

BEFORE THE HAWAII STATE EMERGENCY
MEDICAL SERVICES SYSTEM

PETITION FOR RULEMAKING TO REGULATE SIRENS AND
FLASHING LIGHTS

SUBMITTED BY
SOFT LIGHTS FOUNDATION
ON
JANUARY 1, 2024

CITIZEN PETITION

The undersigned submits this petition under the Hawaii Administrative Procedure Act to request the Chief of the Hawaii Emergency Medical Services System issue Hawaii State Comprehensive EMS System's Rules and Regulations Section 11-72-24 – Emergency Vehicles.

A. ACTION REQUESTED

Petitioner requests that the Chief issue State Comprehensive EMS System's Rules and Regulations Section 11-72-24 – Emergency Vehicles to regulate vehicles that respond to medical emergencies. Specifically, this petition requests that the Chief act to prohibit or restrict the use of high intensity flashing lights and loud sirens to ensure first responder, patient, and public comfort, health, safety, and civil rights.

B. STATEMENT OF GROUNDS

I. Introduction and Summary

Light Emitting Diodes can be used to pulse intense, flashing, directed energy visible radiation using electronics that can create synchronous and asynchronous flash patterns with a digital on/off characteristic. The luminance of these LED strobe lights may be as high as 100,000,000 candela per square meter, whereas maximum human comfort level is about 300 cd/m² and seizures can be induced as low as 20 cd/m². LED flashing lights have been documented to cause life-threatening photosensitive seizures, multi-day migraines, and anxiety panic attacks. The intensity of LED flashing lights may be causing permanent eye damage.

Research has shown that flashing lights, especially with such high intensity, puts the patient, the public, and first responders at risk of injury or death because they impair vision and cognitive functioning. LED flashing lights create discriminatory barriers for people with disabilities such as those with epilepsy, autism, PTSD, and migraineurs. LED flashing lights violate basic civil rights such as the right of visual freedom.

The sirens used on emergency vehicles are typically omni-directional and can exceed 100 decibels. As an emergency vehicle travels while using such a siren, large numbers of people who are uninvolved in the emergency are impacted, with certain individuals and animals suffering anxiety, fear, panic attacks, and pain. The use of sirens increases stress.

This petition requests that the Hawaii Emergency Medical Services System publish regulations prohibiting the use of flashing lights and restricting the directionality and limiting the volume of sirens used on emergency vehicles to protect the comfort, health, and safety of the public, to eliminate the discriminatory barriers created by sirens and LED flashing lights, and to ensure that the civil rights of citizens are not violated.

II. Statement of Facts

A. Examples of LED Flashing Lights

1. **Tungsten Filament Flashing Lights** - This link shows non-LED flashing lights which are unlikely to trigger seizures, migraines, or panic attacks or cause eye injury:

<https://youtu.be/DHJZTb7qXQo> Notice the slow rise and decay times, the gentle glow, and low luminance. The light from a flashing tungsten filament such as the one shown in this video disperses over distance following an inverse square law.

2. **Police Vehicles** - Figure 1 shows the use of intense LED flashing lights on a police vehicle.



Figure 1 - Police LED Flashing Lights

3. **Ambulances** – This video shows LED flashing lights on ambulances.

<https://youtu.be/amoR1QSiBhw>



Figure 2 - Flashing Lights on Ambulance

B. Patient Outcomes and Safety

In the research study titled, Is Use of Warning Lights and Sirens Associated with Increased Risk of Ambulance Crashes? the researchers conclude, “*Ambulance use of lights and sirens is associated with increased risk of ambulance crashes.*”¹ In the article published in FireRescue1 titled Why Running Lights and Sirens is Dangerous, the author writes “*No evidence links lights and sirens use to better patient care or improved patient outcomes.*”²

In an article in EMS1, the authors wrote, “[*The Plum EMS*] crew came upon road construction and chose not to light it up. This resulted in a 5-6 minute delay, which turned out not to have a measurable impact on the patient.”³ The author of the article titled A Ten-Point Toolkit for Effective Warning Lights published in Ambulance Visibility wrote, “*There is now no doubt that the dazzling display of (no less than) seven uncoordinated flash patterns will definitely amplify the confusion felt by drivers as they strain to decode the crazy light show.*”⁴

Given the information presented above, the question must be asked, “Why are lights and sirens used on emergency vehicles if there is no improvement in patient care or patient outcome, but there is a higher risk of injury or death to the patient, the first responder, and the public? The answer is that there are companies that sell flashing lights and sirens, and these companies seek to make a profit. There is no research that

¹ <https://pubmed.ncbi.nlm.nih.gov/30648537/>

² <https://www.firerescue1.com/fire-products/vehicles/ambulances/articles/why-running-lights-and-sirens-is-dangerous-nHnR5EPEXd3SzfIt/>

³ <https://www.ems1.com/ems-products/ambulance-safety/articles/team-driven-improvement-in-the-use-of-lights-and-sirens-6YcxOle9akfbNZUn/>

⁴ https://ambulancevisibility.com/web_images/EMSAC%20Star%20-%20Lighting2%20-%20October%202011.pdf

supports the use of lights and sirens, while there is substantial evidence that supports the prohibition of lights and sirens. (See Appendices).

C. Neurological Impacts

A January 2022 study titled, Visually Sensitive Seizures: An Updated Review by the Epilepsy Foundation published in the journal *Epilepsia* contains vital information on the negative impacts of flashing lights.⁵ The opening line in the abstract states, *“Light flashes, patterns, or color changes can provoke seizures in up to 1 in 4000 persons.”* For the American population, this translates to approximately 83,000 people who must be protected from the risk of suffering a life-threatening seizure.

The abstract also states, *“Images with flashes brighter than 20 candelas/m² at 3-60 (particularly 15-20) Hz occupying at least 10 to 25% of the visual field are a risk, as are red color flashes or oscillating stripes.”* This report uses 3Hz as a lower limit and 60Hz as the upper limit, but other research uses 1Hz or 5Hz. While the author of this petition has been unable to obtain the luminance specs from the manufacturers for LED flashing lights, it is likely that that the luminance exceeds 100,000 cd/m². Considering that seizure risk increases at a luminance greater than 20 cd/m², it is clear that LED strobe lights are dangerous for people who have been diagnosed with photosensitive epilepsy. The authors of the *Epilepsia* review write, *“Prevention of seizures includes avoiding provocative stimuli...”* Government officials thus have an obligation to eliminate the use of high-luminance flashing lights to remove the provocative stimuli from public spaces such as emergency vehicles. The last line in the abstract states, *“Visually-induced seizures remain significant public health hazards so they warrant ongoing scientific and*

⁵ <https://onlinelibrary.wiley.com/doi/10.1111/epi.17175>

regulatory efforts and public education.” This petition to the Hawaii Emergency Medical Services System is one of those regulatory efforts.

In the article IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers⁶, there is a diagram showing the risk of seizure. Notice that in any situation in the chart, there is at least a medium risk of seizure. The high risk of seizure begins at a luminance of 20 cd/m² and a flash rate greater than 1 Hz. Given that LED flashing lights are likely 100,000 cd/m² or greater, LED flashing light intensity is essentially off the chart in intensity and would likely trigger seizures regardless of the flash rate. It should be clear from this diagram that the use of LED flashing lights should be avoided in almost all situations.

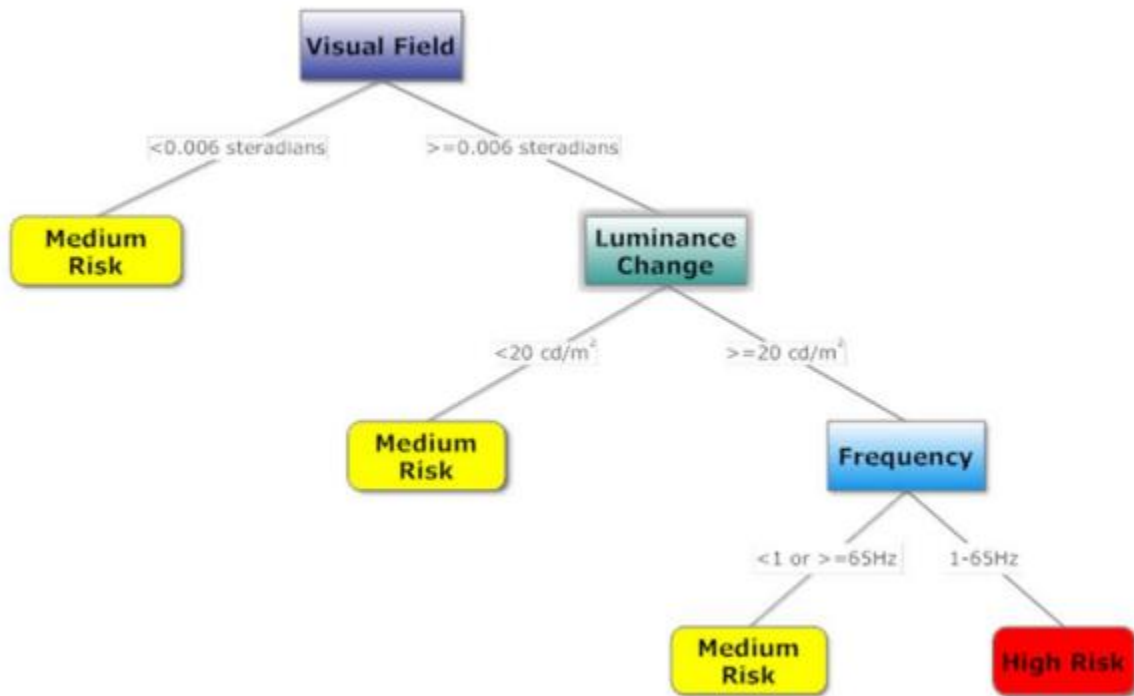


Figure 3 - IEEE Photoepilepsy Diagram

⁶ https://www.bio-licht.org/02_resources/info_ieee_2015_standards-1789.pdf

A study published in *Frontiers in Psychology* on June 8, 2021 stated that individuals with autism displayed , “*dislike for extreme or flashing lights.*”⁷ A February 21, 2023 study published in *Frontiers in Human Neuroscience* stated that, for individuals with autism, “*increased sensitivity to sensory input, such as light, can lead to experienced overstimulation that might cause distress...*”⁸ The research article titled *A Review of Decreased Sound Tolerance in Autism: Definitions, Phenomenology, and Potential Mechanisms* stated that “*many autistic adults continue to experience anxiety in response to loud noises*”⁹

D. Personal Injury Stories

The possibility of injury such as seizure, migraine, or panic attack is not theoretical. These injuries have already occurred in the real world. Here are stories of personal injury from LED flashing lights.

Individual 1 – September 9, 2021 – Email to Oregon Department of Transportation

“LED lights are now so intense, they are causing injury. I personally have suffered repeated psychological trauma from being poked in the eyes by LED lights. Many times, when I drive on Highway 101, I am attacked by these devices and poked in my eyes by the light. My nervous system is now completely frazzled by having been assaulted by these strobing lights so many times. I most likely have Complex PTSD. LED lights have such an intense peak luminance and peak radiance that they overwhelm my central nervous system. I cannot properly see, think, or concentrate. I have mild autism, so these RRFBs are illegal barriers to access and are discriminatory.”

⁷ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8217662/>

⁸ <https://www.frontiersin.org/articles/10.3389/fnhum.2022.1052604/full>

⁹

Individual 2 - March 17, 2022 – Email to Little Canada, Minnesota

“I have photosensitive epilepsy and experience epileptic auras. One day I was driving home from work and I encountered an RRFB (Rectangular Rapid Flashing Beacon). A pedestrian pushed the button on the RRFB and the strobing RRFB was so distracting and blinding that I almost drove into the pedestrian. My epileptic auras began and I was immediately nauseous, my left leg started to twitch, and I felt pain in my eyes. My legs were wobbly, and I felt physically unstable. I drove to my apartment, stepped inside, and then felt like I was losing control of my bladder. Instead, I vomited. I then did almost nothing but sleeping for the next two days and missed work.”

Individual 3 – July 8, 2022 – Email to Williamstown, Massachusetts

“This incident occurred on Friday, July 8th of 2022 in Williamstown Massachusetts around 3:50 in the afternoon. My mother and I were driving west on Rt. 2 through Williamstown MA, as we approached the intersection of Park St and Rt. 2, a pedestrian approached the crosswalk positioned on the west side of the intersection which triggered the strobe lights on the crosswalk sign. There were no other visible strobe lights in the area and there is a small rise in the road just before the intersection, so the crosswalk came into view suddenly. My mother, a photosensitive epileptic, had an immediate and violent seizure in the passenger seat sitting next to me. Her head and her right arm smashed against the passenger side window a couple of times and her left hand hit my arm a few times while her limbs flailed. Thankfully, I was able to maintain control of my car and rapidly decided to turn right (north) onto park street, to reduce any prolonged exposure to the strobe light facing Rt. 2.

There is no curb on Rt. 2 to pull over and I did not want to risk my mother coming into contact with another strobe light, so I felt it best to take this course of action. The crosswalk is

positioned to the west of the intersection so I was able to make the turn immediately without needing to wait for the pedestrian to cross. After turning down park street, I turned right again into the first available driveway to get myself and my mother off the road. That entire maneuver, from contact with the strobe light to when I ultimately pulled into the driveway off of Park St. took about 20-25 seconds, and my mother's seizure was ongoing this entire time. I turned the car off in the driveway and put my arms around my mother to help prevent any further physical injury to her limbs which are still flailing around the cabin of the car. Her seizure progressed for another 60 seconds before she began choking, so I tilted her head forward a bit.

Her body stopped seizing after another 30 seconds and then she remained unresponsive for another 2 minutes. I could tell she was breathing so I remained in the driveway until she recovered. I had no ability to administer actual first aid and I could not take her to a hospital without risking further exposure to strobe lights or other seizure triggers. She finally recovered enough to talk to me and asked me for some water/milk to drink. I helped her get a drink of water and I decided to remain on the driveway for another 10 minutes while she regained some strength. We exited Williamstown by heading north on Park St. until it eventually meets up with Rt. 7 north. We had no further incidents on our drive home to Cambridge NY however, my mother was in visible pain the entire ride home. This was one of the most violent seizures I had ever witnessed my mother having and my ability to respond would have been even more limited if it weren't for the position of Park St being east of the strobe light."

Individual 4 – September 3, 2021 – Incident in Yachats, Oregon

"On September 3, 2021, at approximately 8:00pm, my partner and I were driving south on Highway 101 at Yachats when we came across an emergency vehicle that was attacking us with high luminance LED flashing lights. Neither of us could see properly, and my partner, the

driver, started swearing because of the assault and because she was afraid for my life. I have been diagnosed with Autism Spectrum Disorder. LED flashing lights exceed my tolerance level and cause sensory overload. I tried to leap out of the car, but my partner grabbed onto me, trying to protect me. Eventually I freed myself and ran to the emergency vehicle and told them to stop assaulting us, that we couldn't see, and that their flashing lights were killing us. They refused to turn off the assault weapons. Here is a link to the video I took just as I suffered my sensory overload panic attack. WARNING: MAY CAUSE SEIZURES:

<https://youtu.be/GULzdBENYqA> I could not get immediately up to the truck because the light weapons were overpowering. I ran to the front of the truck and closed my eyes and waved my arms around to try and get them to stop, but they kept attacking me. Every time I opened my eyes I was stabbed by the lights. I finally ended up rolling around on the street in front of the emergency vehicle, screaming my head off and telling them to stop assaulting us. My partner came over and got me off the road, and another woman came over to try and help. I was crawling around on the ground, pulling the grass, pulling my hair, screaming. I eventually ran away from the scene. I began hyperventilating and could not stop. My partner eventually found me, and we took a number of side streets to get home.”

Individual 5 – February 11, 2022 – LED Strobe Lights on Utility Vehicles

“It’s hard to tell exactly how much of my sensitivity to LED lights comes from my autoimmune condition (Sjogren’s – which is known to cause photophobia in some patients), and how much comes from having the innate trait of high sensitivity. I get very stressed now when I drive to work and sometimes, I have to work from home to have a break from driving. Even the daytime running lights on cars are nauseating for me. And the only tinted lenses that work for me are amber ones, which create other safety issues in that it’s harder to spot the traffic light

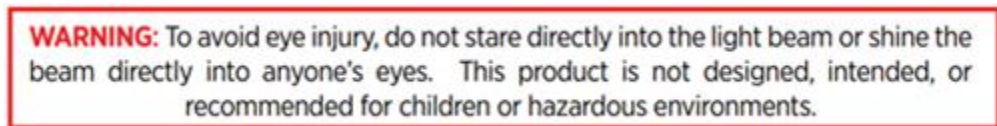
color changes etc. Strobming LED lights are becoming so common on utility vehicles and they actually cause me to go into a completely overloaded state where I can't think straight. So, I have to block them with my arm – also a hazard as I might not see a cyclist or pedestrian. I have friends and acquaintances who tell me about their aversion to LEDs also. They have a range of conditions that make LEDs harder to bear. E.g., post-concussion syndrome, migraines, high sensory sensitivity, PTSD and more. If you add up all the people in society who have one of these disorders or inherited traits then there are A LOT of people who have a reduced quality of life due to LEDs.”

E. Warnings On Other LED Products

Whelen Engineering states that LEDs can cause momentary blindness or eye damage.¹⁰



GearLight states that a person should not stare directly into an LED light beam.



The operator's manual for the Ryobi P705 Flashlight includes the following: "**WARNING: Do not direct the light beam at persons or animals and do not stare into the beam yourself (not even from a distance) Staring into the light beam may result in serious injury or vision loss.**"

The parenthetical "(not even from a distance)" indicates that Ryobi is aware that LEDs emit

¹⁰ <https://www.whelen.com/wp-content/uploads/2020/08/14555.pdf>

dense directed energy that has little dispersion, even at long distances, and that LED visible radiation does not follow an inverse square law for dispersion.

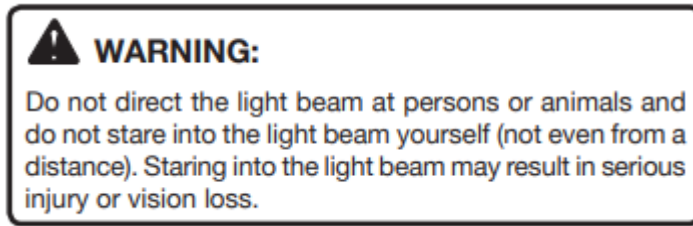


Figure 4 - Ryobi P705 LED Flashlight Warning

It is difficult to imagine that products that pulse high intensity directed energy beams of visible radiation directly into the eyes of citizens are not regulated, when companies such as Whelen Engineering, GearLight, and Ryobi put a warning label on their product explicitly stating that LED light is dangerous and can cause serious injury or vision loss. This is a liability issue for government and private entities that operate LED flashing lights, knowing that they can cause eye injury.

F. Website Flashing

The US Access Board and the World Wide Web Consortium have already developed guidelines to protect against seizures on websites due to flashing lights and images.¹¹ The fact that the Access Board has not published similar guidelines for flashing lights on vehicles is a failure of the Access Board, but cannot be used as the basis for a claim that flashing lights do not discriminate.

As per the Web Accessibility Guidelines, web pages that may cause seizures or physical reactions should be avoided and using more than 3 flashes per second should be also avoided.

¹¹ <https://www.w3.org/TR/WCAG21/#seizures-and-physical-reactions>

LED flashing lights on emergency vehicles have been documented to trigger seizures, migraines, and panic attacks. Many of these device flash faster than 3 flashes per second and there are typically multiple emitters flashing asynchronously. As per the Access Board, *Multiple, unsynchronized visual signals within a single space may produce a composite flash rate that could trigger a photoconvulsive response in such persons.*¹²

The Web Accessibility Guidelines are generally for computer displays, which have luminance values of around 300 candela per square meter. The intensity of LED flashing lights on vehicles may exceed 100,000 candela per square meter, and thus is hundreds of times more intense than a computer screen and thus far more dangerous. Given that government officials and standards bodies have already recognized the hazard of flashing lights for individuals with a neurological intolerance to flashing lights for websites, it should be prima facie evidence that LED flashing lights on emergency vehicles must be prohibited or regulated and restricted.

G. Food and Drug Administration Regulation

In 1968, Congress passed the Radiation Control for Health and Safety Act, directing and authorizing the Food and Drug Administration to regulate electromagnetic radiation from electronic products. Electromagnetic radiation is categorized by frequency. While humans have managed to harness this radiation, the radiation can also be harmful to human health. In the US, the federal agency responsible for setting comfort, health, and safety standards for electromagnetic radiation is the FDA. As can be seen in Figure 5, this includes radiation on the human visible portion of the spectrum. Light Emitting Diode products are electronic products that emit visible radiation, and thus it is the duty and responsibility of the FDA to set protective standards.

¹² <https://www.access-board.gov/advisory-committee-reports/passenger-vessels/pvaac-report-ch04/>

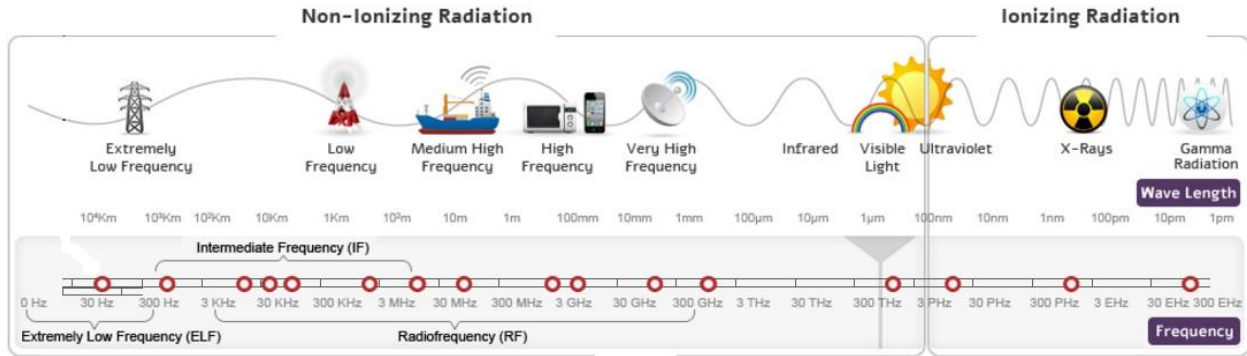


Figure 5 - Electromagnetic Spectrum¹³

The FDA has not yet published the necessary comfort, health, or safety standards for LED products. To rectify this situation, the Soft Lights Foundation has petitioned the FDA to regulate LED products and the visible radiation emitted by them.¹⁴ As of this writing, the petition is under review by the FDA and accepting public comments.

The federal Administrative Procedures Act of 1946 defines the system for creating new regulatory rules. To our knowledge, no manufacturer of LED flashing light products has petitioned the FDA for authorization to manufacture, sell, or operate LED strobe lights products. The FDA made a grave error by not publishing comfort, health, and safety regulations for LED products decades ago, but that error did not alleviate the manufacturer's requirements to comply with the Administrative Procedures Act. The correct set of steps for the manufacturers is to petition the FDA for regulatory approval, at which point the FDA would either reject the petition or would develop the necessary regulations and restrictions to protect the public from the directed energy visible radiation emitted by LED devices.

In a letter to the Soft Lights Foundation on October 19, 2022¹⁵, the Federal Highway Administration Office of Civil Rights stated, "The allegations you have raised about the health

¹³ <https://www.tnuda.org/en/physics-radiation/what-radiation/electromagnetic-radiation-spectrum>

¹⁴ <https://www.regulations.gov/document/FDA-2022-P-1151-0001>

¹⁵ <https://www.softlights.org/wp-content/uploads/2022/10/Baker-CL-2022-0375.pdf>

impacts of RRFBs raise complex issues related to the regulation of all Light Emitting Diode (LED) lights, not just those used in RRFBs, that extend beyond FHWA's authority." The reference to regulation of LEDs is to the FDA. The FHWA thus acknowledges that it has no authority to regulate LED products and the letter implies that the FHWA understands that the FDA is a federal agency with authority to regulate LED strobe light products. The Soft Lights Foundation has received similar letters from the Consumer Product Safety Commission, National Highway Traffic Safety Administration, Environmental Protection Agency, Occupational Safety and Health Administration, and Federal Aviation Administration, each confirming that they rely on the FDA for regulations for LED products.

H. Americans with Disabilities Act

LED flashing lights create discriminatory conditions that prevent a class of individuals from safely and comfortably accessing public services. LED flashing devices are unvetted, unregulated, unapproved, dangerous, and discriminatory. The paragraph below is just one of many paragraphs within the Americans with Disabilities Act Title II statutes that prohibits exclusion and discriminatory barriers created by public entities.¹⁶

§ 35.130 General prohibitions against discrimination - "(a) No qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any public entity." --- The use of LED flashing lights and loud sirens create discriminatory barriers for certain individuals, excluding them from the benefits of services, programs, and activities by public entities.

¹⁶ https://www.ada.gov/regs2010/titleII_2010/titleII_2010_regulations.htm#suppinfo

I. Civil Rights Legal Actions

Discrimination is prohibited by the Americans with Disabilities Act. The lack of FDA regulations for dangerous and discriminatory LED flashing lights has already led to multiple claims of discrimination. The Minnesota Human Rights Commission issued a Finding of Probable Cause of Discrimination against the city of Little Canada, Minnesota for their use of a high-luminance LED strobing light device.¹⁷ A lawsuit has been filed against Fairfield, California for their failure to provide accommodation for their use of an RRFB LED flashing light.¹⁸ An LED civil rights claim has been made to the New York State Human Rights Commission, Case 10212383. A news media story details an RRFB ADA lawsuit in Ashland, Oregon.¹⁹

LED flashing lights violate citizens' right to visual freedom. While the idea that LED flashing lights restrict visual freedom may be a new idea, and lacking legal case histories, it should not be difficult to realize that pulsing high intensity, strobing, directed energy visible radiation into the eyes of citizens is a violation of basic human and constitutional rights.

J. Autonomous Vehicles

Autonomous Vehicles routinely crash into emergency vehicles that are using LED flashing lights. An August 24, 2023, news story from NBC describes a crash in San Francisco involving a Cruise autonomous vehicle.²⁰

¹⁷ <https://www.softlights.org/wp-content/uploads/2023/06/74059-6-15-2023-ECP-Memorandum-.pdf>

¹⁸ https://www.softlights.org/wp-content/uploads/2023/12/Baker-v.-Fairfield_Filed.pdf

¹⁹ <http://ashland.news/local-activist-sues-city-of-ashland-over-flashing-leds/>

²⁰ <https://www.nbcbayarea.com/news/local/cruise-car-involved-san-francisco-crash/3303566/>



In another San Francisco incident, a Cruise vehicle crashed into a fire truck on August 17, 2023.²¹ In February 2023, a Tesla on autopilot crashed into a fire truck, killing the driver.²² On February 27, 2021, a Tesla on autopilot crashed into a police vehicle.²³



Figure 6 - Tesla Autopilot Crash²⁴

²¹ <https://techcrunch.com/2023/08/18/cruise-robotaxi-involved-in-a-crash-with-fire-truck-one-passenger-injured/>

²² <https://abc7news.com/tesla-autopilot-crash-driver-assist-crashes-into-fire-truck-walnut-creek-fatal/13144903/>

²³ <https://www.teslarati.com/tesla-crash-police-car-autopilot-150-warnings-report/>

²⁴ <https://youtu.be/LTk7P6gFxQg>

Autonomous vehicles use vision in much the same way as human drivers. The use of intense LED flashing lights decreases the ability of the Artificial Intelligence system to make sense of what it is viewing and to make safe decisions. The obvious solution to this problem is to eliminate the use of high intensity LED flashing lights on emergency vehicles.

III. Statutory Authority

The following Hawaii Revised Statutes provide the statutory authority for the Hawaii Emergency Medical Services System to regulate the sirens and flashing lights on emergency vehicles.

HRS Section 321-221 Findings and purpose. The legislature finds that the establishment of a state emergency medical services system, including emergency medical services for children, is a matter of compelling state interest and necessary to protect and preserve public health. A system designed to reduce medical emergency deaths, injuries, and permanent long-term disability through the implementation of a fully integrated, cohesive network of components, the legislature further finds, will best serve public health needs.

HRS Section 321-224 Department of health, functions, duties. (a) In addition to other functions and duties assigned under this part, the department shall: (1) Regulate ambulances and ambulance services statewide;

HRS Section 321-227 Regulation of ambulances. The department of health shall adopt, amend, and repeal rules under chapter 91 for the regulation of ambulances within the State, including but not limited to the certification of vehicles, equipment, supplies, and communications systems;

State Comprehensive EMS Rules and Regulations Section 11-72-45 (A) Each licensed ambulance service ambulance shall, at all times when in, use as such: (1) Be suitable for the transportation of patients with respect to health, sanitation, and safety;

IV. Conclusion

In this petition, we have shown the following:

1. LED flashing light products are unvetted, unregulated, unapproved, dangerous, discriminatory and their use violates fundamental civil rights.
2. LED flashing lights have been shown to cause serious harm and injury, including nausea, panic attacks, seizures, reduced cognitive functioning, and possible eye injury.
3. LED flashing lights are discriminatory, violating ADA prohibitions against discrimination and ADA requirements of equal access.
4. LED flashing lights violate basic civil rights such as the right to visual freedom.
5. Research shows that there is a risk of seizure from flashing lights starting at 20 cd/m². LED flashing lights greatly exceed 20 cd/m², possibly exceeding 100,000 cd/m².
6. Loud, omni-directional sirens interfere with daily life for those who are not involved in the emergency.
7. Loud sirens can trigger migraines, panic attacks, anxiety, and fear in both humans and animals.

8. The use of flashing lights and sirens has been shown to increase the risk of injury and death to the patient, first responders, and the public.
9. There is no evidence to support that the use of flashing lights or sirens improves patient outcomes.

C. PROPOSED REGULATIONS

For the reasons stated above, we request that the Hawaii Emergency Medical Services System adopt and publish the following regulations to protect the comfort, health, safety, and civil rights of patients, first responders, and the public:

State Comprehensive EMS System's Rules and Regulations Section 11-72-24 –
Emergency Vehicles.

A. Emergency Sirens

1. The use of emergency vehicle sirens shall be limited to a maximum of 80 decibels.
2. Sirens shall be directed towards the front of the vehicle, restricting sound to the sides and rear of the vehicle. Omni-directional sirens are prohibited.
3. Siren use shall be limited to a specific need. Continuous operation is prohibited.

B. Emergency Lights

1. Emergency vehicle warning lights shall be static. Flashing lights are prohibited.
2. Lights that trigger seizures, migraines, panic attacks or other adverse neurological impacts, which impair vision or cognitive functioning, or which create a discriminatory barrier, are prohibited.

Respectfully Submitted By:

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APPENDIX A - Bibliography

1. 4-D Light Field Reconstruction by Irradiance Decomposition - <https://ipsicva.springeropen.com/articles/10.1186/s41074-016-0014-z> - Shows spatial difference between isotropic and anisotropic emitters.
2. Derivation and Experimental Verification of the Near-field 2D and 3D Optical Intensities From a Finite-size Light Emitting Diode (LED) - <https://ieeexplore.ieee.org/document/8879542> - Shows that radiation from a flat surface is a Lambertian shape.
3. Is Street Lighting Damaging Our Health? - <https://online.flippingbook.com/view/702884488/> - Cree Lighting acknowledges that LEDs emit non-uniform luminance.
4. Light Emitting Diodes, Chapter 16, Human Eye Sensitivity and Photometric Quantities - <https://ocw.snu.ac.kr/sites/default/files/NOTE/791.pdf> - States that point source brightness is measured with luminous intensity in candela, and surface source brightness is measured with luminance in nits (candela per square meter).
5. The Influence of LED Emission Characteristics on the Efficiency of Lighting Systems by Osram Opto Semiconductor - <https://www.led-professional.com/resources-1/articles/the-influence-of-led-emission-characteristics-on-the-efficiency-of-lighting-systems-by-osram-opto-semiconductor-1> - Describes the difference between volume and surface LED emitters and describes the spatial emissions as a Lambertian or near-Lambertian.
6. Angular Distribution of the Averaged Luminous Intensity of Low Power LEDs Transfer Standards - <http://www.softlights.org/wp-content/uploads/2022/03/Lambertian-2013.pdf> - LEDs emit non-uniform energy in a Lambertian shape, sometimes off-center.
7. Curved vs. Flat - https://www.softlights.org/wp-content/uploads/2022/11/Curved-Versus-Flat_American.pdf - Primer on the differences between curved and flat emitters.
8. Team-Driven Improvement in the Use of Lights and Sirens - <https://www.ems1.com/ems-products/ambulance-safety/articles/team-driven-improvement-in-the-use-of-lights-and-sirens-6YcxOle9akfbNZUn/> - Discussion of the dangers of using flashing lights.
9. Can Behavioral Interventions be Too Salient? Evidence from Traffic Safety Messages - <https://www.science.org/doi/10.1126/science.abm3427> - Electronic messaging boards can increase crash rates.
10. Visually Sensitive Seizures: An Updated Review by the Epilepsy Foundation. - <https://onlinelibrary.wiley.com/doi/10.1111/epi.17175> - Flashes brighter than 20 nits create a risk of seizure.
11. Effects of Emergency Vehicle Lighting Characteristics on Driver Perception and Behavior - <https://www.respondersafety.com/Download.aspx?DownloadId=f31a5f73-7b95-44c7-bd25-1e4cdfce5229> - This study concludes that high intensity flashing lights put lives at risk.

12. Impacts of Flashing Emergency Lights and Vehicle-Mounted Illumination on Driver Visibility and Glare. - <https://www.sae.org/publications/technical-papers/content/2019-01-0847/> - This study concludes that strobe LED lights are dangerous.
13. IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers. - https://www.bio-licht.org/02_resources/info_ieee_2015_standards-1789.pdf - Flasher brighter than 20 nits and greater than 1 Hz is creates a high risk of seizure.
14. Flashing Lights Induce Prolonged Distortions in Visual Cortical Responses and Visual Perception. - [Flashing Lights Induce Prolonged Distortions in Visual Cortical Responses and Visual Perception - PMC \(nih.gov\)](#) - A flashing light induces an anomalously delayed response in the primary visual cortex of mice, rats, and humans.
15. Hazardous Effects of Light Stimulation in the Central Nervous System - <https://austinpublishinggroup.com/clinical-neurology/fulltext/ajcn-v1-id1010.php> - High-temporal-frequency visual stimuli can yield hazardous responses in the central nervous system.
16. Emergency Lights and Sirens May Do More Harm Than Good - <https://www.statnews.com/2023/07/07/emt-ambulance-emergency-lights-sirens/> - Studies show that lights and sirens can actively cause harm.
17. Sirens May 'Do More Harm Than Good,' Research Shows - <https://www.planetizen.com/news/2021/10/115044-sirens-may-do-more-harm-good-research-shows> - Quote: "The ear-piercing sirens used by emergency vehicles are shown to have little impact on patient outcomes while contributing to more dangerous road conditions, experts say."
18. EMS: Lights and Sirens: "We Always Did It This Way" - [Considerations for Fire Apparatus and Ambulances Not to Use Lights and Sirens | Firehouse](#) - Lights-and-sirens response increases the chance of an EMS vehicle crash by 50 percent and almost triples the chance of crash during patient transport
19. LED Study: To Protect First Responders, Brighter Isn't Better. - [LED Study: To Protect First Responders, Brighter Isn't Better \(coffeordie.com\)](#) - A report in the media based on the ERSI study of flashing lights.

APPENDIX B – Incidents with Flashing Lights

December 22, 2023 – [Patient Killed, Gretna Firefighters Injured in Ambulance Crash](#) – Lights and sirens involved in crash.

December 7, 2023 – [Waltham Police Officer, National Grid Worker Killed After Hit-and-Run Driver Barrels Into Worksite](#) – Flashing lights were in use. The video shows intense, rapidly flashing LED lights.

March 18, 2023 – [4 Scottsdale Police Cars Hit by DUI Driver](#) – Scottsdale police were using LED strobe lights.

June 9, 2022 – [Death Investigation in Goulds](#) – Many LED flashing lights and emergency vehicle flashing lights.

May 2, 2022 – [Are Louisiana Police Emergency Lights Too Bright?](#) – A news story about people saying that LED flashing lights are too bright.

April 11, 2022 – [Patrol Officer, 2 People Injured](#) – Police siren and flashing lights were on, likely triggering the crash.

March 25, 2022 – [Crash in Hartford Split Car in Two](#) – Police and tow trucks with LED flashing lights.

March 17, 2022 – [LED Taillight Flicker](#) – Video of flickering LED taillights.

February 19, 2022 – [Houston Police Officer Hit by Driver While Blocking Traffic](#) – The video shows multiple rapidly flashing LED lights, which likely caused the driver to lose vision.

February 1, 2022 – [Woman Killed by Tractor Trailer](#) – Incident occurred at 8pm. The video shows first responder vehicles with LED flashing lights.

January 24, 2022 – [Lake Worth Police Run Over Man](#) – Lake Worth PD initiate an incident by assaulting a man with LED flashing lights. – [Letter to Lake Worth, TX Police Department](#)

January 23, 2022 – [Austin, TX removed flashing lights in the 1950s](#) – Austin, Texas had improved safety by prohibiting flashing lights and sirens. Later, the Texas legislature mandated the flashing lights, and deaths went up.

January 21, 2022 – [2 NYPD Officers Shot](#) – Use of LED flashing lights by New York City police.

January 21, 2022 – [Arnold Schwarzenegger Accident](#) – The former California Governor was involved in an accident. The response by the emergency crews and their LED flashing lights makes the incident even more dangerous.

January 20, 2022 – [Reporter Hit by Car](#) – A reporter standing in front of LED flashing lights on a tow truck is struck by a car.

January 19, 2022 – [Compilation of New York City Ambulances](#) – Intense LED flashing lights and noise.

January 16, 2022 – [2022 Dodge Charger Pursuit Police Car](#) – LED flashing lights at 3:45 of the video clip.

January 7, 2022 – [Belt Parkway Mayhem](#) – Police agitated by their own LED flashing lights.

November 12, 2021 – [Police Chase in New Jersey](#) – The use of LED flashing lights by the police are violating civil rights.

August 18, 2021 – [Semi Truck Road Rage](#) – This nearly one hour video captures the use of LED streetlights, LED headlights, LED taillights and LED flashing lights on an freeway in Oklahoma.

December 3, 2021 – [Pedestrian Killed by Police Vehicle](#) – After the first police vehicle struck the pedestrian, more police vehicles appeared with dangerous and discriminatory LED flashing lights.

September 20, 2021 – [Miami Shooting shows Police Strobe Lights](#) – A shooting shows that excessively bright LED lights did not prevent the crime, and that the police response is to use LED flashing lights.

August, 2021 – [Tesla Autopilot Crashes into Police Vehicle](#) – “The trooper whose cruiser was hit shortly before 5 a.m. Saturday had activated his emergency lights”

March, 2021 – [Tow Truck Driver Killed](#) – An already impaired driver’s vision was further reduced by blinding LED strobe lights from a tow truck, and the motorist struck and killed the tow truck driver.

March, 2021 – [Michigan State Trooper Vehicle Hit by Tesla](#) – A police vehicle with strobe lights on was struck by a Tesla on autopilot, most likely due to the glare from the LED strobe lights.

February 13, 2021 – [Dallas Police Officer Killed by Driver](#) – Quote: “Officer Mitchell Penton was standing outside his squad car with his emergency lights on when another vehicle hit the squad car about 1:45 a.m. Saturday.”

February, 2021 - [Miami-Dade Shooting](#) – Police respond to shooting scene with high luminance strobe lights.

February, 2021 - [Winter Blast](#) – Multiple strobe lights at 0:21 in the video shining into the eyes of everyone.

August 26, 2020 – [Tesla on autopilot crashes into North Carolina Sheriff vehicle with LED flashing lights.](#)

July, 2019 - [Painesville Police](#) – Police car flashing lights contributing to a vehicle crash.

2017 – [1993 Ford Mustang Police Vehicle with Incandescent Flashing Lights](#) – These non-LED flashing lights are less intense and less likely to cause pain and seizures.

2007 - [Epileptic Complaint About Police Lights](#). The police pulled over a vehicle whose passenger had epilepsy. The police refused to accommodate her by turning off their strobe lights.

December 27, 1955 – [Siren, Light Removal Makes Police Unhappy](#) – “Removal of the sirens and red lights has materially reduced accidents involving police cars rushing to other smashups or speeding to the scene of a crime.”