical examples of poisonous gases are Sulfur Hexaflouride, Carbon Monoxide, and Hydrogen Sulfide.

FLAMMABLE: A condition that results when even small quantities of a specific gas when mixed with air forms a mixture that is capable of being ignited. Once ignited, the burning gas mixture can ignite other nearby combustible materials. Typical flammable gases are Acetylene, Hydrogen, and Methane.

CORROSIVE: Corrosive materials can cause visible destruction or irreversible injury to human skin and eyes (similar to a burn) at the site of contact or can cause serious degradation of various construction materials, such as steel, or brass. An example of a corrosive gas is Chlorine.

OXIDIZERS: A gas that supports or enhances combustion. These gases must be handled with caution since they increase the potential of fire or explosion. They require special storage considerations. Typical oxidizer gases are Oxygen, Chlorine, Fluorine, and Nitrogen Oxides.

ASHYXIANT (oxygen displacement): Asphyxiation is a condition which results when a gas reduces the concentration of breathable oxygen to a hazardous level in air by displacing and diluting normal air. Typically all gases other than oxygen and air can do this.

CYLINDER RECEIPT AND CONTENT IDENTIFICATION

Because of the different hazards associated with different gases, it's important that cylinders be properly labeled. When a cylinder is delivered to the gas warehouse, a laboratory, or a job site, it should have (1) content identification by stenciling or labels, the personnel at the BNL Gas Warehouse will Attach a Cylinder Status Tag on the cylinder when it is delivered , 2) DOT label, and (3) a valve protection cap. **UNDER NO CIRCUMSTANCE** should the means of identification be removed from a cylinder. The valve protection cap should remain in place until the user has secured the cylinder to a fixed support at the point of use and is ready to attach a pressure regulator to withdraw the contents.

Sometimes cylinders are received with no identification other then color code. There is no uniformity in the identification of cylinder contents through color coding of the cylinders. **Under no circumstances should such cylinders be accepted.**

DOT labels have a minimum of precautionary handling information and will classify the cylinder contents.

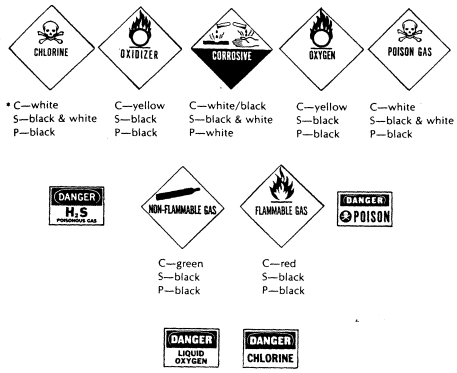
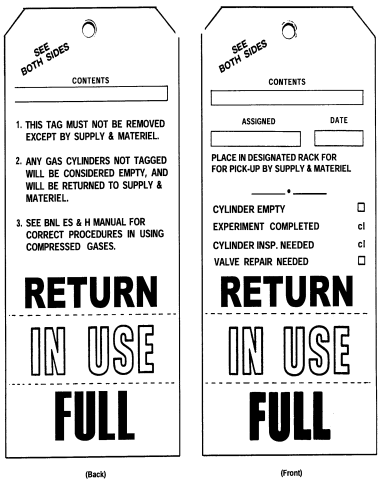


Figure IV-1
Safety Signs

The personnel at the BNL Gas Warehouse will attach a Cylinder Status Tag on the cylinder when it is delivered.



GENERAL RULES FOR CYLINDER HANDLING

- Do not drop cylinders or permit them to violently strike each other
- Do not roll cylinders in a horizontal position
- Do not drag cylinders
- Do not handle cylinders with oily hands or oily gloves (This is especially important when handling oxygen and other oxidizers)
- If hoisting is necessary, use a suitable cradle or platform
- Do not lift a cylinder by its cap
- Keep cylinder caps on the cylinder whenever they are not in use
- Transport cylinders using a cart or hand truck designed for that purpose
- Whenever placing a cylinder in service, check the hydrostatic test date
- Tear off the bottom of the Cylinder Status Tag and write name of assigned user on tag indicating the cylinder is in use

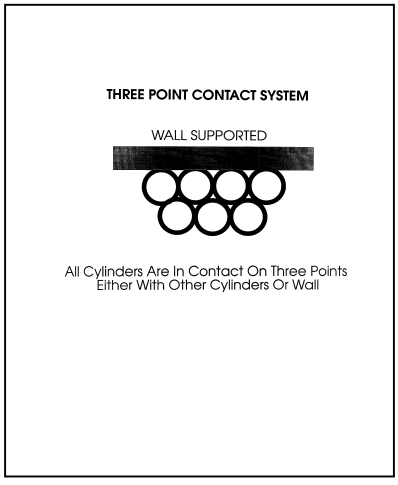
COMPRESSED GAS CYLINDER SAFE STOREAGE

- Storage areas should be dry, cool , and well ventilated, and where practical, fire resistant
- Gases of different types are to be grouped by type and non-compatible types should be separated. Flammable gases shall not be stored with oxidizing gases.
- Cylinder storage areas are to be prominently posted with the types of gases stored
- Charged and empty cylinders should be stored separately. Cylinders should be arranged so that old stock can be removed first with a minimum handling of other cylinders
- Cylinders should not be stored at temperatures above 125 ^{0}F, (52^{0} C) or near sources of heat.
- Cylinders should not be stored near highly flammable or combustible materials.

- When cylinders are being moved on a cylinder cart, they must be secured to the cart

SECURING CYLINDERS

Safe methods for securing capped compressed gas cylinders in storage include the three-point contact system. By restraining cylinders in a tight mass using a contiguous three - point system with other cylinders or solid support structure. All compressed gas cylinders shall be secured to prevent falling. An appropriate method for securing cylinders is by providing a substantial chain, which is positioned in front of, or around the cylinder(s) and secured to a solid structure.



OXYGEN DEFICIENCY HAZARDS

What is oxygen deficiency? Normal atmospheric content is 20.9% oxygen, 78% nitrogen, and 1% argon. Oxygen deficiency is defined as less than 19.5 % oxygen. This happens when air in an enclosed space is displaced by another gas.

What causes oxygen deficiency? Cryogenic systems use large amounts of helium and nitrogen. Both liquids expand about 700-800 times when released into air. This could happen quickly with a major release as a result catastrophic failure. In a major release, one might see a rapidly expanding white cloud and hear a "whooshing " sound. The leak could also be slow, invisible and silent. Both helium and nitrogen are colorless and odorless.

HEALTH EFFECTS OF OXYGEN DEFICIENCY

The following table summarizes the health effects of oxygen deficiency.

Volume % O	Effect on Healthy Person	Approximate Time
17	Deep Breathing Rapidly Faster Heartbeat	
16	Dizziness, Slower Reaction Time	Rapidly
15	Impaired Attention And Coordination, Intermittent Breathing, Rapid Fatigue, Loss Of Muscle Control	Rapidly
12	Very Faulty Judgement, Inability To Move, Loss Of Consciousness, Brain Damage	10 Min 10 Min 2 Hours
10	Inability To Move, Nausea, Vomiting, Loss Of Consciousness	4 Min 10 Min
6	Loss of Consciousness Coma Death	30 sec 1 min 5 min

CLASSIFICATION LEVELS OF ODH

There are five classes: 0 through 4, with 0 being the least hazardous. Classification is based on the likelihood of ODH. There are no areas at RHIC or AGS with classification greater than Class 1. Two areas, 1005R refrigerator and g-2 refrigerator are Class 1. Additional control measures and training are required for entry into a Class 1 ODH area.

This access training allows you to enter the following Class 0 areas at AGS:

- g-2 Compressor Building,
- g-2 Muon Ring Storage Building (High Bay), and
- EVA Compressor Room (E850), EEBA Rectifier House #3.
-

WHEN IS EVACUATION OF AN ODH AREA REQUIRED?

Any one or combination of the following requires an immediate evacuation of an ODH area:

- The in-place oxygen monitors set off an alarm.
- A vapor cloud is observed inside the ODH area or a loud "whooshing" sound is heard (even if no alarm sounds).

The evacuation procedure is as follows:

- Leave the area, moving away from any vapor cloud or other potential problem.

- If someone is in danger, hurt or feeling ill, call 2222 or 911. Otherwise, call the Control Room.

It is important to remember that you should not re-enter even with an escape pack. Let the Fire/Rescue Group handle it. ODH deaths usually come in pairs; more than 50% of ODH deaths are of would be rescuers. One or two breaths could cause loss of consciousness under certain conditions, and lung damage is possible if the gas cloud temperature is -50 to -70 ºC.

FREQUENTLY ASKED QUESTIONS AND ANSWERS

The answers to these questions provide limited guidance and they are intended to help you plan your experiment at the AGS. Consult your liaison engineer or liaison physicist for more detailed information.

Do I really need to hang my TLD badge up every day?

Yes. TLD badges are required to be left at the assigned station or rack at the end of the workday, and must not be taken outside the Laboratory. TLD storage racks are located in low-background areas in Building 911 near the AGS Training Office. If you leave your TLD badge at the work area or the counting house instead of using a rack, then unwarranted dose may be recorded.

Ninety per cent of the lost badges have been as a result of AGS experimenters taking them off-site and not returning them, especially at the conclusion of an experimental run. Getting used to putting the badge on the rack at the end-of-shift will help alleviate the problem of un-returned badges.

Does a senior User have to be present during every shift?

During beam operations, all shifts must be staffed by at least one person experienced in operation of the experiment. He or she should be aware of proper response to alarms for normal maintenance actions such as change-out of gas cylinders, and alarms for emergency actions. Emergency actions may include closing-off flowing gas or

cutting power. Senior Users should also be aware of access controls for the experimental area and operations procedures for the gas-mixing systems if appropriate. In order not to staff the experiment during idle periods, gas flow must be throttled down and high voltages must be reduced.

Do Users need to have written procedures?

The AGS Department conducts its operation using formal written procedures in a style prescribed by DOE Orders. DOE currently desires uniform operations through out its facilities but recognizes that Users must apply a graded approach commensurate with the hazards and programmatic importance of their experiment. Users at the AGS should write down all procedures or protocols with safety implications such as mixing flammable gases, opening/closing vacuum window shutters, or the actions to be followed in an emergency. Users should follow all requirements of sweep procedures if they are allowed to assist in the sweep of their secondary area.

In addition to written procedures, the experimental areas should be orderly and clean at all times. Keep all gas lines, power lines and water lines labeled and in separate raceways. Label all containers of liquids. Keep combustible materials to a minimum.

Do all changes to an experiment need to be brought before the AGS Experiment Safety Review Committee?

Inform the Liaison Physicist about all changes to the experiment. He will know if further review is needed. In addition to keeping the AGS informed, you should share knowledge about the rules with all members of the collaboration. For example, all Users should be aware of any local actions to be followed in response to a hydrogen alarm or a fire alarm. Users should be aware of the hazards associated with protective systems such as halon fire protection. They should know of hazards associated with the experimental equipment such as vacuum windows, enclosed spaces or pressurized devices. Additionally, Users should be aware of the harmful nature of any hazardous materials in use.

Should Users assume the safety committees have made the experiment safe, or should Users continue to minimize hazards?

It is preferable to engineer all hazards out of an experiment. The AGS Department safety review committees try to ensure that safe or acceptable configurations are planned. In some cases, the plans are not followed or subtle hazards appear after the experiment is built. Common problems that arise after review of an experiment are:

1) bottled gases with suitable pressure do not have two-stage regulators,
2) flammable gas lines are not properly supported or labeled; plastic is used between the regulator and the flow limiter even though metal lines are required,
3) more than a reasonable supply of flammable gas is stored inside the experimental halls,
4) gas cylinders are improperly secured,
5) cable trays are used as tables or work surfaces, and
6) wood and plastic packing materials are stockpiled in or around the beam line.

If you feel some area or apparatus or practice is not safe, then say so. The AGS management will back you up and investigate.

Are there special permits required to emit gases from detectors?

The AGS has been reviewed for air-permit release-points by New York State. No permit has been required by Users to date; however, we have had to build a Freon recovery unit at the last minute. Prior to each experiment, the AGS Experimental Safety Review Committee and the Liaison Physicist must review the gas flows for all the detectors. For any release, the liaison physicist must submit a completed Effluent Evaluation Form in order to check the need for a permit.

REMOTE CONTROLLED ACCESS INTO GATES UGE2 AND UGE3, SPECIFIC TO EXPERIMENT E933 AND E945B.

Remote controlled access (RCA) will be used at security entrance gates, UGE2 and UGE3, located in the U-line. Entrance to these gates require the experimental collaborators obtain a CA (EB005) key from the Main Control Room (MCR). The entrants will be required to pass this training and have a valid laboratory identification card. All entries require the presence of a qualified E933 User (Q clearance) whenever a classified object is in the U-line. The radiological posting of this area is **Radiation Area with Beam Off. TLD Required.** An activation check is required for all materials that were in the U-line when beam was present, prior to removal of these materials from the area. A brief outline of the entry-exit process is described below. Refer to the AGS Temporary Operations Procedure, TPL-99-16 Operations for E933—Proton Radiography, when on-site for specific details of the entry-exit procedures.

- Entrants shall obtain a CA key from MCR.
- Entrant shall telephone MCR, x7400, when they arrive at gate to enter or exit.
- Entrant shall hold up ID card and CA key to the camera as per MCR instructions.
- The CA key is inserted into the lock and turned with a simultaneous release from the MCR.
- Upon completion of the task in U-line the entrant shall return to MCR and surrender the CA key.

STRICT ADHERENCE TO THE RCA PROTOCOL DESCRIBED IN THE AGS OPM TPL-99-16 SHALL BE ENFORCED.

MANAGEMENT WILL PURSUE DISCIPLINARY ACTIONS FOR NON CONFORMANCES.

LIST OF ACRONYMS

AGS - Alternating Gradient Synchrotron
ALARA - As Low As Reasonable Achievable
BNL - Brookhaven National Laboratory
BSA – Brookhaven Science Associates
DEC - Department Emergency Coordinator
DOE - United States Department of Energy
EP&S - Experimental Planning and Support Division, a Division of the AGS Department
FEB - Fast Extracted Beam
HOSS - Head of Safety Section
HP - Health Physics
LEC - Local Emergency Coordinator
LOTO - Lock Out Tag Out
MCR - Main Control Room
OC - Operations Coordinator
ODH – Oxygen Deficiency Hazard
OSHA - United States Occupational Health and Safety Administration
PAAA – Price Anderson Act Amendments
RCD – Radiation Control Division
RCT- Radiological Control Technician
RHIC - Relativistic Heavy Ion Collider
RWP - Radiation Work Permit
SEB - Slow Extracted Beam
SRD - Self-Reading Dosimeter
TLD - Thermo-Luminescent Dosimeter