

Use of high-power laser equipment in public events

General information

The aversion reflex of the eye protects eyes when they are exposed to a laser beam with output power of less than one milliwatt. The output of laser equipment used in public events is considerably higher, with output powers of tens of watts. When a laser beam with output power of one watt is shone into an eye, it can damage the eye in less than a microsecond. In this case, no reaction can protect the eye from damage. Beams can be dangerous even from far distances because laser equipment with output power of one watt can cause eye injuries from several hundreds of meters. Laser equipment operating at the visible light wavelength damages the retina, as it destroys the neurons in the retina. Damaged neurons will not regenerate, and thus vision is permanently damaged. For these reasons, there are statutory requirements concerning the use of high-power laser equipment in public events in order to ensure the safety of the practice.

This guide aims to describe the responsibilities of the responsible party regarding the use of high-power laser equipment. The objective is to clarify the requirements set forth in the Radiation Act (859/2018), Decree of the Ministry of Social Affairs and Health on the limitation of public exposure to non-ionizing radiation (1045/2018) and regulation of the Radiation and Nuclear Safety Authority on the use of high-power laser equipment (STUK S/10/2021) and the obligations set forth in other legislation. In case of any discrepancies between this document and the content of a law, decree or regulation, the stipulations set forth in the law, decree or regulation take precedence.

The responsible party is responsible for safety

The responsible party is responsible for the radiation safety of the practice. This responsibility cannot be transferred to another person or party. The obligations imposed on the responsible party are not diminished by the appointment of a person responsible for the use of high-power laser equipment, as required under the Radiation Act.

The responsible party must implement the organization of the practice in such a way that the operations meet the requirements set forth in the Radiation Act and that any radiation safety incidents are prevented with adequate effectiveness and that their consequences are as insignificant as possible.

The obligations of the responsible party include applying for licence to use high-power laser equipment, submitting a notification on the use of such equipment, assessing risks related to the use of the equipment and the safe use of equipment.

What equipment is deemed to be high-power laser equipment?

Under the Radiation Act, high-power laser equipment means products belonging to class 3B or 4 as specified in the EN 60825-1 standard. You do not have to be familiar with the standard to find out the classification of the laser equipment. The safety requirements applicable to laser equipment require that the equipment's laser classification is stated in the user instructions of the equipment and that the classification information is also marked on the equipment.

Licence is required for the use of high-power laser equipment

The use of high-power laser equipment as a lighting effect, in an advertisement, work of art or some other equivalent performance or game is subject to a licence granted by the Radiation and Nuclear Safety Authority if members of the public have access to the place where the equipment is used or to a space where laser beams are directed. Licence is required for any performances held in public places and for performances where laser beams are directed to a public place. In addition, licence is required for private events.

A new laser licence or an amendment to an existing licence can be applied for using STUK's form service (formbox.fi). Links to the forms can be found on STUK's laser applications page <https://www.stuk.fi/stuk-valvoo/sateilyn-kayttajalle/laseresitykset-solariumit-ja-kauneudenhoito/laseresitykset>. The form is filled in without logging in and cannot be saved as incomplete for later completion. A PDF copy of the application can be saved for your own use before sending the form to the Radiation and Nuclear Safety Authority. The browsers supported by the form service are Chrome, Firefox, Edge and Safari (version 9+). The user must enable javascript and cookies.

An acknowledgement message is sent to the sender when the form has been successfully sent. If you do not receive an acknowledgment message, you should interpret the message as a failure and fill in and send the form again.

If STUK's form service can't be used the applications can be send by post. Send your application by post to the address

RADIATION AND NUCLEAR SAFETY AUTHORITY

Jokiniemenkuja 1

01370 VANTAA, FINLAND

The common email address for laser experts laserlupa@stuk.fi can be used to request further information.

The application for licence must include:

- details of the applicant;
- a description of the laser equipment and its intended use;
- a risk assessment concerning the practice;
- information on the person in charge.

Details of the applicant

When applying for licence, information on the applicant must be provided, including information identifying the applicant and the applicant's contact information and invoicing details:

- Name
- Business ID and VAT number. If the responsible party does not have a VAT number, for example, when the responsible party operates through an invoicing service, the personal identity code of the responsible party must be provided.
- The domicile of the responsible party
- Postal address, postcode and city
- Telephone number
- Email address
- Invoicing details

When applying for licence, the responsible party must describe the training that the responsible party or the laser operator has received concerning laser safety and his or her experience relating to laser safety. There is no training available in Finland through which the appropriate laser safety knowledge could be acquired. For this reason, the knowledge on laser safety is usually assessed based on general knowledge and knowledge acquired through self-study. Laser safety courses that are aimed for laser light show operators are organized abroad (e.g. in Germany and the UK).

A description of the laser equipment and its intended use

The application for licence must include a description of the laser equipment and its intended use. The description must provide the following information: what kind of laser equipment will be used, in what types of events will they be used, who will use the laser equipment, how

will the laser equipment be used and how the laser beams will be directed.

In addition to the above, the description must provide the following details:

- The period for which licence is applied (a single event, a period defined by the responsible party or licence that is valid until further notice and that covers a more permanent practice.)
- Whether the laser equipment will be installed in a fixed manner so that it is used in one place only or is the intention to use the laser equipment in several locations so that it will be installed and directed several times.
- Whether the intention is to direct the beams towards the audience (more specifically, beams will be directed to areas protected by the limit values for exposure).
- Whether the lasers are used outdoors and not directed towards the sky.
- Whether beams are directed towards the sky.

A standard operating model is a model where the responsible party is applying for licence that covers its practice until further notice. After the responsible party has obtained licence, the responsible party may give performances that meet the requirements for licence. The use of laser equipment is subject to a notification obligation, which means that the licence holder must notify the Radiation and Nuclear Safety Authority of all performances in advance. A single notification can be used for submitting a notification of several similar performances. The information to be included in the notification is discussed in detail later in this document.

A typical single event using a high-power laser device is a concert by a foreign performer. In this case, the laser operator touring the concert has designed the laser installation and uses the laser equipment. The recommended procedure for such events is for the concert organizer to acquire an operator with a valid license for the use of laser equipment to perform the laser presentation. The holder of a valid license ensures that the presentation complies with the safety requirements for the use of the laser and makes the necessary announcements. The list of license holders holding an indefinite license can be found on the STUK website at <https://www.stuk.fi/stuk-valvoo/sateilyn-kayttajalle/laseresitykset-solariumit-ja-kauneudenhoito/laseresitykset>.

If necessary, the concert organizer may apply for a permit for the use of laser equipment for a single event and act as the operator. In this case, the laser operator will be the laser operator operating at the concert and, when applying for a permit, the tour information about the lasers

and their use is included. The tour information usually includes information about the tour's laser operator, the laser equipment used, the laser effects used in the presentation, and a risk assessment of the operation. The information required for the notification of the use of a laser device must also be provided when applying for a permit for an individual event. The license fee must be paid separately for each license. The license fee is same for an individual license or for an indefinite one. In the case of individual performances, STUK will, as a rule, always conduct a paid inspection. The costs associated with the license are described in more detail in the Licence for using laser equipment is subject to a charge.

Risk assessment

The responsible party must include in its application for licence a risk assessment concerning the laser operation. The purpose of the risk assessment is that the responsible party evaluates the timing, nature and magnitude of the risks related to the use of lasers. Based on the risk assessment, the safety of the laser operation can be improved, and methods mitigating the likelihood of any damage and the related consequences can be adopted. Risk assessments are not one-time assessments that are made when starting laser operations. The maintenance of risk assessments should be an ongoing process, in which the safety of the laser operations is continuously improved. For this reason, a risk assessment must be made for the various phases of laser equipment use. The risk assessment must include an evaluation of the risks related to the installation, alignment and operation of the laser equipment.

The risk assessment should identify and assess the risks related to the use of high-power laser equipment and any potential radiation safety incidents. Radiation safety incidents are events compromising or potentially compromising radiation safety. In laser shows, an example of this would be a situation in which a laser beam is accidentally directed towards the audience. The risk assessment must include an evaluation of the potential exposure in risk situations, a plan on how to prevent radiation safety incidents and a plan for situations in which a radiation safety incident occurs. In addition, the responsible party must know which measures must be taken if a laser beam has caused an eye injury or if there is a reason to suspect that an eye injury has occurred as a result of exposure to a laser beam.

Table 1. A table of examples presenting how risks can be described and assessed and how to present risk mitigation measures.

Use phase	Risk	Hazard	Severity	Risk group	Measures
alignment	People are exposed to a laser beam during beam alignment	eye injury	major	Laser equipment operators	<p>The NOHD distance for the laser equipment is known</p> <p>The hazard zone has been defined and eye protection is used within the zone</p> <p>Beam alignment is performed using the lowest possible power</p> <p>Alignment starts by pointing the beams in the safest possible direction</p>
				Other staff	Only the persons required for the laser alignment are present in the premises during alignment
				audience	The audience is not present in the premises during alignment.

Please note that under the Consumer Safety Act (920/2011), a safety document must be prepared for an event *involving a significant risk, which might endanger the safety of a person due to the large number of people participating in the service or for some other special reason.* Information on the safety document and how to draw it up is available on the website of the Finnish Safety and Chemicals Agency (Tukes) <https://tukes.fi/en/products-and-services/services-for-consumers/obligations-of-service-providers/safety-document>

The role of the person in charge

The responsible party shall appoint a person in charge who is tasked with organizing the installation and use of the laser equipment as well as the monitoring during operation. As a rule, the person in charge must supervise the use and installation of laser equipment personally, but he or she can, if necessary, delegate tasks to other persons to an extent that is reasonable in terms of the safe organization of the practice. The responsible party may appoint him-/herself as the person in charge.

The responsible party must ensure that it has access to the expertise that is necessary in terms of the nature and scope of the practice and that it has sufficient financial and human resources for the safe implementation of the practice. Even though a person in charge is required to be appointed for the practice, the responsible party is solely responsible for the radiation safety of the practice.

When submitting the notification on the use of lasers, the responsible party must provide the details of the laser equipment operator. Usually, the operator is the same as the person in charge stated in the application for licence. The operator of laser equipment can also be someone other than the person in charge of the practice. In this case, the responsible party ensures that the laser equipment operator has the knowledge and skills required for the safe installation and operation of laser equipment. When laser equipment is being used, the laser equipment operator is responsible, in practice, for safety of laser operation. In a dangerous situation, the laser equipment operator must immediately stop using the laser equipment.

In summary, the difference between the person in charge and the laser equipment operator is that the person in charge has the overall responsibility for the safety of laser equipment use, while the operator is responsible for the laser safety when the equipment is being operated.

A notification of laser use is required

The licenced party must submit a notification to the Radiation and Nuclear Safety Authority for each instance of high-power laser equipment use. The notification should include information on where, when and how the laser equipment is used.

Notifications can be sent by using STUK's form service ([formbox.fi](https://www.stuk.fi/stuk-valvoo/sateilyn-kayttajalle/laseresitykset-solariumit-ja-kauneudenhoito/laseresitykset)). Links to the forms can be found on STUK's laser applications page <https://www.stuk.fi/stuk-valvoo/sateilyn-kayttajalle/laseresitykset-solariumit-ja-kauneudenhoito/laseresitykset>. The form is filled in without logging in and cannot be saved as incomplete for later completion. A PDF copy of the application can be saved for your own use before sending the form to the Radiation and Nuclear Safety Authority. The browsers supported by the form service are Chrome, Firefox, Edge and Safari (version 9+). The user must enable javascript and cookies.

The Radiation and Nuclear Safety Authority receives the notifications and registers them. The Radiation and Nuclear Safety Authority supervises the use of lasers at its discretion through random checks at the place of use. As a rule, first-time performances related to a licence are always inspected at the place of use.

The notification should include the following information:

1. Place of use
2. Contact information for the place of use: address and telephone number
3. Laser operator(s)
4. Dates and times for installation and use
5. Date and time when the performance can be inspected if deemed necessary. At the time of inspection, it must be possible to use the laser equipment in order to check the alignment of laser beams and the effects that are used.
6. Equipment in use
7. Installation plan. The installation plan must include information on the location of the equipment and the alignment and termination of laser beams.

Laser beams must be aligned and terminated safely

Laser beams must be directed so that they cause no danger. In addition to the direction of the beams, it must be ensured that beams are terminated (that is, the precise routes and end points of beams are known). The surface where the beams are terminated must not create any reflections and it must tolerate the power of laser beams (fire hazard). When using mirrors and other elements for beam alignment, the careful installation of such elements must be ensured. In addition, any potential errors and small deviations in the alignment of beams must be considered, and it must be ensured that they cause no hazards.

The exposure limit values for laser radiation must not be exceeded in areas accessible to the audience. This area extends up to the height of three metres in the vertical direction and up to two and half metres in the horizontal direction in the area that the audience can access.

During the use of the lasers, the operator will ensure that the lasers are safe to use. This means that the laser operator constantly monitors that there are no changes in the alignment and installation of the lasers, that the laser equipment is working as designed and that people are not in the danger zone of the laser beams. If necessary, the laser operator must turn off the lasers immediately. Operation of the lasers is the main task of the laser operator while the lasers are in use.

In an area that is not supervised on a continuous basis, the exposure to laser radiation is required to be lower than the exposure limits up to the

height of six metres. The laser operator must be able to switch off the laser without delay if necessary.

Any situations in which laser beams are terminated between the laser equipment and audience must always be assessed on a case-by-case basis. An example of such a termination is directing a beam to a balcony located between the lower and upper floor. In this case, when assessing the safety of the alignment, factors such as the following must be considered: the dimensions and materials of the balcony and the venue, the distance between the balcony and the laser equipment, the stability of the laser equipment installation and the physical beam masks used for beam alignment.

The basic principle is that no laser beams are directed to the above-mentioned areas. If beams are directed or reflected to the above-mentioned areas, the responsible party must ensure, through measurements performed on site, that the exposure limit values are not exceeded. Measurements must be performed before each instance of use. A suitable measuring instrument must be used for the measurements.

Typical laser effects in which beams are directed towards the audience include diffraction or burst effects. In these effects, a diffraction element is used to spread a laser beam into several separate beams. In these effects, the forward-directed zero-order beam is the most powerful, and the more a beam is directed to the side, the weaker the power of an individual beam is. Beams with higher power are directed outside the area where the audience is, and some of the light beams on the side are directed at the audience. For these beams, the responsible party must verify through measurements that the exposure limit values are not exceeded. Measurements are carried out by stopping the movement of the effect and by measuring the power of individual beams in the area that the audience can access. Measurements are carried out as continuous power measurements. The exposure limit of 2.55 mW/cm^2 corresponding to the exposure time of 0.25 seconds is used as the limit value for exposure. (power of 1 mW measured with a 7 mm aperture)

The exposure limit value depends on the duration of exposure, which means that the duration of exposure and the corresponding exposure value must be determined when a moving beam is measured. If the safety of a beam is based on the constant movement of the beam, the assessment must consider the response time for beam termination in case of an equipment error. When using laser equipment that has an internal safety system that monitors the functioning of the equipment and terminates the beam if exposure exceeds the limit values, the responsible party must be able to test the operation of the safety system and to demonstrate the operation of the system if necessary, for example, by using a test pattern designed for this purpose.

Deadlines for laser licence applications and use of laser notifications

Licence for laser equipment use must be applied for well in advance before starting the practice. There is no deadline for granting licence. Usually, the processing of an application for licence takes 30 days from the date all the documents required for the processing have been provided to the Radiation and Nuclear Safety Authority.

The licenced party must notify the Radiation and Nuclear Safety Authority of any use of laser equipment no later than five days prior to the intended time of laser use.

The Radiation and Nuclear Safety Authority must be notified of any changes in the practice. A notification on any changes to the contact details of the licenced party must be submitted without delay. A notification detailing any changes to equipment and their planned use or changes to the risk assessment concerning the practice and changes concerning the person in charge must be submitted 30 days in advance of such changes taking effect. Depending on the nature and extent of the change, the change may result in amendments to the licence that are subject to a charge, in addition to which an inspection related to the matter may be required.

If laser beams are terminated to the sky, Fintraffic Lennonvarmistus Oy must be notified of the use of laser 10 weeks in advance of the intended time of use. At the same time, the information required by Fintraffic Lennonvarmistus Oy must also be submitted to the Radiation and Nuclear Safety Authority, which inspects the calculations provided in the notification.

Licence for using laser equipment is subject to a charge

The licence granted for use of high-power laser equipment is subject to a charge. In addition, an annual regulatory charge is charged for any licence that is valid until further notice.

Provisions on the granting of licence and charges related to changes are set forth in the decree of the Ministry of Social Affairs and Health on charges collected for the services provided by the Radiation and Nuclear Safety Authority

<https://www.stuklex.fi/fi/ls/20221277>

The current charges are valid until 31 December 2024, and the charges are updated by updating the decree.

The current charges are presented in Table 1. The objective is that applications for licence are processed within 30 days. The processing of applications can be expedited upon request if the responsible party presents reasonable grounds and the expedited processing does not

have a significant effect on the processing of other pending matters. Expedited processing is subject to a higher charge.

If, in an individual case, the state incurs clearly more costs than the basic fee charged for the performance under public law, Säteilyturvakeskus can use an additional fee in addition to the basic fee when determining the fee. The customer or recipient of the delivery will be notified of the use of the surcharge.

Before granting licence or making any licence amendments, an inspection is usually carried out at the place of use before the planned time of laser equipment use. Such inspections are subject to a charge. If laser beams are directed at the audience or terminated in the sky, the inspection is more demanding and requires more preparation work from the Radiation and Nuclear Safety Authority. A higher fee is charged for such inspections.

Table 1. Charges applied to services concerning high-power laser equipment.

Service	Basic charge, €	Additional charge, €/h	Note
Licence	515	160	
Licence amendment	195	160	
Inspection related to a licence	370	160	
Extensive inspection related to a licence	590	160	If beams are directed at the audience or terminated in the sky.

Services related to high-power laser equipment can be expedited upon request if there are reasonable grounds related to the organisation of the work or activities of the person who ordered or received the service, and the expedited processing does not have a significant effect on the processing of other pending matters. In this case, the service charge is increased by 50%.

An annual regulatory charge, as specified in the Regulatory Charges appendix of the Radiation Act, is applied to any licence that is valid until further notice <https://www.stuklex.fi/fi/ls/20180859#L22> .

The regulatory charge applied to the use of high-power laser equipment comprises a practice-specific basic charge and a radiation source-specific surcharge.

The practice-specific basic charge for the use of high-power laser equipment is EUR 180, which includes the use of high-power laser equipment that is permanently installed in a specific location. In addition to the basic charge, a surcharge of EUR 560 is applied to movable laser equipment. Therefore, the annual regulatory charge for movable laser equipment is EUR 740.

The obligation to pay the regulatory charge commences at the beginning of the year following the granting of licence. The regulatory charge is imposed for each calendar year and it will fall due annually on the date determined by the Radiation and Nuclear Safety Authority, however, not earlier than on 30 April. The Radiation and Nuclear Safety Authority sends the payment decision concerning the regulatory charge no later than 30 days prior to the due date. Payment obligation ends at the end of the year during which the responsible party has notified the Radiation and Nuclear Safety Authority of the discontinuance of the practice or during which the Radiation and Nuclear Safety Authority otherwise establishes that the practice has been discontinued.

Actions may be taken in case of unauthorized or hazardous practice

Under the Radiation Act, the Radiation and Nuclear Safety Authority may cancel licence if the criteria for granting it are not met or if the authorized party repeatedly or substantially breaches the terms and conditions applied to the licence or violates the provisions and regulations provided in this Act or pursuant to it, and fails to remedy the deficiencies or its conduct within the prescribed period of time despite a request to do so.

In addition, the Radiation and Nuclear Safety Authority may decide to suspend or restrict a practice if the practice is not compliant with this Act or if there is a risk that it is obviously detrimental to health. In cases that are urgent in terms of safety, an inspector may decide on the immediate suspension or restriction of a practice in situ.

The Radiation and Nuclear Safety Authority may impose a penalty payment to enforce a decision made or a prohibition imposed under the Radiation Act if the responsible party has not complied with a decision made by the Radiation and Nuclear Safety Authority.

In addition, actions may have legal consequences. Using high-power laser equipment without the licence of the Radiation and Nuclear Safety Authority or violating the terms and conditions of licence is a radiation violation, as referred to in the Radiation Act.

Under the Criminal Code of Finland (39/1889), the use of a radiation source, in this case, the use of high-power laser equipment, in violation of the Radiation Act so that the action is conducive to causing general danger to life or health, is a punishable act of endangerment of health. In addition, if the danger results from the negligence of the offender, the offender shall be sentenced for negligent endangerment.

Requirements under legislation other than the Radiation Act

Other legislation also includes provisions on laser equipment and its use. The key requirements are listed below.

Requirements for equipment

The requirements applied to electrical equipment are derived from EU directives, regulations, and decisions and also from national legislation. The Electrical Safety Act (1135/2016) and the Low Voltage Directive (2014/35/EU) regulate electrical safety.

Directives for electrical equipment include essential requirements for the equipment and assessment methods that are used to assess the conformity of the equipment. The technical details required for electrical equipment are specified in European harmonised standards. The harmonized standard for laser equipment is EN 60825-1 Safety of laser products - Part 1: Equipment classification and requirements. Laser equipment must not cause a hazard to health or property. This means that the classification of laser equipment must be determined in accordance with the EN 60825-1 standard and that the equipment must meet the class-specific safety requirements set out in the standard.

Fintraffic Lennonvarmistus Oy must be notified when laser beams are terminated in the sky

Eye exposure to a laser beam may be hazardous by causing temporary visual impairment. Such visual impairments include flash blindness, afterimages and glare. The power of a laser beam resulting in such visual impairment is considerably weaker than the power required for causing eye injury. The colour of the laser beam and the level of lighting prevailing during the exposure are factors contributing to the impairment of vision. Laser beams can cause visual impairment even from distances of several or even tens of kilometres. When driving a vehicle, even temporary visual impairment can have serious consequences. This risk is particularly high in air traffic, where a laser beam directed into the air may disturb a pilot in a critical landing or take-off phase. For this reason, when using lasers in the vicinity of airports, directing laser beams towards an airport or the extensions of runways must be avoided to the extent possible. When laser beams are directed to the sky, a notification of any such activities must be submitted to the aviation authorities and arranged with them. Thus, the use of lasers may be organized so that there are no additional disturbance or inconvenience to any parties.

According to Section 159 of the Finnish Aviation Act (864/2014), the person setting up the operation must first inform the air traffic service provider which will evaluate the possible effect of the planned activity for air traffic. Fintraffic Lennonvarmistus Oy will give the statement on customer request. The request should be submitted to Fintraffic Lennonvarmistus Oy 10 weeks before estimated activity. For expedited processing, requests must be submitted to Fintraffic Lennonvarmistus Oy 4 weeks before estimated activity.

Fintraffic Lennonvarmistus Oy provides statements on laser use based on customer requests as a case-specific service. The statements are subject to a charge. Contact information and up-to-date information on the services and fees are available on the Fintraffic Lennonvarmistus Oy website <https://www.fintraffic.fi/fi/ans/palvelumme>. The price list amended on 4 April 2023, the charge for a statement is EUR 340 + VAT 24%, with the price for expedited processing being EUR 750 + VAT 24%.

Notifications concerning the use of laser equipment can be submitted by email to the address kehityys@fintraffic.fi.

Information required by Fintraffic Lennonvarmistus Oy

In order to provide a statement, Fintraffic Lennonvarmistus Oy requires information on the laser equipment that will be used and the place of use:

- The geographical coordinates of the place of use (WGS-84)
- Beam direction. The horizontal sector of laser beams must be provided as compass directions (magnetic bearing or true bearing, the type of the bearing must be stated) between which laser beams will be directed. The lowest and highest elevation directions must be provided as angles.
- The Nominal Ocular Hazard Distance (NOHD) and visual effect distances (SZED, CZED and LFED). More information on the calculation of these distances is provided in the "Doc 9815 Manual on Laser Emitters and Flight Safety" publication of the International Civil Aviation Organization (ICAO). The maximum vertical and horizontal distances depending on the vertical direction of the beam must be provided for these distances.
- Times of using the laser equipment. All occasions when beams will be directed to the sky must be provided when stating the times of laser equipment use. In addition to the performance time, information on the time when beams are being aligned and any scheduled laser equipment checks must be provided.
- A phone number to which air traffic control can call during the time the laser equipment is being used in case there are any questions concerning the use of the laser equipment or if it is necessary that the laser beams are turned off immediately.

This information must be provided to the Radiation and Nuclear Safety Authority at the same time as it is provided to Fintraffic Lennonvarmistus Oy. The Radiation and Nuclear Safety Authority checks the eye protection and visual effect distances that were provided to Fintraffic Lennonvarmistus Oy based on the technical information.

The Radiation and Nuclear Safety Authority does not calculate these distances on behalf of the responsible party.

Safety of employees

In addition to the safety of audience, the party responsible for the laser equipment must ensure the safety of employees. Requirements concerning the use of lasers have been set based on the Occupational Safety and Health Act, and it is supervised by occupational safety authorities.

The general requirements for employers concerning the use of laser equipment are more generally related to the protection of employees from the hazards of optical radiation. More information on this is available on the website of the Occupational Safety and Health Administration in Finland: <https://www.tyosuojelu.fi/web/en/working-conditions/physical-factors/optical-radiation>

Of the requirements related to the safe use of laser equipment, the most important requirements concerning the use of high-power laser equipment are listed below.

The employer must ensure that

- only qualified personnel specifically assigned for the work operate Class 4 lasers,
- the eyes and skin of any employees who work in the danger zone of Class 4 lasers are protected workers' eyes are not directly exposed to laser beams from Class 2, 3 or 4 laser devices,
- workers' skin is not directly exposed to laser beams from Class 4 laser devices,
- when class 3B and 4 laser equipment is used, the employer must keep the area in which the lasers are operated and the surrounding danger zone under surveillance and prevent unauthorised access to these areas
- laser beams are never pointed directly at people
- provide laser radiation warning signs at the routes leading to the area where lasers are operated.

Further information

Radiation Act (859/2018) <https://www.stuklex.fi/fi/ls/20180859>

Decree of the Ministry of Social Affairs and Health on the limitation of public exposure to non-ionizing radiation (1045/2018)

<https://www.stuklex.fi/fi/ls/20181045>

Regulation of the Radiation and Nuclear Safety Authority on the use of high-power laser equipment (STUK S/10/2021)

<https://www.stuklex.fi/fi/maarays/stuk-s-10-2021>

Consumer Safety Act (920/2011) <https://www.stuklex.fi/fi/ls/20110920>

Criminal Code of Finland (39/1889)

<https://www.finlex.fi/fi/laki/ajantasa/1889/18890039001>

Finnish Aviation Act (864/2014)

<https://www.finlex.fi/fi/laki/ajantasa/2014/20140864>

Electrical Safety Act (1135/2016)

<http://plus.edilex.fi/tukes/fi/lainsaadanto/20161135?toc=1>

Government decree on the protection of workers from risks arising from exposure to optical radiation (146/2010)

<https://www.stuklex.fi/fi/ls/20100146>

Government decree on laser equipment and inspection of the same (291/2008) <https://www.stuklex.fi/fi/ls/20080291>

IEC TR 60825-3:2008 Safety of laser products - Part 3: Guidance for laser displays and shows

EN 60825-1:2014 Safety of laser products - Part 1: Equipment classification and requirements

EC/TR 60825-14:2004 Safety of laser products - Part 14: A user's guide