

# Safety Guidelines for Lightwave Transmission Systems

Verizon Safety Management  
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National Manager / LASER Safety Officer



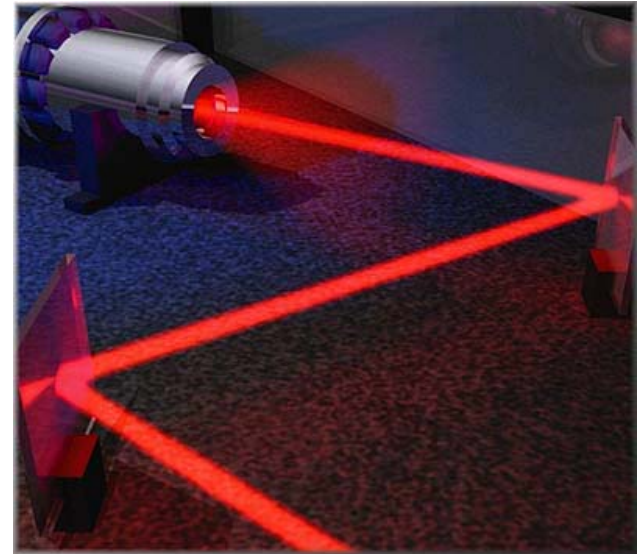
# LASER

Light Amplification by Stimulated Emission of Radiation

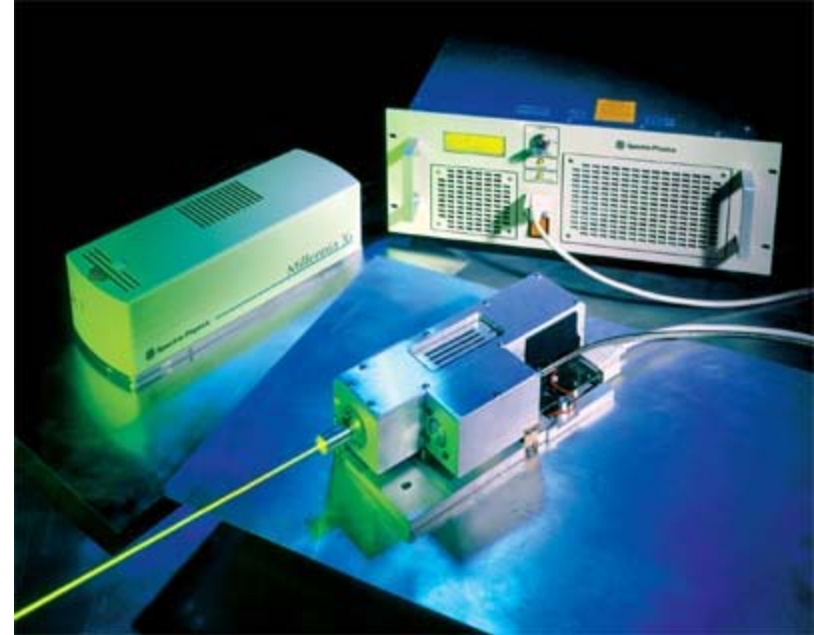
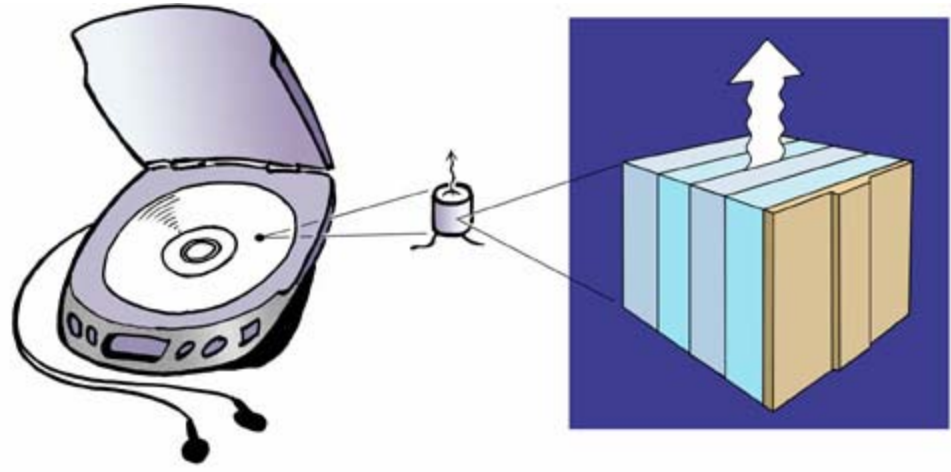


# LASER Types

Argon fluoride (UV)  
Krypton fluoride (UV)  
Nitrogen (UV)  
Argon (blue)  
Argon (green)  
Helium neon (green)  
Helium neon (red)  
Rhodamine 6G dye  
(tunable)  
Ruby ( $\text{CrAlO}_3$ ) (red)  
Nd:Yag (NIR)  
Carbon dioxide (FIR)  
Diode Tel-Com



# Semi Conductor LASER





# Gas LASERS

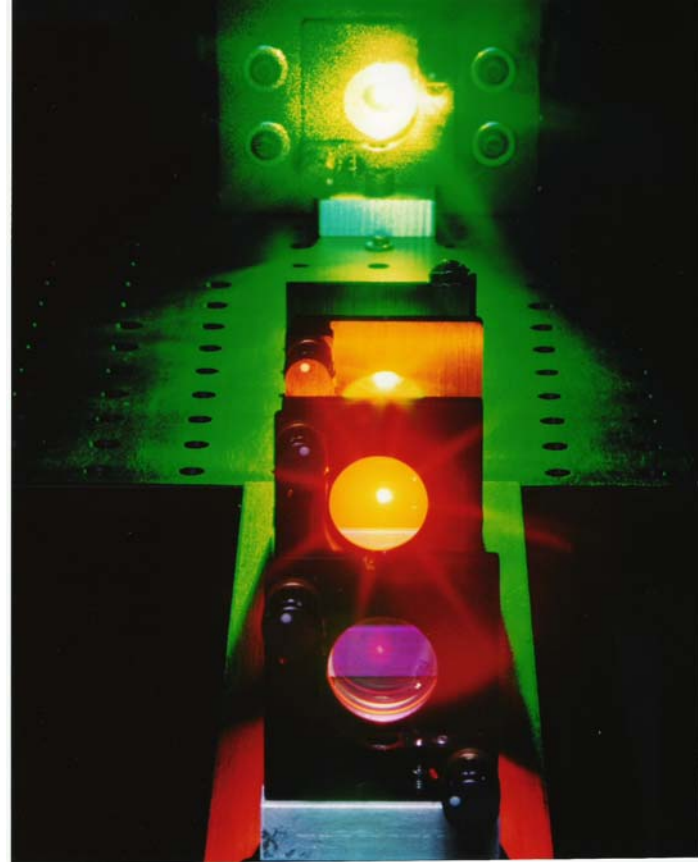




# Excimer LASERs



# Dye LASERS



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<http://www.cartoonbank.com>



*"For God's sake, Edwards. Put the laser pointer away."*

## Characteristics of a LASER



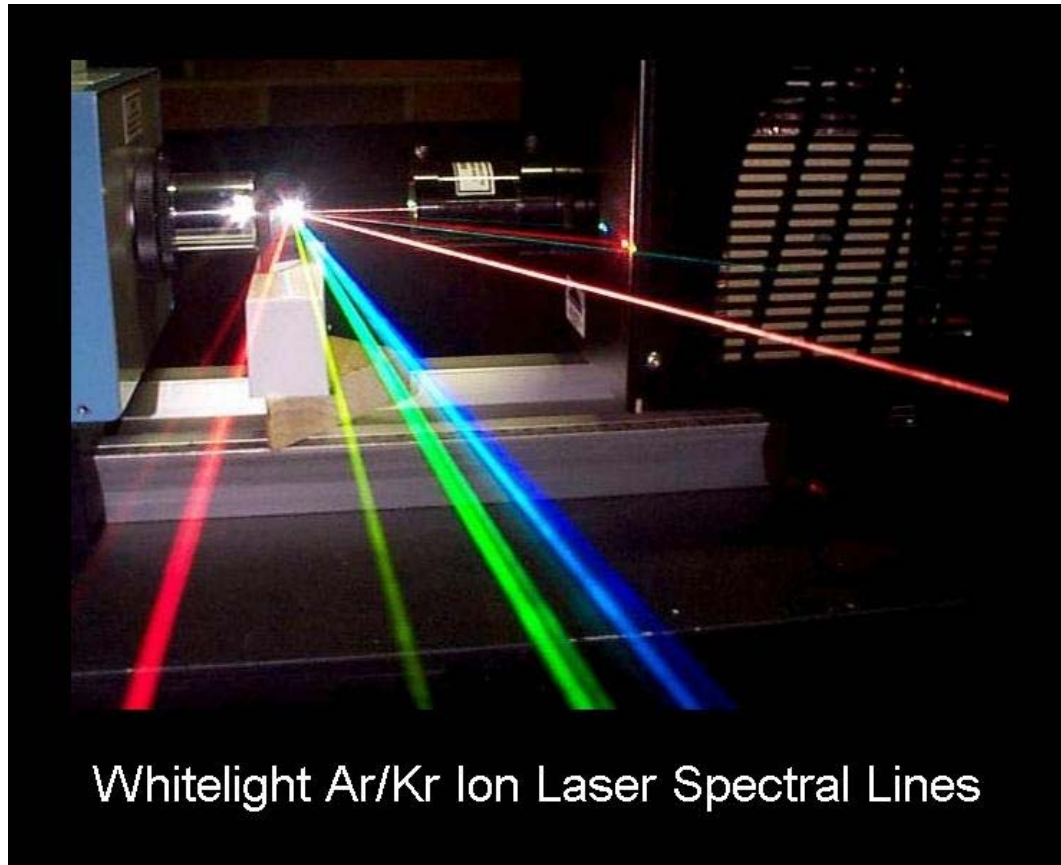
# LASER Classifications

## LASER Classification (American National Standards Institute – ANSI)

- LASERs are classified into four broad areas depending on the potential for causing injury (tissue burns). When you see a LASER, it should be labeled with one of these four class designations:
- **Class 1 (Closed System)**
- **Class 1A**
- **Class 2 (low power)**
- **Class 3A and 3B- (Medium Power)**
- **Class 4- (High Power)**



# 3 Characteristics of a LASER



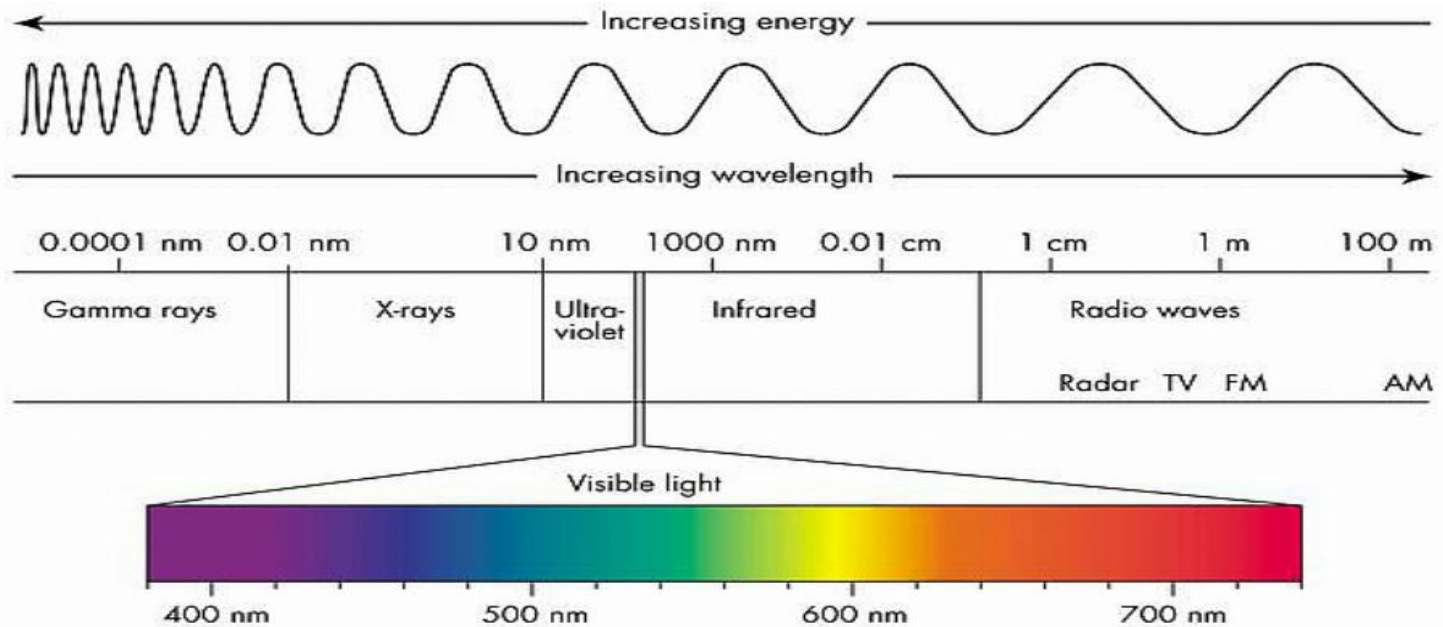
# OPTICAL FIBER(LIGHT WAVE) COMMUNICATION SYSTEMS (OFCS)



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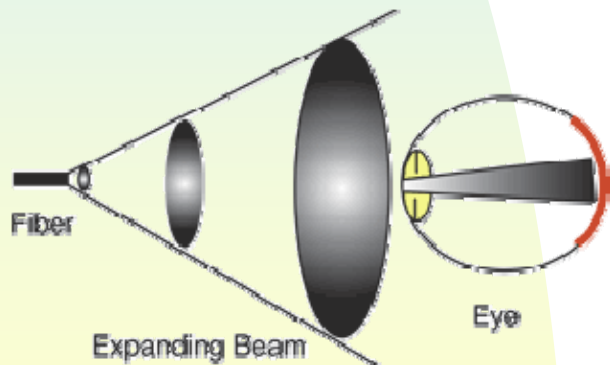


# Spectrum

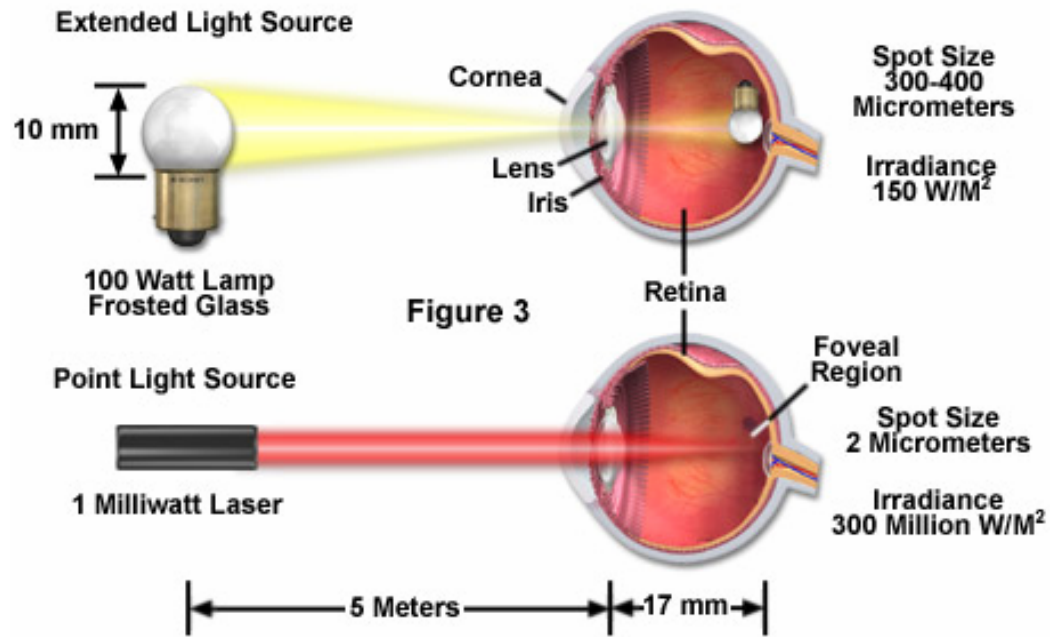


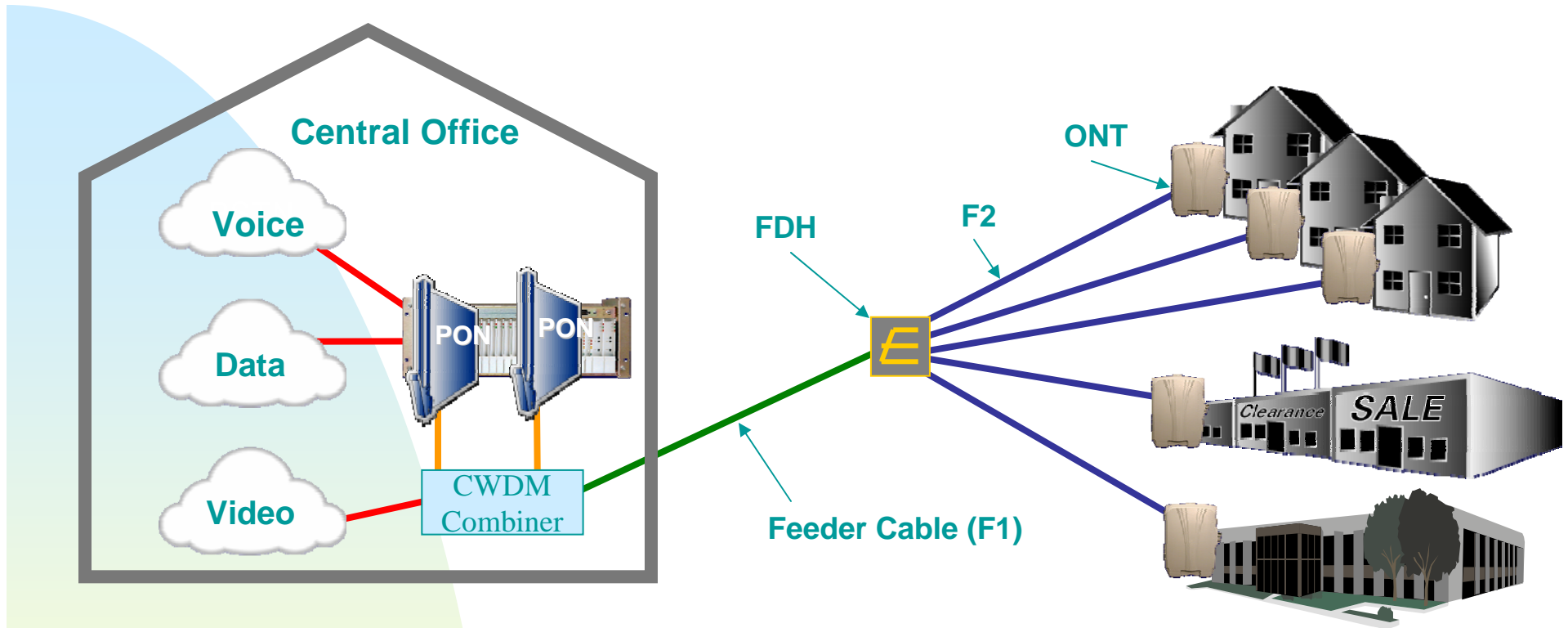
# LASER Safety and the Eye

**WARNING!!!!**  
**NEVER LOOK**  
**DIRECTLY INTO A**  
**FIBER END, A**  
**LASER SOURCE**  
**OR POINT A**  
**LASER IN YOUR**  
**EYES OR AT**  
**OTHERS!**



**Extended and Point Source Power Density at the Retina**





# Verizon's Fiber to the Premises FIOS



# Non-Beam Hazards of LASERs



Glass Particles



Fusion Splicing

Chemical/Solvents



# Safe Practices

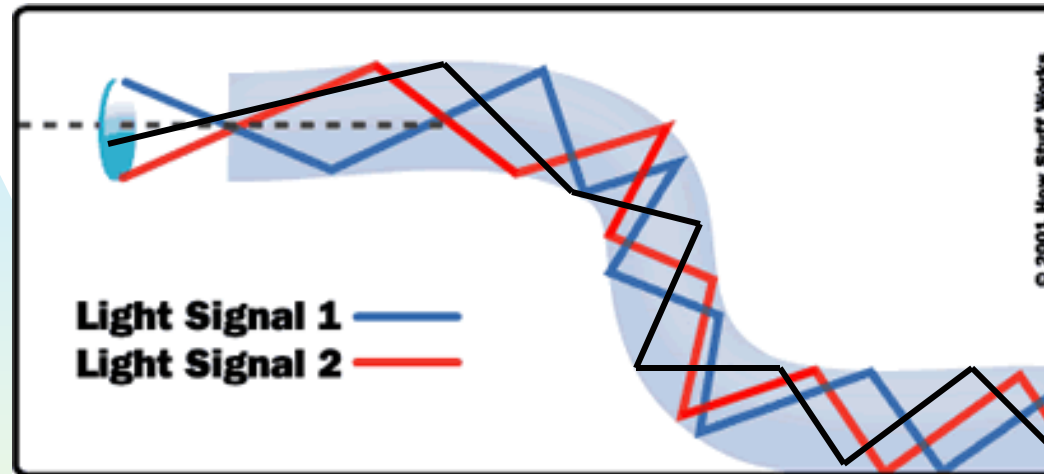
ANSI Standards					
Z136.1/Z136.2	Class 1 (SG1)	Class 2 (SG2)	Class 3A (SG3a)	Class 3B (SG3b)	Class 4 (SG4)
Power Level mW	Cannot emit LASER Radiation	$\leq 1\text{mW}$	1-5 mW	5 -500 mW	$> 500\text{ mW}$
Power Level dBm	Cannot emit LASER Radiation	$\leq 0.00\text{ dBm}$	0.01 - 7 dBm	7 - 27 dBm	$> 27\text{dBm}$
Eye Exam Req.	No	No	No	Yes	Yes
LASER Eyewear	No	No	No	Should	Shall

Class 1 (SG1) system for transmission during normal operations.

When being serviced it becomes a Class 3a or 3b depending on power level.



# Multimode Fiber Optics



Downstream Video  
Downstream Voice and Data  
Upstream Voice and Data



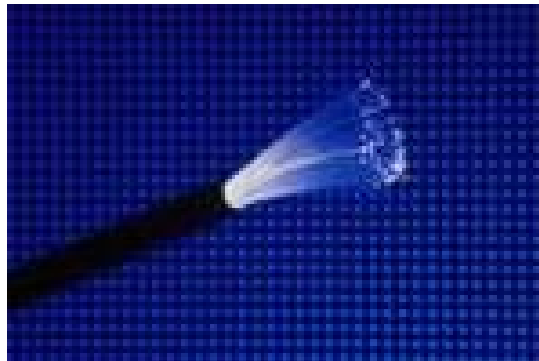
# Safety Considerations



Class 3a



Class 3b



**SYSTEMS THAT ARE NOT ENCLOSED AND ENERGIZED ARE CLASSIFIED AS A 3A OR 3B LASER.  
THE FOLLOWING SAFETY CONSIDERATIONS THEN APPLY:**

**Only authorized-trained employees may:**

- Install
- Service
- Maintain fiber-optic systems that are Not enclosed.



# LASER Eye Protection

Diode Tel-Com  
804-1755nm  
Optical Density 3  
Visible Light Transmission 30%  
Lens Color - Green



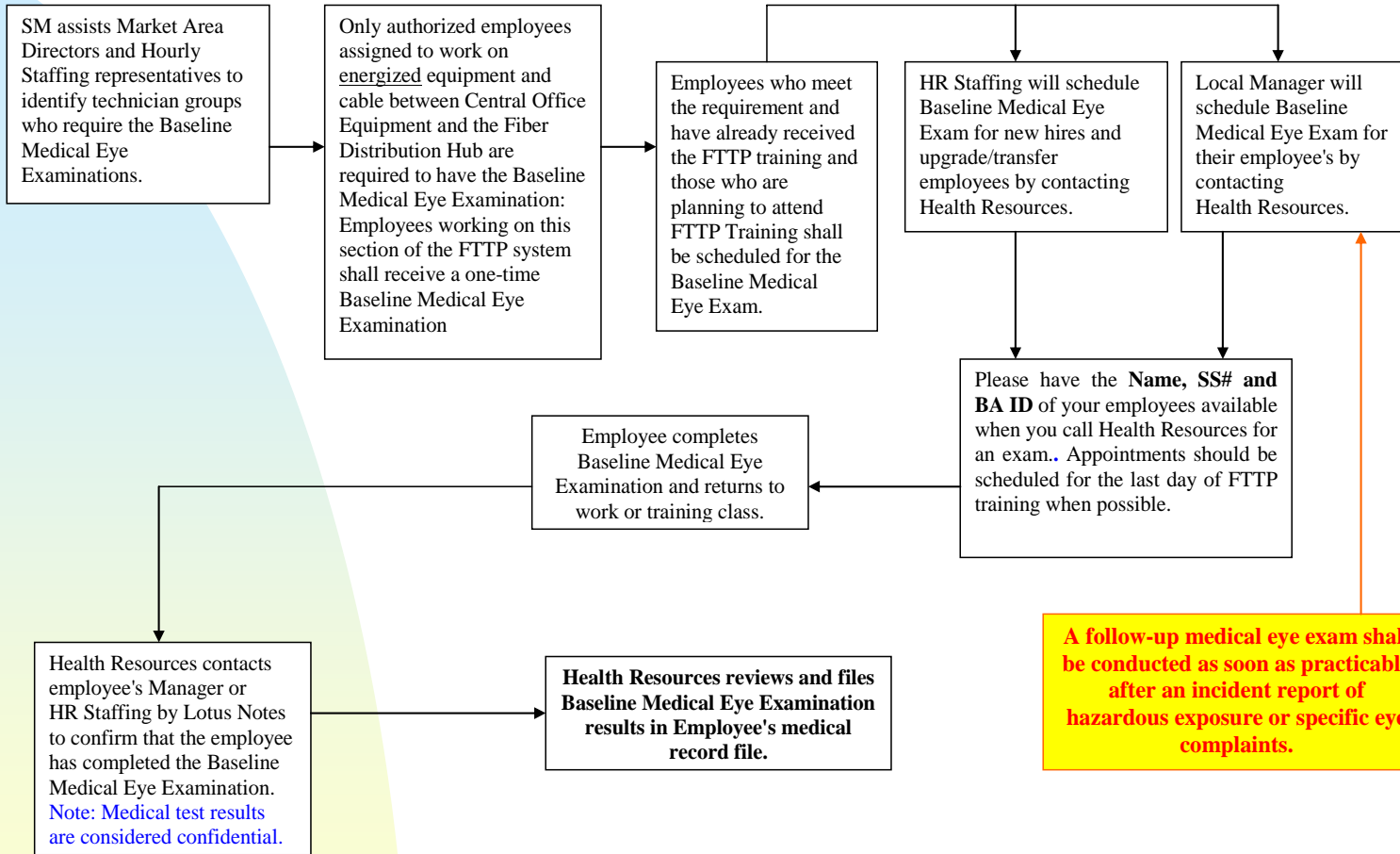


# Medical Surveillance

## – Baseline Eye Exam



# Medical Surveillance



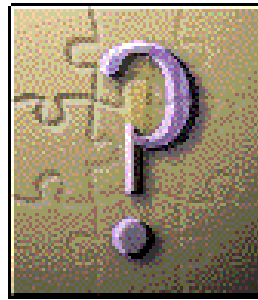
**A follow-up medical eye exam shall be conducted as soon as practicable after an incident report of hazardous exposure or specific eye complaints.**



# FIOS Training Available

Title	Course Code	Classroom Enrollment Available	Other Delivery Options	Course Hours	Course Status	Development Site
<a href="#">FTTP: FIBER OPTIC FOR I&amp;R TECHNICIANS</a>	TT10332T	<a href="#">No</a>	None	104.00	Active	Verizon (excluding 272's)
<a href="#">FTTP: FIBER OPTIC FOR I&amp;R TECHNICIANS</a>	TT10332	<a href="#">Yes</a>	None	104.00	Active	Verizon (excluding 272's)
<a href="#">FTTP: FIBER OPTIC FOR I&amp;R TECHNICIANS - NEW HIRE - WEST</a>	TT10332NH-W	<a href="#">Yes</a>	None	120.00	Active	Verizon (excluding 272's)
<a href="#">FTTP: I&amp;M INSIDE PREMISES</a>	TT10332B	<a href="#">No</a>	None	32.00	Active	Verizon (excluding 272's)
<a href="#">FTTP: I&amp;M INSIDE PREMISES - CONTINUING EDUCATION - MAR05 UPDATE</a>	TT10332B-CE0305	<a href="#">No</a>	None	24.00	In Dev.	Verizon (excluding 272's)
<a href="#">FTTP: I&amp;M INSTALLATION</a>	TT10332A	<a href="#">No</a>	None	40.00	Active	Verizon (excluding 272's)
<a href="#">FTTP: I&amp;M MAINTENANCE</a>	TT10332C	<a href="#">No</a>	None	24.00	Active	Verizon (excluding 272's)
<a href="#">FTTP: I&amp;M VIDEO SERVICES</a>	TT10332D	<a href="#">Yes</a>	None	40.00	Active	Verizon (excluding 272's)

# Questions?



# Additional Contact Information

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