LIA TODAY

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LIA
THE LASER INSTITUTE

LIA TODAY

THE OFFICIAL NEWSLETTER OF LIA

LIA TODAY is published bimonthly to educate and inform students and professionals of challenges and innovations in the field of photonic materials processing.

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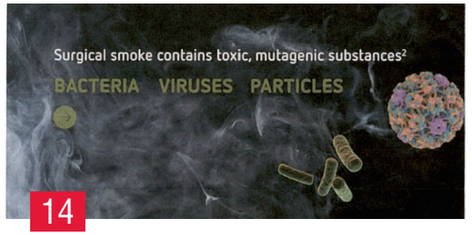
WILLIAM 'BILL' SHINER

By Ron Schaeffer

William Shiner, who passed away in May of this year, is remembered in this article by Ron Schaeffer, a close friend of Bill's. Bill was a founding member of LIA and was instrumental in the growth of major laser producers and laser users.



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CONTROL THAT SMOKE

By Melanie Brooks, BSN, RN, CNOR

This article is about hazards of surgical smoke with lasers and the operating room. It discusses with the reader some of the challenges, why it is important to control surgical smoke or plume, and some solutions.

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A GREEN LIGHT FOR GREEN MOBILITY

By David Harvilla, Stefanie Bisch and Sebastian Zaske; TRUMPF, Inc., Trumpf Laser- und Systemtechnik GmbH

Automotive manufacturers and suppliers require reliable standards for electric car production. Experience has shown that green lasers are the perfect welding tool for electric components made of copper.

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BLS: ESTABLISHING A MEDICAL LASER SAFETY PROGRAM

By Bobbi Childers, CMLSO

Establishing a laser safety program is important to provide safe, efficient, and effective care for the patients undergoing laser procedures. A systemic approach helped to better organize a successful program and involved each department providing laser procedures. It took an interdisciplinary team to reach this goal.

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LIA Laser Safety Trainings

LASER SAFETY OFFICER TRAINING	
Orlando, FL	Jan. 22 - 24, 2020
Orlando, FL	May 27 - 29, 2020
Orlando, FL	Aug. 19 - 21, 2020
Orlando, FL	Dec. 2 - 4, 2020
LASER SAFETY OFFICER WITH HAZARD ANALYSIS	
Orlando, FL	Jan. 27 - 31, 2020
Orlando, FL	Jun. 1 - 5, 2020
Orlando, FL	Aug. 24 - 28, 2020
Orlando, FL	Dec. 7 - 11, 2020
MEDICAL LASER SAFETY OFFICER TRAINING	
Orlando, FL	Jan. 25 - 26, 2020
Orlando, FL	May 30 - 31, 2020
Orlando, FL	Aug. 22 - 23, 2020
Orlando, FL	Dec. 5 - 6, 2020

Visit www.lia.org for all course and event listings

Course Highlight

MEDICAL LASER SAFETY AWARENESS TRAINING: 2020 REVISION
ONLINE - ANYWHERE, ANYTIME

If you're a laser safety officer in a medical facility such as a hospital, surgery center, clinic, or physician's private practice who must train his or her staff, this is the course to have your employees take – without having to bring in an outside expert or send personnel to a course and losing valuable productivity. This short training session will cover the safety basics for those medical personnel operating or working near a laser system. LSOs save their medical facilities time and money while their medical laser personnel upgrade their knowledge at a place and time that works well with their schedule. For the first time, LIA is offering discounts for medical facilities that purchase multiple "seats," so the more employees you enroll, the more you save. Hospitals that have facilities in various locations can administer the same course to employees no matter where they work.

ONLINE

PRESIDENT'S MESSAGE

Gilbert Haas
LIA President 2020

Working through these challenging COVID times in the United States, some states are opening up while others are now seeing record daily cases emerge. While Florida is seeing the latter, the LIA staff continues to work safe remotely.

The annual LIA Executive Committee meeting, held remotely for the first time, was very successful. Given the COVID environment, remote meetings that we all dreamed of achieving in the future were fast-tracked to the present and will now serve as a viable platform for future national and international communications. In addition, the change over to a virtual ICALEO 2020 will set the stage moving forward toward future ICALEO's. The "collateral beauty" is that we will now have these tools to enhance all future communication and events.

In the near future you will begin to notice the efforts and hard work the LIA staff has been doing during these times. Membership benefits will be enhanced while the LIA continues to evolve into a very unique organization. We appreciate your support and guidance along this journey.

Be well and stay safe,
Gilbert J. Haas

EXECUTIVE DIRECTOR'S MESSAGE

Nat Quick
Executive Director

We all are experiencing challenges recently, some new and some rooted in past events that have yet to be resolved, that have emerged simultaneously. COVID-19, in addition to having severe negative health impacts, has impacted international business causing job losses and implementation of lockdowns and quarantines. The push to reopen businesses with the intent of boosting the economy has unfortunately led to a new surge in cases. Safeguards, particularly social distancing and wearing masks, have been lacking in some locations and are now being vigorously enacted to curb this new surge. As this pandemic continues, LIA urges all to follow safeguard guidelines defined by medical personnel to help not only to protect yourself but to help you protect others.

Also escalating at this time is the pursuit of the dream for "equal justice for all under the law" leading to a resurgence in activism. Eyes should always be focused on this prize of equality and as the country struggles to figure out how to best achieve that, we encourage all to stay safe.

We will get through these challenges and I agree with Ron Schaeffer that "the laser industry will emerge strong because it is a vital and important enabler".

To add to this stupor, we received word on the passing of two revered members of the LIA:

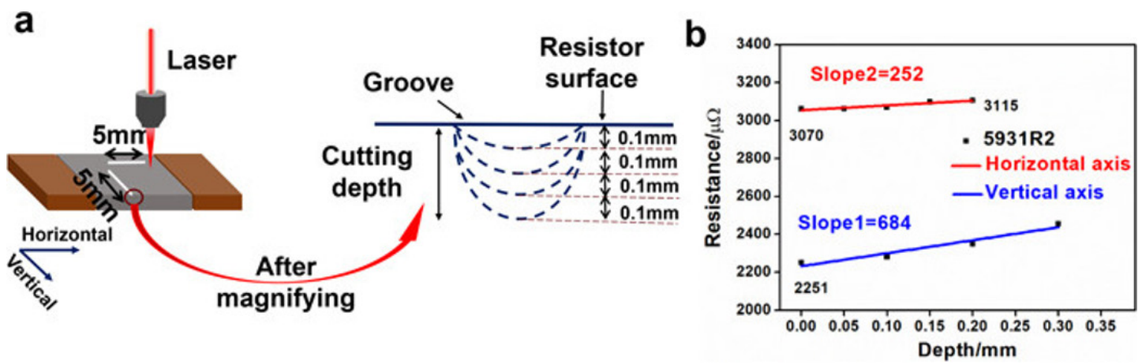
Steve Llewellyn (1941-2020), a Fellow of LIA passed away April 30th. He was a dedicated supporter of LIA serving on many committees and panels providing unique insights on laser materials processing and growing the industrial laser business.

Bill Shiner (1941-2020) who passed away May 7th is remembered in the article by Ron Schaeffer, a close friend of Bill's. Bill was a founding member of LIA and served on the Board of Directors for over 40 years generating a "fountain of ideas", and lending financial, facilities and personal assistance to advance the LIA. He was LIA President in 2007 and was recognized with the LIA President's Award for his many years of support. As a commenter stated, he was Mr. Laser. Bill was instrumental in the growth of major laser producers, particularly IPG, and laser users.

Along with this tribute article, we have an article discussing the importance of controlling surgical smoke from lasers in this issue. Finally, the article "A Green Light for Green Mobility" discusses that automotive manufacturers and suppliers require reliable standards for electric car production. Experience has shown that green lasers are the perfect welding tool for electric components made of copper. You can read up on these topics following the Bill Shiner piece in this issue.

Stay healthy and safe.

JLA | EDITOR'S PICK



The schematic diagram of depth cutting along two directions. (b) Resistance as a function of the cutting depth. The solid lines are the linear fitting at two cutting directions. Both the vertical and horizontal cutting lengths are 5 mm, while the cutting depth is changed with multipass scanning.

PRECISE LASER TRIMMING OF ALLOY STRIP RESISTOR: A COMPARATIVE STUDY WITH FEMTOSECOND LASER AND NANOSECOND LASER

By: Qiuyue Su, Shi Bai, Jitai Han, Ying Ma, Yongchao Yu, Yangbao Deng, Meiping Wu, Chong Zheng, and Anming Hu

Abstract: Laser trimming has become one of the powerful tools for precise manufacturing of alloy resistors that are widely used in electrical vehicles, electrical controlling, and in appliances. In this work, the influence of femtosecond laser trimming is compared with nanosecond laser trimming. The authors found that lasers focused on different heights relative to the sample surface induced significant changes in surface morphologies. The resistance change was systematically investigated as a function of cutting lengths and cutting depths of different laser powers for both lasers. The experiments display that femtosecond laser trimming has a higher precision of the resistance adjustment than nanosecond laser trimming. The periodic ripple structure by the femtosecond laser was investigated at the focus position above, onto, or beneath the surface. The period of a low frequency ripple structure (LFRS) on the ablated groove bottom is about 600–700 nm when the laser focuses just right on the surface but changes to 490–560 nm when focusing above or beneath the surface. The period of a high frequency ripple structure is about 100–380 nm at the vertical direction of LFRS. The period of low frequency ripple on the outside of the groove is smaller than that on the groove bottom for all three focusing cases. The period of the LFRS is not sensitive to the laser power. The range of the resistor value change in the s-polarized light direction of the femtosecond laser is more than that in the p-polarized light direction.

Journal of Laser Applications 32, 022013 (2020); https://doi.org/10.2351/1.5131528

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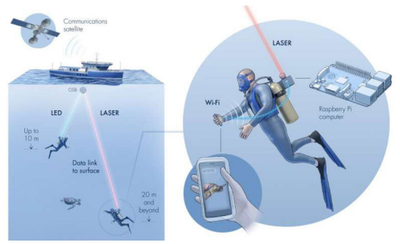
JLA Journal of Laser Applications

TRENDING IN THE NEWS:
LIA'S TOP 4 ARTICLE PICKS

1

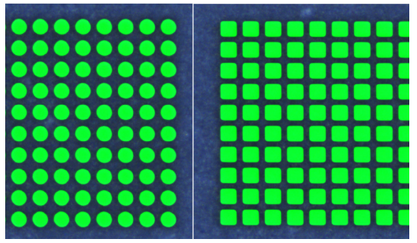


AQUA-FI: UNDERWATER WIFI DEVELOPED USING LEDS AND LASERS

Aquatic internet that sends data through light beams could enable divers to instantly transmit footage from under the sea to the surface.

Read more

2



ULTRASHORT-PULSE LASER MICROPROCESSING WITH UNPRECEDENTED PRECISION

Posalux SA, a company in Switzerland, has introduced a femtosecond laser that can produce the smallest hole geometries to meet the complex market requirements of applications in test electronics.

Read more

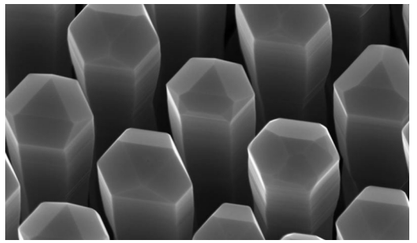
3

RAMPING UP WITH HIGH-INTENSITY LASERS

In Europe, China, and the U.S., laser projects — either built or planned — are ramping up intensity, with systems now reaching peak power of 10 petawatts (PW), or 10 million billion watts.

Read more

4



LIGHT-EMITTING HEXAGONAL SIGE PROMISES INTEGRATED PHOTONICS BREAKTHROUGH

Researchers in Europe have found a way to make silicon-germanium (SiGe) alloys emit light efficiently, a breakthrough that has the potential to revolutionize integrated silicon photonics.

Read more

William 'Bill' Shiner

(1941-2020)

By: Ronald Schaeffer

Intro

The last few months have been full of sorrow from many different directions with the virus, the lockdowns, loss of jobs, markets, and civil unrest. In the middle of all of this, we have also had bad news about several of our colleagues in the laser industry.

The laser industry itself will, I am sure, come out strong because it is a vital and important enabler. The industry is also strong because it has strong anchors in many of the leaders who were around for the start of this still relatively young branch of manufacturing technology. People like Bill Shiner.

Bill has been a fixture at conferences around the world for over 40 years, most recently associated with industry giant IPG where he helped grow the company from a small entity to one of the industry's superpowers. Everybody knew Bill; everybody liked Bill. I have been in the industry for 35 years and sometimes I think I have been just about everywhere and done just about everything. Bill has got me beat by a mile.

A Few of My Experiences

I had met Bill and spoken to him on the phone a number of times and we worked on a few minor things together during his time at Convergent, but I never got to know him very well until afterward. In fact, at the time we were looking to expand at PhotoMachining and we thought we might entice Bill into joining us as a Consultant and maybe as an employee longer-term – honestly thinking that it might be hard for 'the old guy' to get another high-level job in the laser industry and we might get him 'cheap'.

When I called him and asked if he had any interest he politely declined and said he was going to work for some company named IPG that made fiber lasers. I didn't think he'd make any money doing it, but at least it was a pretty close commute for him. The rest is history. I also knew a couple of other people in the laser industry who tried and failed at sales and marketing at IPG in the early days for whatever reason (probably the product and market maturity), but this did not stop Bill. I remember what he told me, "Ron, I have spent my whole life preparing for this job."

In his capacity at IPG and long before Bill was always a very strong LIA supporter, lending financial, facilities, and personnel assistance over many years. A few years after Bill joined IPG he got the idea to promote local LIA chapters and pushed it to the LIA Board. His idea was to have a system of local chapters to get people involved in LIA who would not normally get to come to the National conferences (especially students) and also to increase membership. (SME – Society of Manufacturing Engineers - has a similar model what works well for them). A local company would sponsor a dinner, cash bar, and then a one hour talk by some industry expert on some aspect of laser processing – the speaker to be chosen by the organizer.

Characteristically, at the organizing meeting, Bill volunteered to host the first LIA Northeast Regional Event – and then turned to me and told me that he already had picked a speaker for the first event, winked and said: "How about YOU doing a talk on starting and running a small, high tech laser business?"

We had already had a couple of beers so it was not hard to convince me to agree and in fact, we had a great opening night with I think about 100 people in attendance. That one hour talk eventually expanded into a business short course that I have given on many different occasions including at a few LIA ICALEO venues.

Bill was intimately involved in the LIA. He was a founding member and served on the LIA Board of Directors for over 40 years.

He was LIA President in 2007. In 2009 he was recognized with the LIA's President's Award for his many years of support for LIA and his contribution to its success. He was a fountain of ideas that sometimes seemed to just pop out of his head, as is shown in the well-timed photo presented in Figure 1

FIGURE 1 – Bill was always a fountain of ideas!

In the Eyes of His Colleagues

The internet is a wonderful mechanism for keeping in touch if nothing else. There are a large number of people within the laser industry who typically see each other at a dozen or so venues each year. Figure 2 (Pg. 10) is a 'crowd picture' of the Opening Reception at ICALEO 2006 in Scottsdale, AZ with Bill, as usual, working the crowd.

Of course, currently, things are a bit different now and everyone wonders if we will ever get back to where we were before, but one thing that is sadly true is that we will no longer be able to count on Bill's presence, his humor, and his smile. However, even though we can't meet up in person there are so many nice things being posted online about Bill that it would be foolish not to include some.

Here is just a sampling of the comments recently posted about Bill and how he was viewed by his laser industry colleagues:

"Regardless of the situation, good or bad over the 30+ years I have known him, I always felt welcomed by Bill, and I know that was genuine."

"He was one of the Great guys in the laser business."

"Always a hard negotiator and then the guy you wanted to have dinner with."

"I met him very early in my career, and he was always wonderful to me. And he was really instrumental in getting the word out on the use of lasers in MANY applications, every time anyone looks at a Gillette razor blade for example."

"He was a father figure to me. He plucked me from oblivion from Ohio State, took me under his wing, and showed me how you can be competitive, passionate, and a good human. The best salesman I will ever know. What I am, what I have, I owe a great deal to him."

"I knew Bill since I started my career back in 1984 at Laser, Inc. I always looked up to him. He contributed much to the laser community."

"There is much to respect about Bill Shiner. He invited me to a user's group meeting early in my career to promote laser safety. He asked great questions and encouraged folks to lase safely, as well as challenged and encouraged me to promote laser safety throughout my career."

"Mr. Laser for as many decades as I can remember and we do all owe him a debt of gratitude for his tireless effort to promote industrial Laser technology across every application across all industries."

"Bill was always a true gentleman. A man with ideas flowing and the best salesman I ever met. I learned so much from him over the years."

"His entire career in industrial lasers was marked by his positive attitude that an application for lasers could be found in any industrial plant. He and I walked the floors of many plants in the technology's early days and I can't recall Bill leaving without finding at least one potential application. Bill never saw an application he didn't love for laser processing. His enthusiasm, winning smile, and positive attitude turned even the most reluctant potential user into a believer."

"The legacy of Bill in the laser industry will go on for years to come. He can be credited as an inventor, a visionary, a group leader, a spokesman, and a person that has brought lasers into our everyday life."

The Real Bill

I consider Bill to be a great friend, but frankly I only really knew him in an expanded professional manner. I knew Bill had children and grandchildren and enjoyed spending time on the Cape, but only recently did I learn more. I knew his close friends and probably family called him Billy, but I never heard him called that by anyone in the laser industry. I get it – my family and elementary school friends still call me 'Ronny' and my big brother still calls me 'kid'!

I have met Bill's lovely wife Nicki on many occasions, but I did not realize that they were high school sweethearts and had been married for 61 years. My math tells me that Bill was 18 when he was married and started on his life's journey with his life's mate. This wonderful relationship produced 3 children, 9 grandchildren, and 6 great-grandchildren and counting. Even though Bill traveled extensively throughout the world, usually promoting laser applications (but sometimes vacationing with his wife and family), he really was a homebody with a firm base in central Massachusetts. He was born in Worcester, grew up in Auburn, attended Worcester Junior College and Northeastern University and spent basically his entire life within a few hundred miles of where he was born, yet intimately knew many environments around the world. Bill was an avid reader, he also enjoyed skiing and golf, but he was happiest at the Cape surrounded by his family on the beach, on his boat, or sitting around the fire-pit enjoying laughter and lively conversation with his family and friends

Bill started his professional career at American Optical, being hired by another industry luminary, David Belforte – Editor of Industrial Laser Solutions – to head the laser applications lab and find problems for this new tool to solve. I think it is of great interest that the leader of this group was Dr. Eli Snitzer, inventor of the fiber laser and that over 30 years later Bill's laser career would come full circle at IPG where he probably left his most memorable legacy of all his memorable legacies.

Bill and a partner purchased American Optical's laser division and thus in 1972 was born Laser, Inc. The company was sold to Coherent in 1978 and then was purchased by Convergent Prima in 1995 and Bill remained with this entity through its changes until 2002 when he joined IPG as Vice President of Industrial Laser Sales. He had worldwide responsibilities and was instrumental in the company's climb from $30 million in sales to well over $1 billion during his tenure bringing the company to the top of the industrial laser market. He also played a key role in taking the company public in 2006 when he was part of the roadshow team that flew around Europe and the U.S. to meet with investors and promote the company prior to its listing on NASDAQ. He semi-retired from IPG Photonics in 2018 staying on in a consulting capacity as Sr. Advisor to the CEO, Dr. Valentin Gapontsev, until fully retiring in February of 2020. Throughout his career, he was active in research and academic initiatives.

Bill enjoyed tremendous success throughout his career. He is credited with several patents in laser-technology dating back to 1969 and as recently as 2015. He rang the bell at NASDAQ, he had the opportunity to fly in an F-16 fighter jet and to land on an aircraft carrier.

FIGURE 2 – Bill at ICALEO 2006 in Scottsdale, center crowd as usual.

Conclusion

Those that knew Bill best will fondly remember how he enjoyed every day of his life and brought fun and laughter to everyone around him. He loved joke-telling, was a legendary practical joker, and a gadget collector. This is well illustrated in the following anecdote. At the 2010 ICALEO conference in Anaheim, after a Beer's Law performance at the Opening Reception, a number of us Laser Dudes were hanging out on the Marriott pool deck, drinking, laughing, playing music, and having lots of fun. Nearby tables started to fill with (mostly female) attendees at a co-located Real Estate conference. Finding out we were all a bunch of laser geeks piqued their curiosity and they wanted to know details about what it is we do with lasers. Bill decided to have a bit of fun. So... he told them he was a world famous inventor of the Laser Male Enhancement method and that all the laser experts worldwide were there to pay homage to him and his brilliant invention, and that the conference was basically to promote this product. Well, the rest of the week people were trying to sneak into the conference meetings and peeking into doors and hanging around Vendor Night, etc. We all still tell stories about that ICALEO!

All of us in the Laser Industry are going to miss seeing Bill at the next public venue – whenever that is! Bill helped start this great industry and stayed active until the end for a good reason – he loved it and he knew there was a lot more to come. It is up to those who are left to step up and take the industry to the next level. Rest in peace Bill!

Postscript

During ICALEO conferences you can find the more athletic and health-conscious members of our society gathering for an early morning jog with the LIA Laser Running Club. In honor of Bill Shiner, LIA will be hosting an online virtual charity run/walk at this years ICALEO 2020 conference. More information will follow soon. The money raised will be donated in Bill's name to the American Cancer Society.

NOTES

This article is a tribute to our friend and a leader in the laser industry, Bill Shiner. Bill also had many interests outside of the laser industry and he had a wonderful and loving wife, children, grandchildren, and extended family. The published obituary with more about Bill's personal life can be found here

https://www.legacy.com/obituaries/telegram/obituary.aspx?n=william-shiner&pid=196167168&fhid=3259&fbclid=IwAR04BAC-t8xceNf_yc9NFA2LkqSz9AmHA6qQ9QXm5HAdRg_8N31noG8AJSs

Industrial Laser Solutions Editor and long-time friend and colleague of Bill, David Belforte, published a very nice tribute article on Bill's retirement only a couple of months ago:

https://www.industrial-lasers.com/commentary/dabbling/article/14168777/bill-shiner-retires?fbclid=IwAR0wMQrJeiZCEcktKtFkLq4ENQs-7Dj3-RQ_TravghS-w7msYFbaKYID9cc

and then expressed his condolences and reminisced here:

https://www.industrial-lasers.com/commentary/dabbling/article/14175792/the-old-order-changeth-bill-shiner?fbclid=IwAR2cjabYcEq2VVkXI48EGx0BVfU30ZwFT2DRRfE4PwyxXAH9dA38bmp2Km0

ICALEO®
39th INTERNATIONAL CONGRESS ON APPLICATIONS OF LASERS & ELECTRO-OPTICS

LIA's Run with the President - Supporting American Cancer Society in Memory of Bill Shiner

The LIA Laser Running Club meets annually at LIA's ICALEO conference. This year along with the experience of a virtual conference, ICALEO 2020 is hosting a virtual walk/run in Bill Shiner's memory. In honoring the family's wishes this event will raise money in support of the American Cancer Society.

For more information on this event visit: www.icaleo.org/charity

(1941-2020)

U.S. Department of Labor Issues Frequently Asked Questions and Answers About Face Coverings, Surgical Masks and Respirators in the Workplace

WASHINGTON, DC – The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has published a series of frequently asked questions and answers regarding the use of masks in the workplace.

"As our economy reopens for business, millions of Americans will be wearing masks in their workplace for the first time," said Principal Deputy Assistant Secretary for Occupational Safety and Health Loren Sweatt. "OSHA is ready to help workers and employers understand how to properly use masks so they can stay safe and healthy in the workplace."

The new guidance outlines the differences between cloth face coverings, surgical masks and respirators. It further reminds employers not to use surgical masks or cloth face coverings when respirators are needed. In addition, the guidance notes the need for social distancing measures, even when workers are wearing cloth face coverings, and recommends following the Centers for Disease Control and Prevention's guidance on washing face coverings.

These frequently asked questions and answers mark the latest guidance from OSHA addressing protective measures for workplaces during the coronavirus pandemic. Previously, OSHA published numerous guidance documents for workers and employers, available at https://www.osha.gov/SLTC/covid-19/, including five guidance documents aimed at expanding the availability of respirators.

For further information and resources about the coronavirus disease, please visit OSHA's coronavirus webpage.

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to help ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov.

The mission of the Department of Labor is to foster, promote and develop the welfare of the wage earners, job seekers and retirees of the United States; improve working conditions; advance opportunities for profitable employment; and assure work-related benefits and rights.

Original Release: June 10, 2020

Source: https://content.govdelivery.com/accounts/USDOL/bulletins/290004d

CONTROL THAT SMOKE

By: Melanie Brooks BSN, RN, CNOR
University Medical Center in Lubbock, Texas

ABSTRACT:

Safety precautions have advanced to safer and better prevention exposure to surgical smoke/plume for patients and healthcare providers through evidence based practice. The OR team is exposed to harmful elements such as: respiratory (the exchange of oxygen and carbon dioxide for breathing thus conditions such as asthma, bronchiolitis etc.), biologic, virus, carcinogenic (substance that causes cancer), cytotoxic (substance or process which results in cell damage), mutagenic (increasing its rate of change in organism's genes), chemical, and gaseous toxic compounds from the smoke or plume from laser devices and powered energy generating units such as cautery. Studies have shown that inhalation of surgical smoke or plume can have as much or greater damage to the lungs as smoking cigarettes. Will the use of smoke extraction during surgery help reduce the risk of exposure to the toxic byproducts?

THE CHALLENGE

What are the dangers of surgical smoke? Surgical smoke is the hazardous byproduct of surgeries that use lasers and energy devices that cause thermal destruction of tissue and creates a smoke byproduct. Research has confirmed that smoke plume contains toxic gases and vapors such as benzene, hydrogen cyanide, formaldehyde, live and dead cellular material (including blood fragments), and viruses. Lasers such as the NdYag, KTP, Holmium, Thalium, and CO2 are energy generating devices used in an air media along with electrical surgical units, drills, and generators increase the risk of smoke.

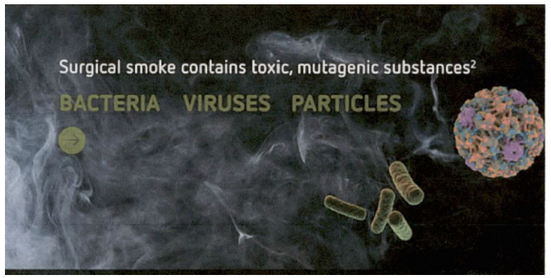


Figure 1: A graphic depicting what can be found in surgical smoke.

WHY EVACUATE?

Particles inside the plume are smaller than 2.5 um, so small that the particles can be easily breathed in and penetrate the alveoli of the lungs. Studies have shown that surgeons, patients, and operating room staff in the immediate area of the surgical smoke are subject to exposure to high levels of particulate and chemicals. One study found that particles in surgical smoke can remain airborne for as long as 20 minutes afterwards and the exposure is prolonged and the risk is increased. Plume has the potential to aerosolize live virus within the living patient such as HIV, HPV, and Hepatitis B. Research has shown that smoke inhaled from cautery or use of a laser on just 1 gram of tissue is equivalent to smoking 6 unfiltered cigarettes.

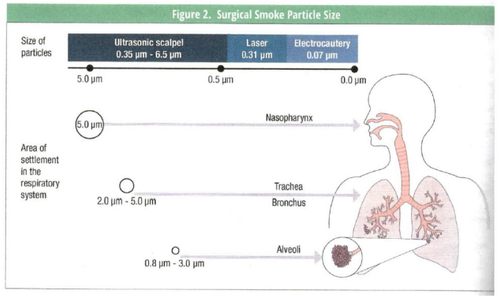


Figure 2: A chart showing surgical smoke particle size.

Besides mitigating the risks associated with the physical, chemical, and biological components of surgical smoke, there are several other reasons to evacuate smoke plume including the following:

- Surgical smoke created visibility difficulty during the operation,
- During Laparoscopic surgery toxic compounds present in surgical smoke are absorbed into the body,
- Medical staff have reported a number of symptoms associated with exposure to surgical smoke including nausea, headaches, sneezing, lightheadedness, dizziness, eye/nose/throat irritation, respiratory work induced asthma, and more respiratory illness,
- Reports have established the relationship between smoke exposure and health according to AORN-Association of Operating Room Nurses

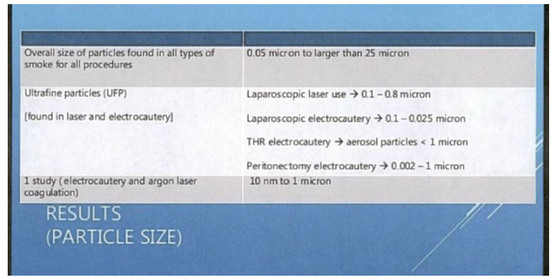


Figure 3: A chart explaining particle sizes of surgical smoke from lasers.

THE SOLUTION

The solution is to reduce the production of smoke, evacuate the smoke, and wear PPE (personal protective equipment. Some of the barriers that have been documented are the lack of smoke evacuators, no smoke accessories available such as laparoscopic filters, surgeons refusal to evacuate the smoke, smoke evacuator to loud or cumbersome, and competency or education deficits.. Some of the decisions to evacuate need to use a smoke evacuator with a 0.1 um filter. Medical-surgical vacuum system with an in line filter between the wall connection and the suction canister, position the capture device close to the surgical site, use of a filtered mask such as an N95 mask, room ventilation of 20 total air exchanges per hour, and use of administrative controls such as policies and procedures. Regular surgical mask have been documented as being non-effective in filtering particles in the operating room. This is a systematic control of risk reduction and protection for the staff and patient. Patients and staff are in a unique working area and all must participate in keeping the atmosphere as smoke free as possible. The key area of concern is the surgical suite and the team approach is important to reduce the exposure of surgical smoke by having all the requisite information and tools. The data clearly demonstrated there is no such thing as safe surgical smoke.

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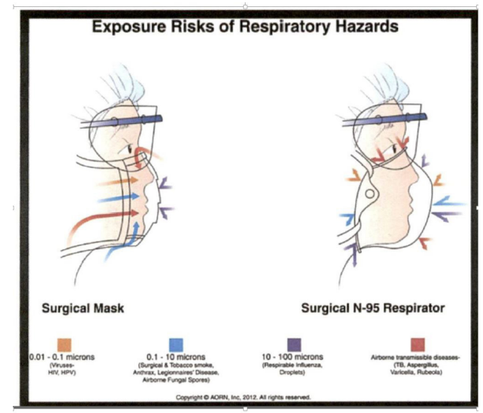
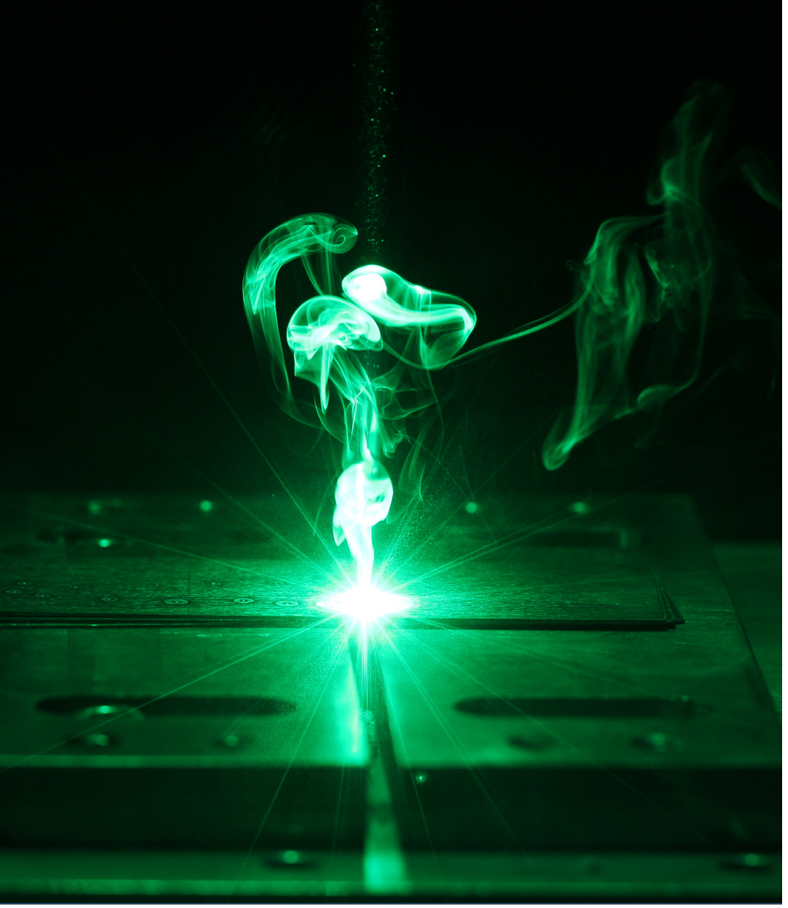


Figure 4: An image depicting the exposure risks of respiratory hazards comparing a Surgical Mask and a Surgical N-95 Respirator.

Meet the Author

My name is Melanie Brooks and I have been a Registered Nurse for 44 years. I have a certification in the operating room and have been involved with the perioperative nursing field for over 40 years. I have been employed at University Medical Center in Lubbock, Texas for the past 10 years. I am involved as a deputy to our Laser Safety Officer, Team Coordinator for Gynecology, Urology, Opthalmology, Infertility, and Robotic surgeries at a Level 1 trauma center..



Powerful disk lasers emitting green light are the perfect tool for welding copper for auto manufacturers and their suppliers.

A Green Light for Green Mobility

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Automotive manufacturers and suppliers require reliable standards for electric car production. Experience has shown that green lasers are the perfect welding tool for electric components made of copper.

Better for the environment, less expensive than gas, less maintenance at a lower cost, quiet operation – these are but a few of the green attributes of the electric vehicle which make it an attractive alternative to the gasoline engine. Electric mobility is currently one of the biggest trends in the worldwide automotive industry. Fueled by a combination of technological progress, statutory requirements and evolving customer demands, electric cars are now on the verge of becoming a genuine mass-market mainstream offering. This has prompted automakers, suppliers and machine makers to determine the best way to produce each e-mobility component in high volume and to a consistently high-quality standard. In some areas, no single manufacturing technology has emerged as an established standard, one example being the joining and welding of copper electrical components in the battery, motor and powertrain. However, the high-power green laser has proven to meet the stringent production requirements of high productivity, excellent quality welds with reproducible results.

The Green Supremacy

Copper – and to a lesser degree aluminum – is an ideal choice for electrical connectors due to its high electrical and thermal conductivity. Copper conducts electricity and heat better than any other commonly used industrial metal. Unfortunately, it absorbs very little infrared light, which is exactly the wavelength regime in which most industrial lasers operate. Working at a wavelength of around one micron, these lasers have a tough time processing copper. At room temperature, copper reflects 95 percent of infrared light and only absorbs between 3 and 5 percent.

As the temperature of the copper increases, so does the rate at which it absorbs infrared laser light, climbing as high as 20 percent. Getting the welding process started requires significant energy input. The material heats up and as soon as the melting temperature is reached, the rate of absorption suddenly increases, producing a spike in energy that is difficult to control. This complicates the production process by causing a delay in the onset of welding that cannot be precisely reproduced even when using identical parameters – so it is impossible to be sure in advance where the weld seam will start. In addition, the excess energy leads to erratic processes with spatter along the entire weld path. This is something that is completely unacceptable in a confined environment full of sensitive electronics, especially when manufacturing electric cars.

With green laser light, on the other hand, all these problems disappear. Scientists have long known that copper absorbs short-wavelength laser light significantly better than long-wavelength light. But only in the past few years have beam sources come onto the market that can deliver this light at the power levels required for industrial welding. Modern industrial disk lasers that operate in the green spectrum (515 nanometer wavelength) can now deliver two kilowatts of power output. At room temperature, copper absorbs 40 percent of this green laser light – a rate of absorption that is eight times higher than the near-infrared wavelengths. This significantly improves welding, leading to a much more stable processes, smoother bead surfaces, low-spatter formation and more consistent penetration depths.

Green Light - Cu for Welding

Green light offers specific benefits when it comes to processing this challenging metal. For one thing, it enables users to carry out reproducible heat conduction welding of copper – something that is currently impossible with near-infrared lasers. Penetration depths of up to 500 microns can be achieved in industrial settings using heat conduction welding with a two-kilowatt laser power. Green light also makes the heat conduction welding process completely spatter-free, helping to create a smooth weld seam surface. Since there is no keyhole formation and therefore no metal vapor, the seam is free of pores. This increases the conductivity of the joint.

Deep penetration welding of copper is another area where the benefit of green light really shines. With a green laser power of two kilowatts users can achieve consistent weld depths of up to 1.5 millimeters, which is unachievable with near-infrared lasers. What's more, the higher absorption rate means welding can also be performed with defocused laser light. The green laser then produces a wedge-shaped keyhole that gets wider toward the top, creating a seam form that makes it easy for vapor to escape. This results in stable, low-spatter processes and an even weld seam surface.

Another benefit to using green light is that relatively little heat is transferred to the part being welded. Absorption is high, which means the processing time is relatively short, so minimal heat is lost into the material. The part distorts less and is subjected to a lower thermal load. What's more, users do not have to resort to beam oscillation (wobbling) to achieve high seam quality but can simply stick to linear welding. This allows for a high feed rate and thus higher productivity. It also makes the process simpler because fewer parameters need to be defined. Not to mention, there is no need for more expensive beam delivery optics that oscillate or wobble the beam.

> *In an industrial setting, this means that, in many cases, users can do without upstream surface preparation processes such as sandblasting or tin coating if they use a green laser.*

Numerous tests have demonstrated that surface conditions of the copper have no effect on results when welding with green light. In other words, it makes no difference whether the copper is polished, sanded, untreated or heavily oxidized. The weld depth or consistency is not affected by the degree of oxidation, superficial scratches or highly reflective, mirror-finished surfaces. In an industrial setting, this means that, in many cases, users can do without upstream surface preparation processes such as sandblasting or tin coating if they use a green laser.

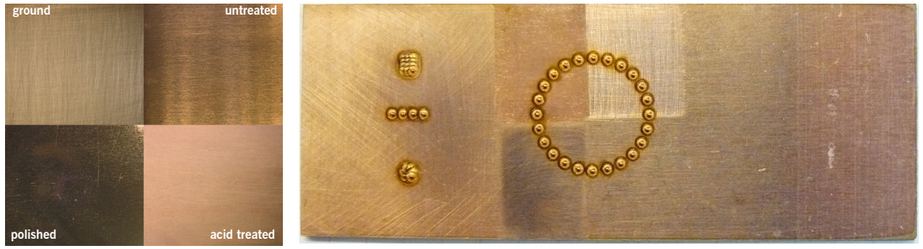

Figure 1: The surface of the copper makes no difference to green laser light. The results are the same for polished, sanded, untreated or etched surfaces – and even scratches and varying degrees of oxidation have no influence.

As well as being an excellent choice for processing copper, green laser light is also suitable for other widely used industrial metals such as aluminum, steel and gold. That makes the green laser particularly interesting for users who wish to process a range of materials with a single beam source.

Applications in E-Mobility

The field of component manufacturing for electric cars offers numerous applications for powerful green laser light – from the battery and powertrain to the power electronics. Four key applications offer particular promise:

Battery foil welding: Battery cells consist of stacked layers of very thin copper and aluminum foils. Each foil is welded to a tab made of the same material before the cell is filled with electrolyte. Two key challenges arise during battery foil welding. First, air between the foils can potentially lead to well spatter. Second, to ensure that the foils (low thermal capacity) do not burn before enough heat has reached the tab (high thermal conductivity). Using green laser light, users can achieve a large, pore-free bonding surface and reduced spatter formation, especially with copper foils.

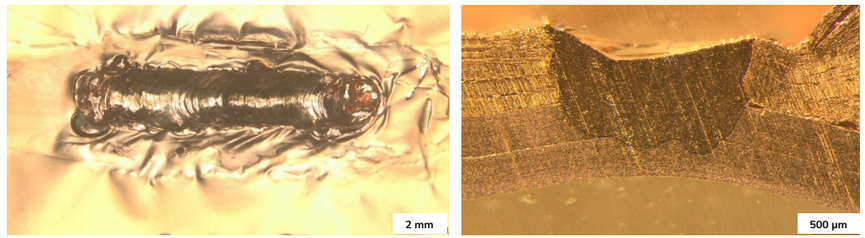

Figure 2: Welding one hundred 6-micrometer battery foils to a 2 x 0.5-millimeter copper tab: a large, pore-free bonding surface and a smooth top bead with minimal spatter formation.

Welding cell connectors: The welding process used to connect battery cells often brings together different materials. A typical combination is welding copper to aluminum or vice versa. By creating a weld seam in a meandering motion using green laser light, users can achieve a large bonding surface with a high tensile strength of significantly more than 600 Newtons for connections between different materials. The high laser power enables high feed rates and high productivity with minimal heat input to the underlying part. The high process speed also helps suppress the formation of undesirable intermetallic phases.

Busbar welding: Copper busbars are used in applications such as battery modules and power electronics. They are generally welded in an overlap joint. With a power output of two kilowatts, the green laser is the ideal choice for quickly and reliably welding copper sheets measuring 0.5 by 2 millimeters, for example. To further increase the cross-section and thus the conductivity of the join, a circular geometry instead of a linear weld seam can be utilized.

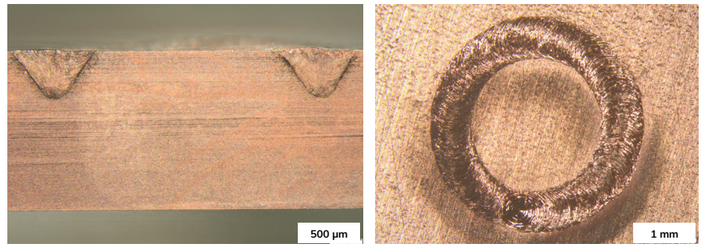

Figure 3: Busbar welding with copper sheets measuring 0.5 by 2 millimeters: a consistent penetration depth in a welding time of just 0.42 seconds.

Welding contacts for DBC substrates: DBC (Direct Bond Copper) substrates for power electronics are heat sensitive. They are generally contained in an extremely confined space, which makes access difficult. Scanning optics can be used to position green laser pulses precisely at the weld point. The rapid welding process means that very little heat enters the contact and the surrounding structure, so the thermal stress load is low. Penetration depth can be precisely controlled and reproduced – and the heat-sensitive DBC substrate remains intact while the contact is being formed. There is also significantly less spatter due to the green laser wavelength. Spatter can lead to short circuits and the destruction of the entire component, especially in the case of power electronics components.

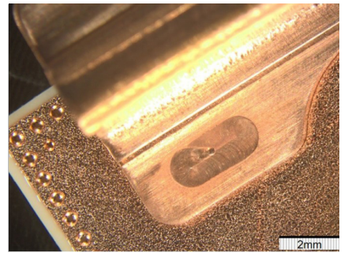

Figure 4: Connecting copper contacts to DBC substrates: green laser light offers a controlled penetration depth that keeps the DCB substrate intact. Scanning optics guide the light to the exact processing point even when space is tight.

Green Gives Blue Light the Blues

In principle, similarly good results should be achievable with blue laser light (450 nanometers), which is next to green on the wavelength spectrum. Technically speaking, it makes no significant difference whether green or blue light is used in terms of the resulting coupling behavior in copper. But what does make a difference is the choice of beam source. Currently available beam sources for blue are based on gallium nitride diode material, which has not yet proven its durability for laser material processing in industrial settings. In contrast, disk lasers with a green wavelength use the same diode material as infrared disk lasers, which have been proven in the field for many years. Green lasers are also superior to blue lasers in terms of the power output that is currently achievable. However, the biggest advantage of green light from disk lasers compared to blue light from the diode is its significantly better beam quality of up to 2 mm*mrad with a small numerical aperture of

0.1. To obtain higher laser power output from blue diodes, manufacturers currently resort to spatial addition of diode material. However, this results in significantly lower beam quality. For many industrial applications in electric vehicle construction – which require delicate weld seams and a correspondingly small focus – blue light is therefore not a viable option.

Yet the primary reasons for green's supremacy over blue are practical ones: the high beam quality of green light hugely simplifies the way machines are designed and enables the use of focusing optics with a longer focal length. This means the optics do not have to be right above where the work is carried out. They can be guided above the workpiece at enough of a distance to allow easier access to narrow work areas, reduce contamination and extend their service life. The significantly longer Rayleigh length (i.e. larger depth of focus) paves the way for far greater tolerances in terms of working distance. Green light requires less precision than blue light when it comes to both fixtures and part tolerances.

> *The biggest advantage of green light from disk lasers compared to blue light from the diode is its significantly better beam quality.*

In addition, green lasers enable the use of scanner optics. Combined with long focal lengths, these provide a larger scan field. For example, programmable scanner optics with a focal length of 265 millimeters cover a scan field of 140 x 100 millimeters. The advantage is that neither the part nor the optics need to be moved. Simply moving the scanner mirrors is all it takes to process a part – or even several parts at a time – and achieve high productivity. No additional axes are necessary.

Transmission losses for blue laser light in fiber-optic cables are higher than for green laser light by a factor of 1.4. This makes it easier to integrate green lasers in machines. It also makes it possible to use a single laser for several different machines via multiple outputs, which increases productivity enormously. Green lasers also have the advantage of an extensive range of industry-standard optics, machines, process monitoring solutions and software, which have been comprehensively tested and are already available.

Based on these advantages and all the applications described above, green laser light from industry-proven disk lasers is the perfect tool for all copper-processing manufacturing tasks, especially in the electric car industry.

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BLS
THE BOARD OF LASER SAFETY

NEWSLETTER

Volume 1 • Issue 3

Certification Maintenance Tip!

You can earn BLS Certification Maintenance points by reading laser-related peer-reviewed academic journal articles. Points for journal article reading are claimed in Category 9, Other Activities. Record your reading using the Journal Article Verification Worksheet and have it signed by your supervisor. Attach it to your Certification Maintenance Worksheet as evidence of completion.

You can earn 0.25 CM points per hour of reading for a maximum of 2.0 CM in Category 9. Visit our website for details.

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Paper-and-Pencil Exam Administration

The pencil-and-paper exam scheduled to be offered prior to the 2020 DOE LSO Workshop on August 17, 2020 in Austin Texas has been canceled due to COVID-19 concerns. Computer-based testing will resume once our third party test administrator's testing facilities open up. After that, Computer–based testing will be available year-round. For exam information, visit www.lasersafety.org, or contact us at bls@lasersafety.org

CLSO Exam Reference Guide Now Available

Updated CLSO Exam Reference Guide is now available. The guide includes test taking tips, practice questions, and a detailed breakdown of the exam areas of practice. This guide is available to download for free on the BLS website.

www.lasersafety.org

DOE LSO Workshop

The DOE LSO Workshop is a great opportunity for CLSOs to earn CM credit toward renewal! The Workshop was **rescheduled** due to the COVID-19 pandemic. The new date of the workshop is **August 18-20, 2020**. You can find a link to the Workshop on the BLS home page www.lasersafety.org

ASC Z136 Annual Meeting

The ASC Z136 Annual Meeting was postponed due to the COVID-19 virus and after careful consideration, it has been decided that the ASC Z136 2020 Annual Meeting will be held virtually via Zoom web conference on the below date:

DATE: Monday, July 20, 2020

START: 8 am PDT/11 am EDT

END: 3 pm PDT/ 6 pm EDT

Check the Z136.org website for updates or for more information please email z136@lia.org

Write for BLS!

Looking for a way to earn BLS CM points for free? BLS has restarted it's newsletter and is inviting CLSOs and CMLSOs to share laser safety knowledge with the laser community! Published article submissions are worth 0.5 BLS Certification Maintenance (CM) points in Category 3. For more information on guidelines and regulations, email us at bls@lasersafety.org. Check out one of our submissions on the next page!

Establishing a Medical Laser Safety Program

by Bobbi Childers, CMLSO

About the Author - Certified Medical Laser Safety Officer

Bobbi Childers is BSN,RN,CNOR,CMLSO of University Medical Center in Lubbock, Texas which is a level 1 trauma center. She has been a nurse for 36 years and the past 19 years worked in the operating room at UMC. She received her Medical Laser Safety Officer certification 6 years ago and since then has expanded my knowledge on the importance of laser safety and the value of a laser safety program.

Respecting Laser Light

Over the years, lasers have become an important part of medical practices. The light produced by lasers is amplified by the stimulated emission of radiation. This light can be invisible, or it can be a bright visible color such as green or red. A laser system can be as small as a microchip or as immense as a ten-story building (National Facility & Photon Science, nd). Since the light starts as a low-energy pulse and is amplified a quadrillion times, it creates a beam that is both useful and potentially hazardous. Lasers can be dangerous if not used properly, leaving the patient and staff in a vulnerable situation. This is why it is vital for medical facilities with class 3B or class 4 lasers to have a laser safety program.

Red laser light beam

Green laser light beam

Responsibilities of the LSO

Each organization should have a designated LSO who has the responsibility for the oversight and the control of laser hazards (American National Standard Institute 136.3, 2018). AORN Recommended Guidelines recommends that all health care facilities performing laser procedures establish a laser safety program. As the Laser Safety Officer (LSO), I determined that the level one trauma center where I worked did not have a laser safety program. Therefore, there was no consistent standard of practice established for laser procedures, and we were out of compliance with standards and regulations concerning the safe use of lasers.

Getting Approval

Once I discovered our hospital was lacking a laser safety program, I started researching the standardized practice for the use of lasers in health care facilities. Guidelines from the American National Standard for Safe Use of Lasers in Health Care, AORN's Guidelines for Perioperative Practice, and the State of Texas regulation were vital resources. This research provides guidelines to help the staff meet the expectations of the hospital and myself.

At this time, I was already a Certified Medical Laser Safety Officer, but I still needed more insight on our particular laser systems, so in November 2015, I attended Laser Institute of America's (LIA) Medical Laser Safety Officer Training. The training provided the confidence I needed to get my laser safety program off the ground. Later, I met with my Operating Room Director and the Vice President of Nursing Services to give my recommendation for this project. At first, they were reluctant about creating a new program and were not sure it was necessary. Then I shared with them my vision of a laser safety committee, that evidence-based practice of laser safety by interdisciplinary teams could help ensure safe, efficient, and effective patient care, and they soon agreed.

The Laser Safety Committee

I had the approval of the administration, and I created my plan of action. I composed a letter explaining the purpose and importance of an LSC. The message went to the hospital's interdisciplinary teams which consisted of: a surgeon who uses lasers, Anesthesia, Credentialing, Nursing Administration, Performance Improvement, Biomed, the Administrator of Surgical Services, and the educators of each department that houses a laser. On July 11, 2016, we had our first laser safety committee meeting. The meeting's goal was to provide information on the importance of laser safety, to standardize safe patient care, and to submit information to the LSC on the regulations and guidelines for various medical laser systems. Standardizing nursing language for documentation was critical for direct patient care and it has helped promote laser safety by communicating why it is essential, what is involved, and the desired outcomes of laser safety.

The importance of policies concerning laser safety was explained to the LSC. The only existing policies in the hospital were

in the surgical department. Each department wrote a plan specifically for their department, and the committee began writing a house-wide policy with the laser safety requirements. Following the completion of the policies and procedures, the education process began. Education was a big challenge, because the other departments, (Cath lab, Gastroenterology, Physical Therapy, and the Cancer Center) had no formal training in laser safety. To remedy this, laser safety in-services were given to each department and now continues annually. Education for the staff members on laser safety is now the responsibility of the Clinical Instructors.

Facing the Challenges of Change

Change always brings some challenges along the way. Educating the staff was not a big issue; it was their acceptance of the new policies and practices related to the use of the lasers; they had been using these laser systems for several years already. The biggest obstacle was wearing laser protective eyewear (LPE) during endoscopic procedures. The argument was that the laser fiber wire was inside the body when the laser fired; therefore, the staff did not need to wear LPE. According to ANSI Z136.3-2018 (C1.6.1), "it should be emphasized that using endoscopes, microscopes, or video monitors does not preclude the laser beam's emission from a break in the optical fiber" (p.65-66). The LSO can determine if the LPE is required (p.66). The staff wears LPE on all laser procedures in compliance with our policy. The decision to use the LPE for all cases ensures the team remembers to wear the LPE when the fiber is not inside the body. We found this made it simpler.

Team members are wearing laser protective eyewear during the laser procedure.

Another obstacle was related to the laser procedures done in the Pediatric Intensive Care Unit. The ophthalmologist was doing procedures in the PICU with no window coverings. Uncovered windows were a problem that had to be solved immediately. The solution was to take the patient to the obstetrical department and use one of the procedure rooms. The window to this area has a laser window covering. This solution worked well once the physician understood that this was safest option for the patients and the staff.

Conclusion

Lasers are changing the lives of people every day, however there are hazards associated with the use of these machines. Safety during laser procedures is never an option and neither is the safety of the patient. The LSO and the LSC are instrumental in training and educating the staff, making lasers safer for everyone involved in the procedures. A successful laser program takes a dedicated LSO, supportive LSC and a cooperative interdisciplinary team. Before I started my mission on creating the laser safety program, I knew I had to do my research on lasers, study the recommendations on the safe use of lasers and determine who to contact with any questions that might arise. LIA, AORN, ANSI Standards for Safe Laser Use, and the Texas Department of Radiation were my resources in building a successful program. Always keep in mind that a team working together can be more successful than working alone.

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About BLS

The mission of the Board of Laser Safety (BLS) is to provide a means for the recognition of laser safety professionals through certification and to promote competency in the field of laser safety. BLS certification will enhance the credibility of a designated Laser Safety Officer, and demonstrate that individuals serving in the field have agreed to adhere to high standards of safety and professional practice. For the employer, having a CLSO or CMLSO on staff demonstrates due-diligence and helps to ensure legitimacy and adequacy of the laser safety program, validating the company's dedication to a safe working environment for all employees.