

AD-A129 155

DYNATRON MODEL DT-820 HELIUM-NEON (HENE) LASER(U) ARMY
ENVIRONMENTAL HYGIENE AGENCY ABERDEEN PROVING GROUND MD
D H SLINNEY ET AL. APR 83 USAEHA-25-42-0340-83

1/1

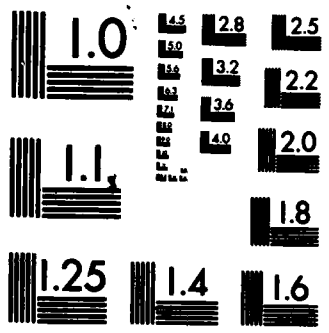
UNCLASSIFIED

F/G 6/18

NL



END
DATE
FILMED
BY
DTIC



MICROCOPY RESOLUTION TEST CHART
 NATIONAL BUREAU OF STANDARDS-1963-A

AD A129155



A
E
H
A

DTIC FILE COPY

**UNITED STATES ARMY
ENVIRONMENTAL HYGIENE
AGENCY**

ABERDEEN PROVING GROUND, MD 21010

NONIONIZING RADIATION PROTECTION SPECIAL STUDY NO. 25-42-0340-83
DYNATRON MODEL DT-820 HELIUM-NEON (HeNe) LASER
APRIL 1983

Approved for public release; distribution unlimited.

DTIC
ELECTE
JUN 10 1983
S D

88 06 10 059

A

(12)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 25-42-0340-83	2. GOVT ACCESSION NO. AD-A129155	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) NONIONIZING RADIATION PROTECTION SPECIAL STUDY NO. 25-42-0340-83, DYNATRON MODEL DT-820 HeNe LASER, APRIL 1983	5. TYPE OF REPORT & PERIOD COVERED Special Study April 1983	
	6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s) MR. DAVID H. SLINEY 1LT BRETT C. ARMSTRONG	8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Environmental Hygiene Agency Aberdeen Proving Ground, MD 21010	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE	
	13. NUMBER OF PAGES 4	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) A	15. SECURITY CLASS. (of this report) UNCLASSIFIED	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) LASER HeNe BIOSTIMULATION ACUPUNCTURE		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Nonionizing Radiation Protection Special Study of the Dynatron Model DT-820 HeNe Laser was performed by this Agency at Walter Reed Army Medical Center. It was determined that the Dynatron Model DT-820 laser was a Class 2 laser system and the laser radiation emitted from the Dynatron did not present a hazard to the skin. ↑		



REPLY TO
 ATTENTION OF

HSNB-RL/WP

7 JUN 1983

SUBJECT: Nonionizing Radiation Protection Special Study No. 25-42-0340-83,
 Dynatron Model DT-820 HeNe Laser, April 1983

Commander
 US Army Health Services Command
 ATTN: HSPA-P
 Fort Sam Houston, TX 78234

EXECUTIVE SUMMARY

The purpose, essential findings, and major recommendations of the inclosed report follow:

a. Purpose. The purpose of this report is to determine if the laser radiation emitted by the Dynatron Model DT-820 Helium-Neon laser exceeds current exposure limits and to make recommendations to eliminate exposure of personnel to potentially hazardous laser radiation.

b. Essential Findings. The Dynatron Model DT-820 laser is a Class 2 laser system and the laser radiation emitted from the Dynatron does not present a hazard to the skin. However, personnel should not attempt to stare directly into the beam.

c. Major Recommendations. Do not point the Dynatron Model DT-820 laser into the eyes of patients.

FOR THE COMMANDER:

1 Incl
 as (3 cy)

Joseph T. Whitlaw, Jr

JOSEPH T. WHITLAW, JR
 Colonel, MSC
 Director, Radiation and
 Environmental Sciences

CF:
 HQDA (DASG-PSP) wo incl
 Cdr, WRAMC (HSHL-MAA-VI-Col Graziano)
 Cdr, WRAMC (PVNTMED Actv) (2 cy)
 Cdr, WRAMC (HSHL-HP) (2 cy)
 Comdt, AHS (HSHA-IPM)



Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced Justification	<input type="checkbox"/>
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	I



DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

REPLY TO
ATTENTION OF

HSHB-RL/WP

NONIONIZING RADIATION PROTECTION SPECIAL STUDY NO. 25-42-0340-83
DYNATRON MODEL DT-820 HELIUM-NEON (HeNe) LASER
APRIL 1983

1. **AUTHORITY.** Letter, HSHL-HP, Walter Reed Army Medical Center, 26 October 1982, subject: Evaluation of Laser Acupuncture Investigational Medical Device, and indorsement thereto.

2. **REFERENCES.** See Appendix A for a listing of references.

3. **PURPOSE.** To evaluate possible optical radiation hazards associated with the Dynatron Model DT-820 Helium-Neon (HeNe) laser and to make recommendations necessary to eliminate exposure of personnel to potentially hazardous optical radiation from this device.

4. **GENERAL.**

a. **Background.** The Dynatron Model DT-820 HeNe Laser was obtained by the Pain Control Clinic, Walter Reed Army Medical Center (WRAMC), from Dynatronics Research Corporation, Salt Lake City, Utah 84104, for consideration for possible use as a laser "biostimulator." An extensive literature on "laser biostimulation" has accumulated in recent years (Appendix B). Many claims have been made in these reports to the effect that low power coherent light has certain properties to stimulate wound healing, pain relief, etc., at levels below thermal heating. In the United States, most of these reports have been met with great skepticism. However, there has been a need to conduct an unbiased study of these effects. The WRAMC Pain Control Clinic planned to use this device to test by objective means these claims found in the literature.

b. **Description.** The Dynatron Model DT-820 is a HeNe laser operating at 632.8 nm. The laser radiation is delivered through a flexible fiber optic light guide to a hand-held stylus. The system may be operated in the pulsed mode from 2.5 Hz to 200 Hz. In the pulsed mode, the beam is mechanically chopped with 50 percent duty cycle. The system is portable and is operated from 120 V AC. The Figure shows an illustration of the Dynatron laser.

c. **Inventory.** One Dynatron Model DT-820 laser [Serial Number (SN) EXP .2] was on hand at the Pain Control Clinic, WRAMC, Room 6344, Ward 63.

d. **Instrumentation.**

(1) United Detector Technology Inc. (UDT) Model 40X Optometer (SN 45101).

(2) Tektronix Model 214 Storage Oscilloscope (SN B111999).

e. **Radiometric Terms and Units.** Radiometric terms and units are listed in Appendix C.

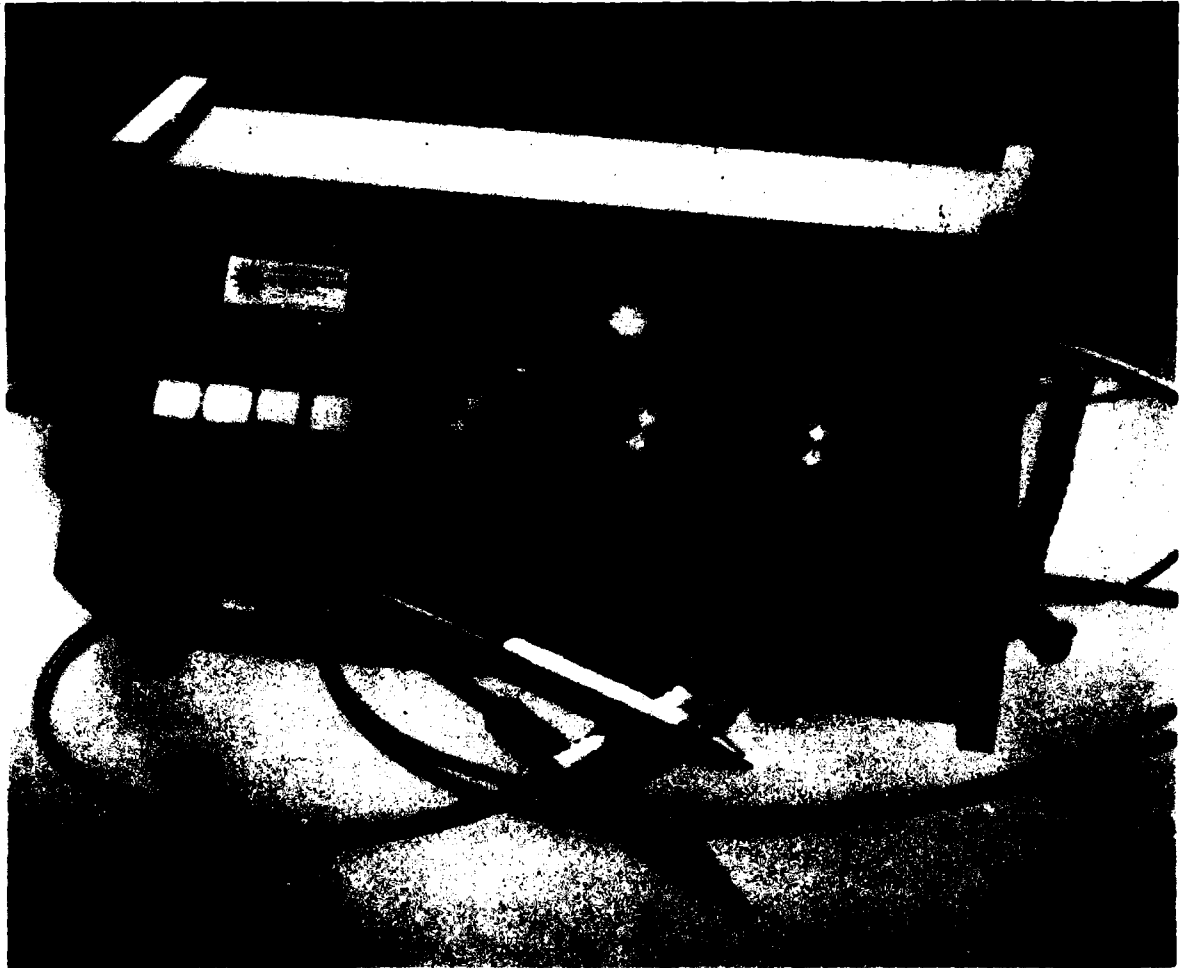


Figure 1. The Dynatron Model DT-820 HeNe Laser.

5. FINDINGS.

a. Radiometric Measurements. Radiometric measurements were made on the Dynatron Model DT-820, SN EXP .2, at the Pain Control Clinic, WRAMC, on 31 March 1983. The results of these measurements are as follows:

(1) Continuous Wave Mode.

Radiant Power: 0.89 mW
 Beam Divergence: 27° at 1/e points

(2) Pulsed Mode. The Table provides values of the measured frequency and the average power for various frequency settings. An indicated frequency of 29 Hz gave the maximum average power of 0.67 mW.

TABLE. LASER OUTPUT MEASUREMENTS

INDICATED FREQUENCY Hz	MEASURED FREQUENCY Hz	AVERAGE POWER mW
<u>Low Mode</u>		
2.5	2.9	0.41
10	26.3	0.39
20	28.6	0.42
25	34.5	0.52
<u>High Mode</u>		
25	28.6	0.48
29	----	0.67
30	40	0.54
60	76.9	0.40
80	125	0.40
140	166.7	0.40
160	188.7	0.40
200	200	0.40

b. Manufacturer's Measured Parameters.

(1) Continuous Wave Mode.

Radiant Power: 0.95 mW
 Beam Divergence: 30°

(2) Pulsed Mode. Average Power at 80 Hz: 0.45 mW

c. Federal Performance Standard. The appropriate warnings were permanently attached to the device housing and other system safety features were present as prescribed in 21 CFR 1040.

d. Investigational Device Exemption (IDE). At the time of the study the WRAMC Pain Control Clinic was preparing an IDE for submission to their Human Use Committee.

6. DISCUSSION.

a. Laser Hazard Classification. The maximum radiant power of the Dynatron Model DT-820 HeNe laser is 0.89 mW. This is greater than the Class 1 emission limit for visible lasers of 0.4 uW and less than the Class 2 emission limit for visible lasers of 1 mW. Therefore, this laser is classified from a hazard standpoint as a Class 2, low power laser. The potential hazard from this laser is limited to the eye, and it does not pose a skin or fire hazard. A retinal injury could result if an individual were to stare within the direct laser beam or a specularly reflected beam. However, an individual's natural aversion response (blink reflex) to the extremely bright light from this laser would limit the exposure to a level below current protection standards; therefore, this laser does not pose a significant hazard to the eye.

b. Exposure Limit. The exposure limit for staring directly into the beam of the Dynatron Model DT-820 laser was calculated to be 10 s at a distance of 2 cm and 8 hr at a distance of 70 cm.

7. CONCLUSION. The Dynatron Model DT-820 laser does not present a hazard during normal use. However, personnel should not attempt to stare directly into the beam.

8. RECOMMENDATION. Do not point the Dynatron Model DT-820 laser into the eyes of patients [para 5-38b(5), AR 40-5].

for Brett Armstrong
DAVID H. SLINEY
Chief, Laser Branch
Laser Microwave Division

Brett Armstrong
BRETT C. ARMSTRONG
1LT, MSC
Nuclear Medical Science Officer
Laser Microwave Division

APPROVED:

Charles E. Day III
CHARLES E. DAY, III
MAJ, MSC
Chief, Laser Microwave Division

APPENDIX A

REFERENCES

1. AR 40-5, Health and Environment, 25 September 1974.
2. AR 40-46, Control of Health Hazards from Lasers and Other High Intensity Optical Sources, 6 February 1974, with Change 1, 15 November 1978.
3. TB MED 279, Control of Hazards to Health from Laser Radiation, 30 May 1975.
4. Title 21, Code of Federal Regulations (CFR), 1982 rev, Part 812, Investigational Device Exemptions.
5. Title 21, CFR, 1982 rev, Part 1040, Performance Standards for Light-Emitting Products.
6. Letter, HSHL-SAO, Walter Reed Army Medical Center, 18 April 1983, subject: Effects of Biostimulation with Laser for Relief of Chronic Pain.

APPENDIX B

BIBLIOGRAPHY

1. Bergsmann, O., "Biocybernetic action of acupuncture in clinical trails," Deutsche Zeitschrift fur Akupunktur, 5:131-135, 1977.
2. Biscar, J. P., "Photon enzyme activation," Bull Math Biol, 38:29-38 (1976).
3. Bischko, J., "Laser in der akupunktur," Bio Med, 11:239-244, 1978.
4. Bischko, J., "Die Bedeutung der laserakupunktur," Erfahrungsheilkunde, 5:328-331, 1979.
5. Caspers, K. H., "Laser-Reiztherapie," Physikal. Med. Rehabil., 9:426-445, 1977.
6. Chlebararov, S., "Use of lasers in dermatology," Dermatological Clinic and Polyclinic, Technical University of Munich, 1980.
7. Gamaleya, N. F., "Laser biomedical research in the USSR," pp. 1-173. In M. L. Wolbarsht (ed.), Laser Applications in Medicine and Biology, Vol. 3, New York: Plenum Press, 1977.
8. Hachenberger-Wildner and Michels, H., "Laserstrahlen bei Herpeserkrankungen," Artitliche Kosmetologie, 11:142-144, 1981.
9. Liertzer, A. and Oppolzer, A., "Laserakupunktur," Bio Med, 7:8, 1979.
10. Mayer, A., "Laser therapy in dentistry," 7pp., monograph, Seeshaupt, Germany.
11. Mester, E., "The stimulating effect of low-power laser rays on biological systems," Med Biol Eng, 8:430, 1970.
12. Mester, E., and Jaszsigni-nagy, E., "The effect of laser radiation on wound healing and collagen sythesis," Stud Biophys 35:227-230 (1973).
13. Mester, E., et al., "Stimulation of wound healing by means of laser rays," Acta Chir Acad Sci Hung 14:347-356 (1973).
14. Niinikoski, J., et al., "Healing of open wounds: effects of oxygen, disturbed blood supply and hypermia by infrared radiation," Acta Chir Scand 137:339-401 (1971).
15. Pothmann, R., "Laser treatment in acupuncture," Medizinische, Einrichtungen, University of Dusseldorf, 1979.
16. Reed, R. D., "Low-Power Laser Alteration of Physiological Processes," Report No. SAM-TR-79-29, USAF School of Aerospace Medicine, Brooks AFB, TX, November 1979.
17. Stemplinger, H., "Laser-therapie in der nervenartzlichen Praxis," Erfahrungsheilkunde, 5:258-265, 1978.

APPENDIX C

USEFUL CIE RADIOMETRIC AND PHOTOMETRIC TERMS AND UNITS-2

RADIOMETRIC			PHOTOMETRIC				
Term	Symbol	Defining Equation	SI Unit and Abbreviation	Term	Symbol	Defining Equation	SI Units and Abbreviation
Radiant Energy	Q_e		Joule (J)	Quantity of Light	Q_v	$Q_v = \int \phi_v dt$	lumen-second (lm-s) (talbot)
Radiant Energy Density	U_e	$U_e = \frac{dQ_e}{dV}$	Joule per cubic meter (J-m ⁻³)	Luminous Energy Density	U_v	$U_v = \frac{dQ_v}{dV}$	talbot per square meter (lm-s-m ⁻²)
Radiant Power (Radiant Flux)	Q_e, P	$Q_e = \frac{dQ_e}{dt}$	Watt (W)	Luminous Flux	ϕ_v	$\phi_v = 680 \int \frac{dQ_e}{d\lambda} V(\lambda) d\lambda$	lumen (lm)
Radiant Exitance	M_e	$M_e = \frac{dQ_e}{dA} = \int L_e \cos \theta d\Omega$	Watt per square meter (W-m ⁻²)	Luminous Exitance	M_v	$M_v = \frac{dQ_v}{dA} = \int L_v \cos \theta d\Omega$	lumen per square meter (lm-m ⁻²)
Irradiance or Radiant Flux Density (These have the same units in photometry)	E_e	$E_e = \frac{dQ_e}{dA}$	Watt per square meter (W-m ⁻²)	Illuminance (luminous flux density)	E_v	$E_v = \frac{dQ_v}{dA}$	lumen per square meter (lm-m ⁻²) lux (lx)
Radiant Intensity	I_e	$I_e = \frac{dQ_e}{d\Omega}$	Watt per steradian (W-sr ⁻¹)	Luminous Intensity (candlepower)	I_v	$I_v = \frac{dQ_v}{d\Omega}$	lumen per steradian (lm-sr) or candela (cd)
Radiance	L_e	$L_e = \frac{d^2 Q_e}{dA \cdot d\Omega \cdot \cos \theta}$	Watt per steradian and per square meter (W-sr ⁻¹ -m ⁻²)	Luminance	L_v	$L_v = \frac{d^2 Q_v}{dA \cdot d\Omega \cdot \cos \theta}$	candela per square meter (cd-m ⁻²)
Radiant Exposure (This is photometry)	H_e	$H_e = \frac{dQ_e}{dA}$	Joule per square meter (J-m ⁻²)	Light Exposure	H_v	$H_v = \frac{dQ_v}{dA} = \int L_v dt$	lum-second (lm-s)
				Luminous Efficacy (of radiation)	K	$K = \frac{\phi_v}{Q_e}$	lumen per watt (lm-W ⁻¹)
				Luminous Efficacy (of a broad band radiation)	$V(\lambda)$	$V(\lambda) = \frac{K}{K_0} = \frac{K}{680}$	unitless
				Luminous Efficacy (of a source)	η_v	$\eta_v = \frac{\phi_v}{P_e}$	lumen per watt (lm-W ⁻¹)
				Optical Density	D_v	$D_v = -\log_{10} T_v$	unitless
				Reciprocal Illuminance in Troilands	E_t	$E_t = \frac{L_v}{S_p}$	troiland (cd) = lumen in cd-m ⁻² times pupil area in cm ²

1. The units may be altered to refer to narrow spectral bands in which case the term is preceded by the word spectral, and the unit is then per wavelength interval and the symbol has a subscript λ . For example, spectral irradiance $H_{e,\lambda}$ has units of W-m⁻²-m⁻¹ or more often, W-cm⁻²-m⁻¹.

2. While the meter is the preferred unit of length, the centimeter is still the unit commonly used unit of length for many of the above terms and the cm or m are most commonly used to express wavelength.

3. P_e is electrical input power in watts. 4. τ is the transmission

5. At the source $I_e = \frac{dQ_e}{d\Omega}$ and at a receptor $I_e = \frac{dQ_e}{dA}$

FILME

7-8