

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY  
- LIGO -  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Document Type	LIGO-G980044-00-	C	6/24/98
<b>LIGO Hanford Laser Safety Presentation View Graphs</b>			
Douglas G. Cook			

*Distribution of this draft:*

xyz

This is an internal working note  
of the LIGO Project..

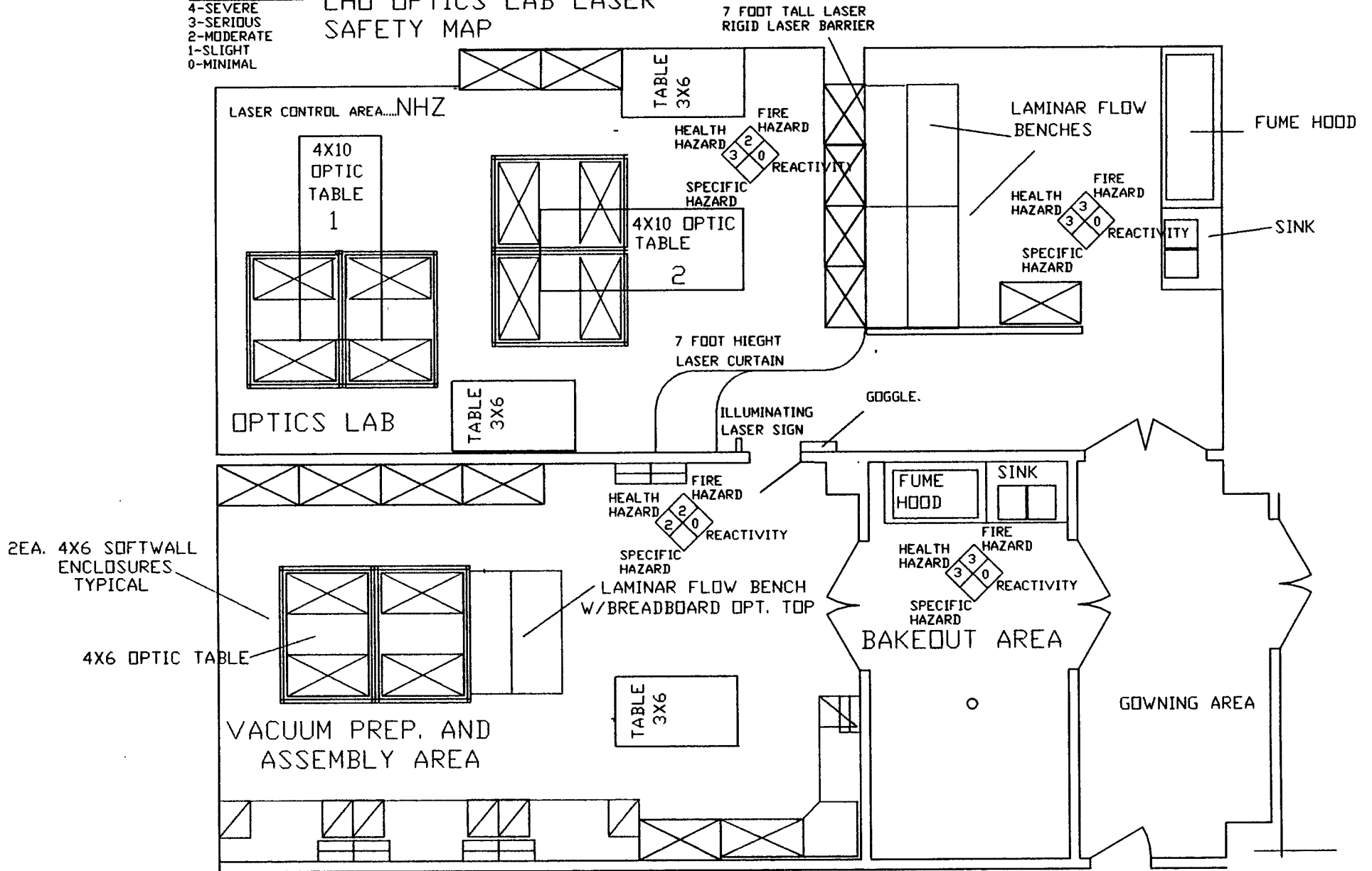
**California Institute of Technology**  
**LIGO Project - MS 51-33**  
**Pasadena CA 91125**  
Phone (818) 395-2129  
Fax (818) 304-9834  
E-mail: info@ligo.caltech.edu

**Massachusetts Institute of Technology**  
**LIGO Project - MS 20B-145**  
**Cambridge, MA 01239**  
Phone (617) 253-4824  
Fax (617) 253-7014  
E-mail: info@ligo.mit.edu

WWW: <http://www.ligo.caltech.edu/>

HAZARD RATINGS  
 4-SEVERE  
 3-SERIOUS  
 2-MODERATE  
 1-SLIGHT  
 0-MINIMAL

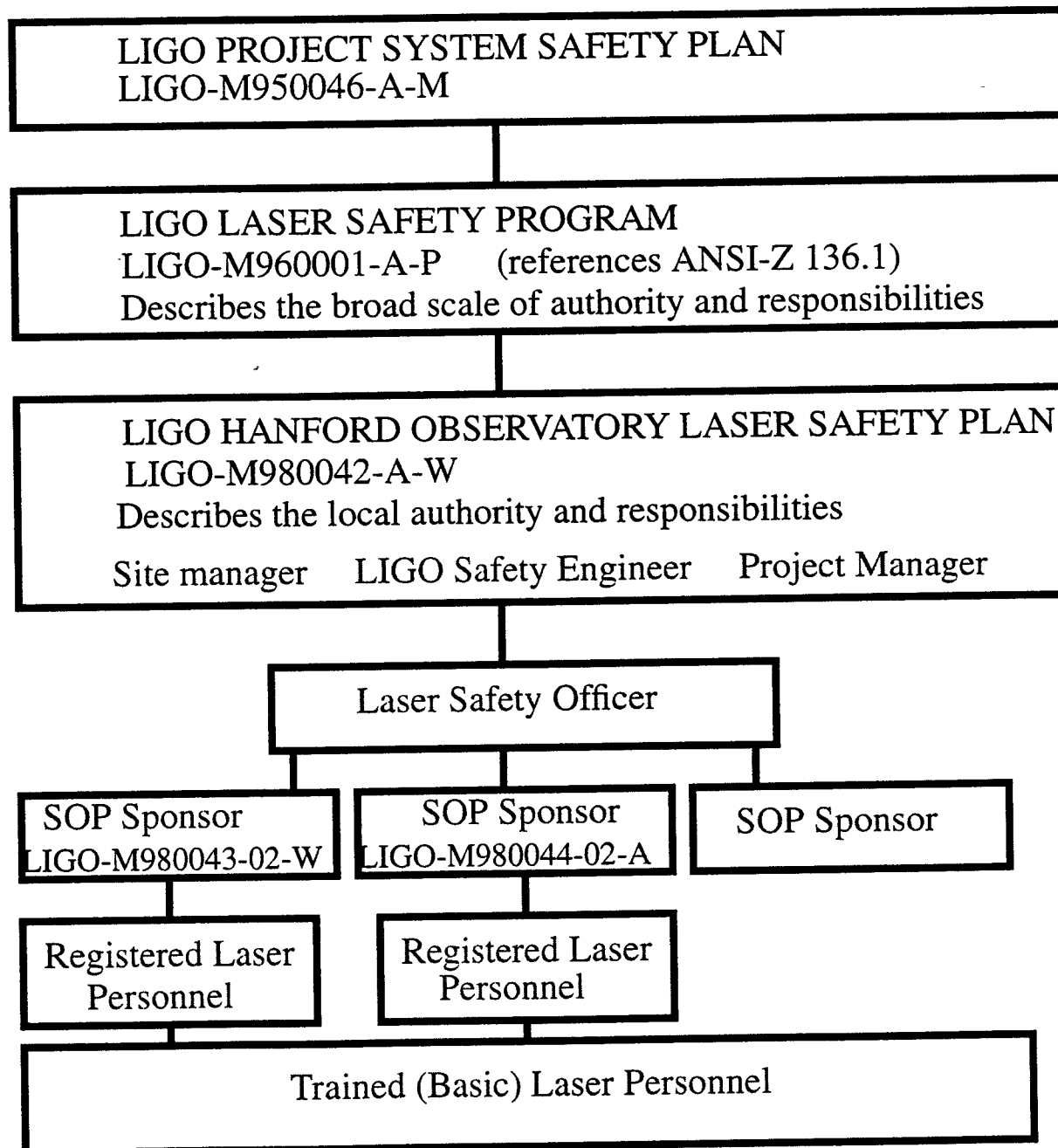
LHO OPTICS LAB LASER  
 SAFETY MAP



ALL OF THE LASER CONTROL AREA FIGURE 1  
 LOCATED BEHIND THE CURTAIN IS  
 CONSIDERED THE NHZ ZONE

1'X36"X246 3/4"

# LIGO Hanford Laser Safety Plan As Currently Implemented



# Laser Safety Officer

---

**The LSO has the responsibility and authority to monitor and enforce the control of laser hazards at the LIGO Hanford Observatory**

- **Tasks: in short**
  - ›› Maintaining list of laser inventory
  - ›› Maintaining up-to-date listings of authorized personnel
  - ›› Ensuring necessary safety equipment is provided
  - ›› Providing basic laser safety training
  - ›› Coordinating “baseline” and ‘termination’ exe exams
  - ›› Assisting sponsors with generating Standard Operating Procedures (SOPs)
  - ›› Approving SOPs

See LIGO-M980042-A-W, Section 1.3-A for details

# Standard Operating Procedure

## Sponsors

---

- Sponsors are experienced laser personnel who have a need to install a laser system.
- Sponsor should be familiar with ANSI-Z 136.1 requirements, LIGO Laser Safety Program and have completed the LIGO Hanford Basic Laser Safety Program.
- Sponsors must prepare and obtain approval of a Standard Operating Procedure for their laser system or area.
- These areas are to have restricted access, entered only by personnel authorized by the system Sponsor or the LSO.

# Standard Operating Procedure

## Sponsors (cont.)

---

- Personnel needing to enter or work in this restricted access area, without an escort, need to become a Registered Laser Personnel by already having satisfactorily completed the LIGO Hanford Basic Laser Safety Training, and having been provided with any additional, specific precautions, by the system Sponsor.
- The names of the personnel that they authorized must be entered on the list near the entrance to the restricted access area along with their signature as the sponsor.

# Registered Laser Personnel

---

- Must conduct all activities in accordance with approved Standard Operating Procedures.
- Must comply with all the requirements of the LIGO Laser Safety Program.
- Must have completed the LIGO Hanford Observatory Basic Laser Safety Training Program.

# Basic Trained Laser Personnel

---

Minimum mandatory requirements for working around lasers at the LIGO Hanford Observatory

- Must have completed the required Laser Referral Eye Exam referred to as the “Baseline” eye exam. Appendix 1 of LIGO-M980042-A-W.
- Must have viewed and understood the two Laser Safety videos.
- Must understand the HAZARDS and the PERSONNEL PROTECTIVE EQUIPMENT associated with working around the LIGO laser systems.
- Must have read and understood LIGO M980042-A-W and have a copy.
- Must have signed the Certificate of Training.
- Know the Emergency Procedures



# Registered Laser Personnel

---

**Description of Laser System or Area:** LIGO 10-W laser in Optics Lab

**Sponsor:** Rick Savage

**Registered Laser Personnel Authorized to enter and /or use this system:**

<u>Name:</u>	<u>Date:</u>	<u>Sponsor 's Signature:</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____



# Registered Laser Personnel

---

Description of Laser System or Area: AOC 990 laser in Optics Laboratory

Sponsor: Daniel Sigg

Registered Laser Personnel Authorized to enter and /or use this system:

<u>Name:</u>	<u>Date:</u>	<u>Sponsor 's Signature:</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____



LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY  
- LIGO -

CALIFORNIA INSTITUTE OF TECHNOLOGY  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Document Type	LIGO-M980043-02-	W	6-19-98
<b>Standard Operating Procedure LIGO 10-W Laser in Optics Laboratory</b>			
<b><u>SPONSOR</u></b> R. Savage			

*Distribution of this draft:*

D. Cook, O. Matherny

1

-----  
LHO Laser Safety Officer

-----  
LHO Hanford Site Safety Officer

**LIGO Hanford Observatory**  
P. O. Box 1970; Mail Stop S9-02  
Richland, WA 99352  
Phone (509) 372-2325  
Fax (509) 372-2178  
E-mail: info@ligo.caltech.edu

**LIGO Livingston Observatory**  
19100 LIGO Lane  
Livingston, LA 70754  
Phone (504) 686-3100  
Fax (504) 686-7189  
E-mail: info@ligo.caltech.edu

**California Institute of Technology**  
LIGO Project - MS 51-33  
Pasadena CA 91125  
Phone (818) 395-2129  
Fax (818) 304-9834  
E-mail: info@ligo.caltech.edu

**Massachusetts Institute of Technology**  
LIGO Project - MS 20B-145  
Cambridge, MA 01239  
Phone (617) 253-4824  
Fax (617) 253-7014  
E-mail: info@ligo.mit.edu

WWW: <http://www.ligo.caltech.edu/>

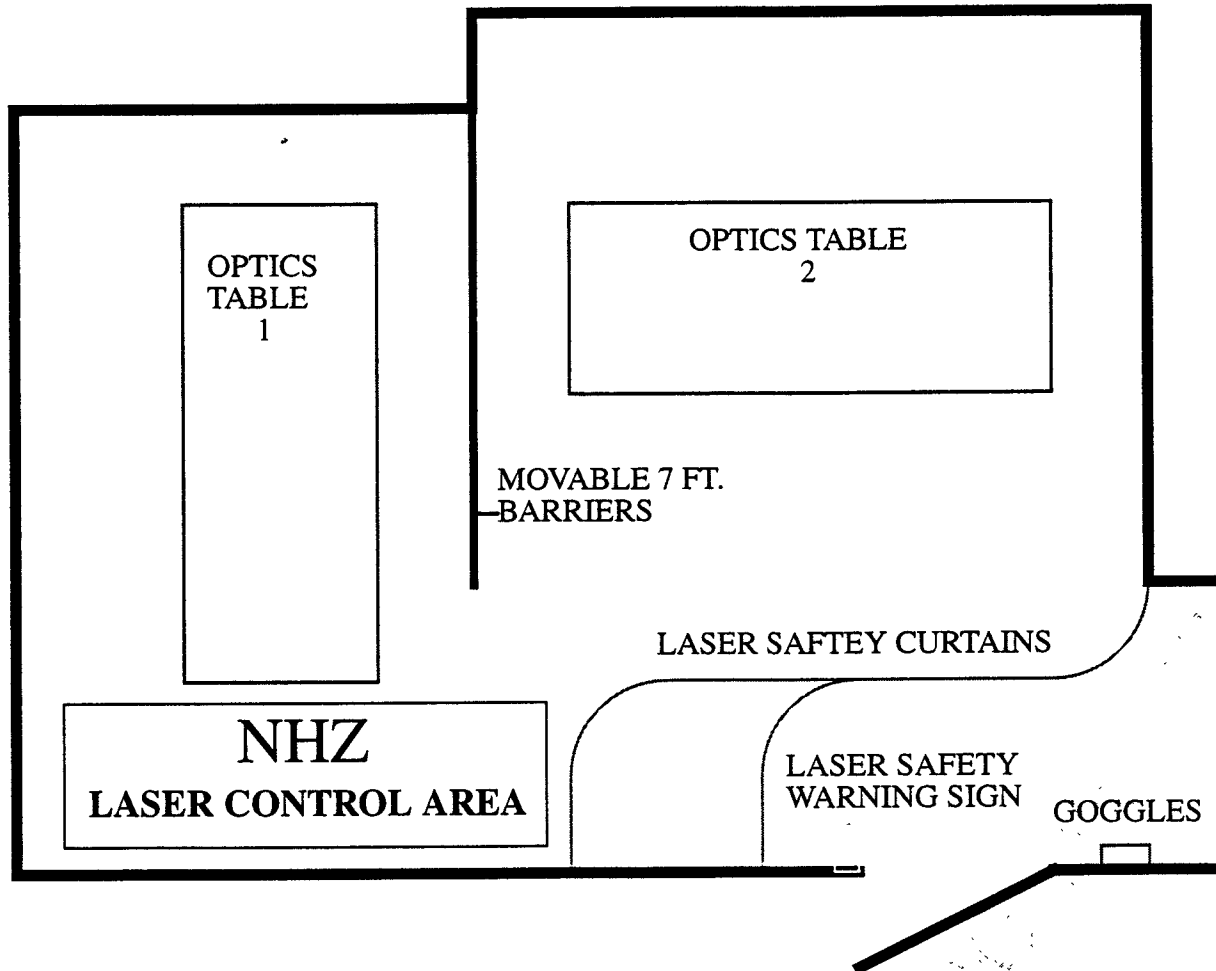
## 1 PURPOSE AND SCOPE

This Document is the Standard Operating Procedure (SOP) for the LIGO 10-Watt Laser when it is operating in the Optics Laboratory. It is designed to ensure the safety of all personnel and equipment in and around the area where the LIGO 10-W laser is operating in the optics laboratory. Its role within the overall laser safety plan is described in LIGOM980042-A-W, LIGO Hanford Laser Safety Plan.

This SOP contains the essential procedures required for the safe operation of the LIGO 10-W laser in the Optics Laboratory and is approved by both the LIGO Hanford Observatory (LHO) Laser Safety Officer and the LHO Site Safety Officer.

## 2 LABORATORY LAYOUT

The LIGO 10-Watt Laser is located in the Optics Laboratory Laser Control Area within the Optics Laboratory. The laboratory layout is shown in Figure 1. The laser and ancillary optical compo-



**Figure 1: Layout of Optics Laboratory Laser Control area**

nents are mounted on Optics Table 2. The designated Nominal Hazard Zone (NHZ) includes all

of the area behind the laser safety curtains, the areas where Optics Table 1 and Optics Table 2 are located, as shown in Figure 1.

### 3 LASER DESCRIPTION

The LIGO 10 W Laser is Class IV Nd<sup>3+</sup>:YAG laser. It is a model 126 MOPA laser system manufactured by Lightwave Electronics Corp. The output from this laser is in the infrared region of the electromagnetic spectrum and is therefore not visible to the human eye. This laser emits radiation from two apertures, the main output beam and a sample beam. The relevant operating parameters for the LIGO 10-Watt Laser are:

#### MAIN BEAM

- 1064 nm wavelength
- 12 W max. power output
- continuous wave output
- 6.1 kW/cm<sup>2</sup> intensity at output aperture

#### SAMPLE BEAM

- 1064 nm wavelength
- 70 mW max. power output
- continuous wave output
- 36 W/cm<sup>2</sup> intensity at output aperture

### 4 HAZARDS

A Class IV laser is a hazard to the eye or skin from the direct beam, maybe a hazard from a diffuse reflection, and may also be a fire hazard. Infrared lasers such as the LIGO 10-W Laser pose an additional hazard because the output radiation is not visible to the unaided human eye.

There are two potentially dangerous output beams as described in Section 3, above.

### 5 CONTROLS

#### 5.1. Access Controls

An illuminated Laser Safety Warning sign with the message, "DANGER VISIBLE AND/OR INVISIBLE LASER RADIATION - AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION," is mounted at the entrance to the Optics Laboratory Laser Control Area, outside the double entrance curtains. This sign is hard-wired such that energizing the power supply to any laser within the Optics Laboratory Laser Control Area automatically energizes the warning sign.

A schematic layout of the Optics Laboratory Laser Control Area showing the location of the LIGO 10-W Laser and a notice identifying emergency contact people is posted near the laser safety warning sign.

A copy of this SOP is also posted at the entrance to the Optics Laboratory Laser Control Area along with a list of all Registered Laser Personnel for this SOP.

Attached to the first laser safety curtain at the entrance to the NHZ is a sign stating, "WHEN WARNING LIGHT IS ON, RESTRICTED ACCESS, AUTHORIZED PERSONNEL ONLY. ALL OTHERS MUST BE ESCORTED BY AN AUTHORIZED PERSON. PROPER SAFETY EQUIPMENT REQUIRED." Only those whose names appear on the list of authorized personnel posted on the wall adjacent to the entrance to the NHZ are allowed to enter the NHZ without an escort. Any authorized person escorting unauthorized personnel inside the NHZ shall assume responsibility for compliance with laboratory laser safety procedures.

## 5.2. Electrical Controls

All control and monitoring functions for the LIGO 10-Watt Laser (labeled 126 MOPA) are accessed via the laser power supply located in the rack next to the optics table.

## 5.3. Beam Controls

A rocker switch on the front panel of the laser power supply activates a solenoid which opens and closes a shutter inside the laser head. From the standpoint of laser safety, the laser is considered to be activated even when the shutter is closed and/or the laser is in the standby mode.

## 5.4. Eye Protection

Required protective eyewear for the LIGO 10-W Laser must have an optical density (OD) of greater than 5.0 for 1064 nm wavelength radiation.

# 6 OPERATING PROCEDURES

1. It is the responsibility of each person working within the NHZ to ensure that LIGO standards for safe laser operation are being followed at all times.
2. All persons entering the NHZ are required to wear eye protection, as described in Section 5.4., above, before entering and at all times while working within the NHZ.
3. Before entering the NHZ each person must announce his or her intent to enter and await a reply from anyone already within the NHZ.
4. Prior to powering up the laser, the user shall ensure that all persons in the NHZ are aware of his intent to power up the laser and that they are in compliance with all laser safety requirements, eye protection in particular.
5. When placing objects such as mirrors, lenses, power meters, or beam dumps, into or near the laser beam paths, jewelry such as wrist watches and rings must be removed.
6. After powering off the laser, the user shall remove the key from the laser power supply and return it to the designated area.
7. Before leaving the laser running unattended, the user shall check that all stray beams are blocked.

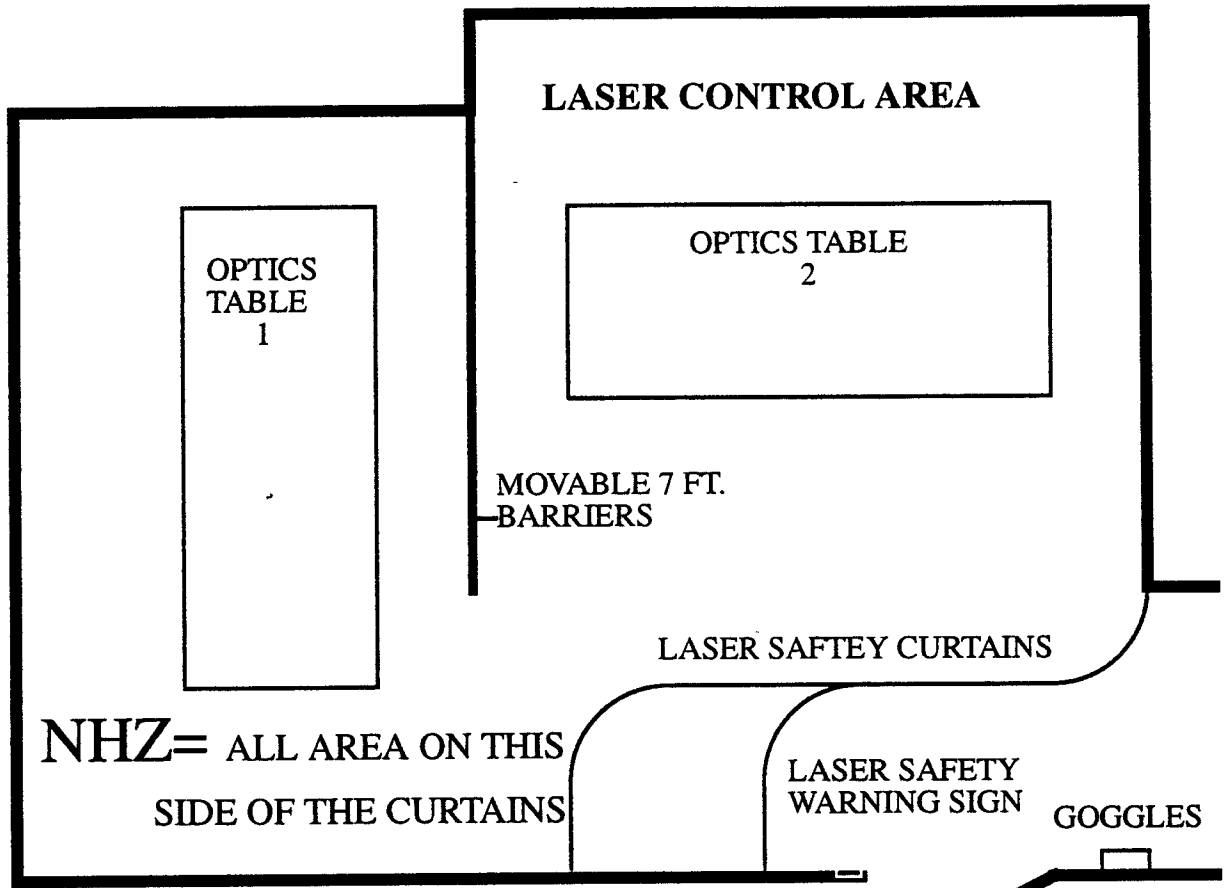


Figure 1: Nominal Hazard Zones

# LIGO HANFORD OBSERVATORY HAZARD PLACARD

BUILDING NAME \_\_\_\_\_ ROOM/LAB NUMBER \_\_\_\_\_

EMERGENCY PHONE NO.

# 911

**TELL:**

1. What has Happened
2. Where it Happened
3. What Help is Needed

**WHEN YOU DISCOVER A FIRE:**

1. Pull Alarm
2. Call 911
3. Notify LHO Site Safety Officer/Building Warden

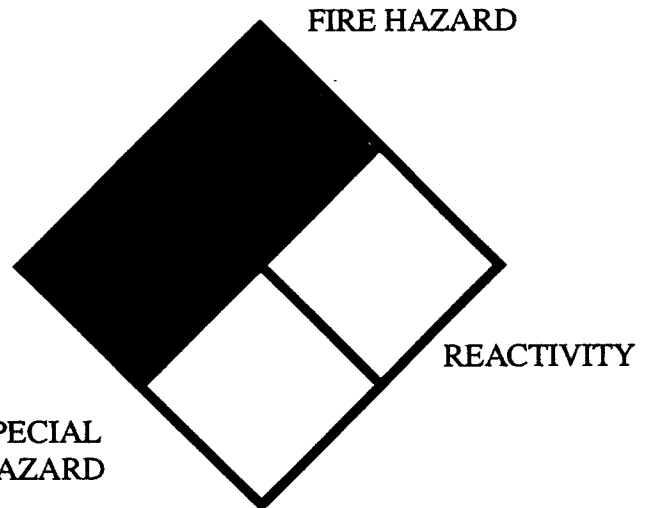
**BUILDING WARDENS**

<u>Name</u>	<u>Office Phone</u>	<u>Home Phone</u>	<u>Cell Phone</u>
PRIMARY: OTTO MATHERNY	(509) 372-1788	(509) 786-4007	(509) 539-8671
ALTERNATE: JOHN WORDEN	(509) 376-2394	(509) 627-3096	(509) 521-0097

( For both during and after working hours)

**HAZARDS PRESENT:**

HEALTH  
HAZARD



**List Specifics:**

- \_\_\_\_\_ Flammable Gases and Liquids
- \_\_\_\_\_ Corrosive Liquids
- \_\_\_\_\_ Lasers
- \_\_\_\_\_ Projects under Pressure or Vacuum
- \_\_\_\_\_ Computers
- \_\_\_\_\_ High Voltage
- \_\_\_\_\_ Others (list below)

- 4 - Severe
- 3 - Serious
- 2 - Moderate
- 1 - Slight
- 0 - Minimal