

Occupational health in forest planting and clear- ing saw work

Birgitta Kinnunen

Finnish Institute of Occupational Health

P.O. Box 40
FI-00251 Helsinki, Finland

www.ttl.fi

Authors Birgitta Kinnunen
Editor: Talvikki Susiluoma

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1 General

1.1 Occupational health care agreement

A written agreement on occupational health care services is made between the employer and the occupational health care service provider. The service provider must have a licence to provide occupational health care services.

The following matters are agreed on in the occupational health care agreement, for example:

- general arrangements for occupational health care, such as the location, opening hours and contact persons of the clinic
- content and scope of the services; statutory or additional medical care
- duration of the validity of the agreement
- prices of services
- matters related to invoicing
- matters related to the termination of the contract
- signatures (1)

In the case of temporary agency employees, the employer's obligations apply to both the employer of the temporary employee and the recipient of the work. The employer of the temporary employee is obligated to comply with the Occupational Safety and Health Act and, thus, also to organize occupational health care. The agency providing hired labour should conduct workplace surveys at the user companies' workplaces. Agencies and companies using temporary employees must co-operate on risk assessments and workplace surveys. The agency is responsible for ensuring that its occupational health care service provider receives sufficient and current information from the user company about the health conditions at the temporary employee's workplace. The agency is responsible for workplace surveys and medical examinations. The work recipient must ensure that the employee receives orientation for their job, the workplace's conditions and occupational health and safety measures. If necessary, the recipient of hired labour is in charge of occupational safety and health co-operation and communications as well as arrangements concerning occupational health care.

The offer is not the same as an agreement, i.e. it usually does not yet include the contact person or the duration of the agreement, for example. The occupational health care agreement must be discussed in co-operation with the employees and made available to the employees. (1, 2)

1.2 Workplace survey and action plan

The workplace survey provides the basis for occupational health care activities. The employer's risk assessment helps the occupational health care service provider better assess the health relevance of exposure agents. Small companies often lack a risk assessment, and occupational health care service providers are unable to demand one strongly enough. In the workplace survey, the health relevance is assessed on a scale of insignificant, minor, moderate, significant, or intolerable. (3)

A workplace visit must be carried out in person at the workplace if there are factors that compromise the health and safety of employees or other factors that are relevant to health and work ability, the

assessment of which requires observation or measurement at the workplace. A prerequisite for the reimbursement of occupational health care costs is that a basic survey has been carried out and is up-to-date. The parts of the workplace survey that can be carried out remotely include planning the visit, preliminary surveys, provision of feedback, follow-up, and assessment. (4)

The occupational health care action plan must be based on a workplace survey (Government Decree 708/2013, Section 6). The action plan must be valid for the period during which the reimbursement of occupational health care costs is applied for (4). The employer is responsible for having medical examinations carried out by the occupational health care service provider: according to the law, the employer must be aware of the health conditions/the hazards of work (2, 5).

2 Planting and clearing work

Forests can be planted mechanically or manually. In the case of manual planting, the seedling boxes are distributed over the planting area within a reasonable distance where they can be reached. The boxes are usually carried to the planting area by hand. A box weighs 10–15 kg. On a daily basis, the total weight carried may be about 100 kg with varying distances. The boxes can also be carried in a seedling backpack, which can hold 3–4 boxes.

Containerized seedlings are planted with a planting pipe. The seedlings are carried in a seedling bushel. In addition to the planting pipe and bushel, protective gloves and a long-sleeved jacket or arm guards are required. The seedlings have been treated with a pesticide against pine weevils, so they must not be handled with bare hands.

The planting procedure is as follows:

- the planting pipe is pressed perpendicular to the ground by applying light pressure with a foot while turning the pipe back and forth against the ground
- the jaws of the pipe are pushed open by pressing the pedal
- the seedling is inserted into the pipe
- the pipe is lifted completely off the seedling and the jaws of the pipe are closed by pressing the spring return with the thumb
- the soil around the seedling is compacted with the tip of a shoe (6).

The sizes of bushels and planting pipes vary. The diameter of the planting pipe may be between 38–75 mm and the pipe can weigh 2.5–3.5 kg. A box of medium-sized seedlings (about 90–100) is typically a suitable amount of seedlings for one bushel. When carrying the bushel, the strap goes over one shoulder. There are repetitive movements when planting seedlings. When lifting the pipe, the upper body and the hands are exposed to a rotational movement. It is therefore important to turn the pipe with both hands. There are also “one-handed” pipes (only one handle) and, when using these, the movement strains the wrist of the hand holding the pipe.

The seedlings to be planted (at least spruce seedlings) are treated with a plant protection product in order to prevent pine weevil infestations. There are four substances in the Finnish Safety and Chemicals Agency register of approved preparations for the control of coniferous trees from pine weevils.

The active substance in Hallmark Zeon and Karate Zeon technologies and the Maatilan Syhalotriini 2 preparation is lambda-cyhalothrin. The active substance of the Imprid Skog product is acetamiprid. (7) The health effects of the chemicals are stated in the chemicals section of exposure agents.

Saplings are cared with, for example, early bushing, in which the coppices that hinder the growth of planted seedlings are removed. Spruce and pine saplings are cleaned when the trees reach a length of about 1–2 metres. In the case of full cleaning, all coniferous coppices competing with the planted trees are removed from the plantation. In point cleaning, the coppices around the seedlings are removed within a radius of about one metre. (8)

When thinning out the plantation, the plantation is thinned out to the planting density with a clearing saw. In this case, in addition to deciduous trees, the planted coniferous trees are also removed in order to achieve a suitable growing density. Before cleaning or final felling, any undergrowth preventing the work must be removed.

Early cleaning and thinning of plantations as well as preliminary clearing and regeneration area preparations are usually done with a clearing saw. The following exposure agents are present when working with a clearing saw in the forest:

- noise
- vibration
- heat
- cold
- risk of injury: slipping, tripping, machinery, sharp tools (saw blades, etc.)
- ticks, insect bites, adders

3 Exposure agents

3.1 Noise

Chainsaws and clearing saws generate noise in forestry work. Chainsaws equipped with combustion engines are used in professional forestry work. According to the equipment manufacturers, the noise level of the chainsaws can be up to 110–120 dB(A), but the noise level is usually around 100 dB(A). Clearing saws generate at least the same level of noise as chainsaws. The risk of hearing damage at repeated noise levels of 100 dB(A) is likely after approximately 15 minutes of exposure. Medical examinations are decided on according to noise exposure. Inadequate hearing protection is a common observation in the forestry industry.

Noise is a particularly hazardous exposure agent and the medical examinations related to it include clinical examinations performed by a physician and supplemented by other examinations, such as examinations or parts thereof performed under the supervision of a physician as well as functional tests and exposure measurements (9).

Lower action value

If the daily noise exposure (8 h) is 80 dB(A) or the peak sound pressure level (impulse noise) exceeds 135 dB(C) (estimated without hearing protection), it is necessary to take measures in accordance with the Government Decree on noise to prevent the risk of hearing damage to employees:

- employees have the right to appropriate, well-fitting hearing protection
- employees exposed to levels exceeding the lower action values must be able to undergo a preventive audiometric hearing test
- employees must be informed of the risks and their right to hearing tests/examinations. (9)

Upper action value

If the daily noise exposure (8 h) is 85 dB(A) or the peak sound pressure level (impulse noise) exceeds 137 dB(C) (estimated without hearing protection), the employer must, in addition to the above measures:

- prepare a noise prevention programme and provide employees with hearing protectors
- require employees to wear hearing protectors
- designate areas in the workplace where such exposure may be present and restrict access to these areas
- supervise the use of protective equipment
- have the employees undergo **an initial examination** before starting the work or within a month thereafter. (9)

Periodic medical examinations (hearing tests) are initially performed annually when deemed appropriate and at least once every three years after four years of **periodic examinations**

- for those exposed to noise levels of at least 85 dB(A)
- for those exposed to noise levels of 80–85 dB(A) with risk factors for noise-induced hearing loss. (9)

3.2 Vibration

Employees are exposed to hand-arm vibration when operating clearing saws. Hand-arm vibration refers to vibration in the employee's hands or arms that causes harm to or compromises their health or safety. The hand-arm vibration values for clearing saws stated by the manufacturers are higher than the action value set for 8 hours, but lower than the limit value for hand-arm vibration (10). Hand-arm vibration values for clearing saws range from 3 to 5 m/s². If the vibration value of the clearing saw is 3 m/s², the action limit is exceeded after 3 hours and 55 minutes of daily work. The limit value is exceeded after 22 hours and 13 minutes of daily work. If the vibration value of the clearing saw is 5 m/s², the action limit is exceeded after 2 hours of work and the limit value after 8 hours of work.

With the right working technique, it is possible to avoid the frequency of kickbacks, for example, and operate the machine with more stability. The condition of the saw blade is decisive not only for the results of the work, but also for vibrations in the hands and smooth working. (11)

Hand-arm vibration can cause issues in the circulatory system, the musculoskeletal system, and the nervous system. In Finland, occupational vibration disease is defined as white fingers caused by hand

vibration and upper limb dysfunction in the area of the fingers, provided that there has been sufficient work-related exposure to vibration and other causes have been excluded. In addition, hand-arm vibration and work that exposes the upper limbs to stress predispose to carpal tunnel syndrome which, in certain cases, can be considered an occupational disease. Occupational health care service providers use a vibration calculator (Vibration Calculator) to assess hand-arm vibration. (12)

According to the Government Decree on vibration (48/2005), the hand-arm vibration action value per 8-hour working day is 2.5 m/s². A limit value of 5 m/s² is defined for hand-arm vibration, which is the highest permitted exposure level. If, despite all preventive measures, the vibration exposure exceeds the action value, the employer must prepare

- a vibration control programme (Government Decree 48/2005) to limit the exposure,
- arrange medical examinations for exposed employees
- provide advice on vibration and its symptoms and guide the employees on correct work practices (12).

The initial examination aims to identify the employees who are particularly susceptible to the adverse effects of vibration. The initial examination includes a medical examination, and it is supplemented by other examinations, functional tests, or exposure measurements. **The initial examination** must be carried out before starting work or within one month of starting work. (9, 13)

The purpose of **periodic examinations** is to identify as early as possible the employees who have symptoms or findings caused by hand-arm vibration. The aim of these examinations is to reduce harmful exposure. (13)

Employees who are assessed to be regularly exposed to vibrations exceeding the operating value or to impulsive or high-frequency vibration should take a symptom survey annually. If any symptoms occur, a physician must be consulted. Employees who are particularly susceptible to vibration may need to be monitored more closely. (13) The hand-arm vibration symptom survey can be found on the Finnish Institute of Occupational Health's website, where medical examinations for jobs that involve a particular risk of illness are described.

If the hand-arm vibration is below the action value, but it is possible to exceed the action limit to the extent that the exposure can cause a health hazard, a symptom survey should be carried out every 2–3 years. A physician's examination is performed with the same protocol as in **the initial examination**. (9, 13)

3.3 Chemical exposure agents

The plant protection products used in forestry can be found in the Finnish Safety and Chemicals Agency's plant protection product register (<https://tukes.fi/en/chemicals/plant-protection-products/authorised-products/plant-protection-product-register>). The register contains the products' label texts, including product classifications and labelling, as well as instructions for use and protective equipment. Only the active substances (at the EU level) and preparations (at the national level) that have been shown to be safe for users of plant protection products and employees in a risk assessment have been approved for use in the register. In order to ensure appropriate safety, compliance

with the instructions on the label texts concerning safe use and the use of the personal protective equipment specified in the instructions is required. (9)

Plant protection products can be easily absorbed through the skin. Respiratory exposure is less significant. Inadequate hygiene, e.g. insufficient hand washing, can result in hand-to-mouth exposure. There are often limited options for washing hands when working in a forest. (9) When planting seedlings, it is possible that the arm and thigh next to the bushel can come into contact with the seedlings or the bushel. This can cause the plant protection product to come into contact with unprotected skin. In addition, the gloves used during planting may contaminate any areas they come in contact with, e.g. when correcting the position of the bushel or handling the implantation pipe.

The active substance in Hallmark Zeon, Karate Zeon and Maatilan Syhalotriini 2 plant protection products is lambda-cyhalothrin. The substances may cause an allergic reaction (H317). If the substances come into contact with skin, the transient symptoms (itching, tingling, burning, or tingling) may last up to 24 hours. The substances irritate the respiratory tracts (H335). Inhaling the substances can cause acute pulmonary oedema and pneumonia. All products are toxic to aquatic environments (H410). (14, 15, 16)

In a plant breeding garden, it is possible to become exposed to liquid pesticides when treating plants with pesticides. Hydrogen cyanide may be released during the opening and dispensing of containers containing lambda-cyhalothrin. Inhaling air from the gas space of the containers must be avoided. Eating, drinking, and smoking is prohibited when using these chemicals. (14, 15, 16).

When handling these chemicals, nitrile rubber gloves compliant with the EN 374 standard with a thickness of at least 0.5 mm and a chemical breakthrough time of more than 8 hours (480 min) must be worn. Changing gloves is recommended at least at meal breaks. During work in which the respiratory tract is exposed, a respirator equipped with a P2/A2 filter must be worn. Required protective clothing includes rubber boots, an impermeable long-sleeved jacket, trousers, and a hat. In addition, face or eye protectors must be worn during work that involves a splash hazard. (14, 15, 16)

The active substance of the Imprid Skog product is acetamiprid. The product's safety data sheet cannot be found directly, but information on the substance can be found in the plant protection product register. The substance is a nervous system agent and is suspected of being harmful to foetuses (H361d). (17)

According to the information on the product packaging, a protective suit, rubber boots, chemical-resistant protective gloves (e.g. nitrile) and a hat must be worn when handling Imprid Skog. In addition, face or eye protectors must be worn during work that involves a splash hazard. (17)

The need for a medical examination of employees using plant protection products is assessed on the basis of the frequency of use and the exposure hazard of the substances used. **An initial examination** is carried out before the start of work or within one month of the start of work at an appointment. (9)

Periodic examinations are recommended annually during the first three years and every 1–3 years thereafter. For example, a survey can be conducted annually, and an examination performed by an occupational health nurse and physician every three years. In the case of infrequent use – a few days

during the growing season – regular **periodic examinations** are not necessary. The aim is to prevent adverse effects by providing advice, work instructions, work methods that minimize exposure and personal protective equipment at the employees' **initial examinations**. (9)

Periodic examinations are recommended every six months for the first three years and once a year thereafter if the employee has symptoms of allergic rhinitis for several environmental allergens (e.g. pollen, animal dander) or conjunctivitis; diagnosed sensitization to a substance used at work; work-related symptoms suitable for allergic rhinitis or previously diagnosed asthma. Some of the medical examinations can then be replaced with a symptom survey. More frequent medical examinations are not needed in the case of smoking, atopic dermatitis, or individual allergies. (9)

Suitability for work must be assessed during medical examinations and the employer and employees must be informed of exposure agents affecting reproductive health. Employers must inform employees of any hazards that may pose a risk to the development of a foetus or pregnancy. Pregnant employees must inform their employer or occupational health care service provider of their pregnancy. Employers must ensure that pregnant employees are not exposed to any chemical factors or use any work methods that may reasonably be expected to pose a risk to the development of a foetus or pregnancy. If possible, pregnant employees must be transferred to other duties that are suitable for the employee until parental leave begins, if it has not been possible to eliminate the factor causing the hazard. (18)

3.4 Heat

Working in hot environments can:

- impair physical, mental, and cognitive functional capacity
- increase the risk of accidents
- cause heat stroke, if prolonged

Working in a hot environment is regulated by the Government Decree on medical examinations in work that presents a special risk of illness (1485/2001), and **an initial examination** must be carried out before the start of work or within a month of the start of work (9).

An initial examination is carried out if a new employee over 45 years of age has no previous experience of working in a hot environment. The employee's health must be carefully assessed before being assigned to work in a hot environment. Conclusions about the employee's suitability for work in a hot environment are made on a case-by-case basis. The need for **periodic examinations** is assessed on a case-by-case basis. (9)

In hot weather, the following is recommended regarding breaks: if the employee performs paced light or moderately heavy work and the temperature is between +28 and +33°C, the duration of consecutive working should not exceed 50 minutes per hour. If the temperature is above +33°C, the maximum duration of consecutive working is 45 minutes per hour. Adequate hydration and regular meal breaks should be ensured. (9) Protective clothing and equipment may increase the heat load when working in hot environments.

3.5 Cold

Seasonal work in the summer is not subject to cold as a special exposure agent. However, the cold can increase the cold load for forestry workers during the winter. There are no binding limit values for cold work, but the social partners have agreed on a so-called frost limit in the collective agreements of some sectors.

Working in a cold environment can:

- cause a decrease in functional capacity, e.g. hand stiffness and complex symptoms
- increase the risk of accidents
- weaken muscle strength
- adversely affect cognitive function
- increase blood pressure
- increase the load on the heart and circulatory system by up to 20% more than in similar work at normal temperatures
- cause frostbite, resulting in tissue damage and impaired peripheral nervous system function
- intensify the white finger symptoms caused by vibration
- trigger asthma (9).

Cold work is regulated by the Government Decree on medical examinations in work that presents a special risk of illness (1485/2001), and **an initial examination** is carried out before work is commenced or within one month of the start of work. Temperatures below + 10°C are considered as the limit value for cold work. Work done outdoors in cold weather is not considered cold work. However, cold, or cool weather conditions can cause cold load when working outdoors. (9)

An initial examination is carried out when working in temperatures with potential health hazards. A symptom survey is sufficient instead of a full medical examination if the survey does not indicate any health problems and exposure to cold is assessed to have a minor health impact. During the examination, guidance, and advice on how to manage the risks of cold work, e.g. wearing multiple layers of clothing, is given. (9)

The symptom survey can be repeated every 3–5 years and it is sufficient instead of **a periodic examination** if the risk remains low and no health problems are reported. The interval of **periodic examinations** is determined according to the risk classification of the job and the age of the employee. If cold exposure is assessed to have at least a moderate health impact and the employee belongs to a risk group, the medical examination also includes a physician's examination. (9)

Sufficient protection against the cold when working outdoors can be acquired by appropriate clothing. The collective agreement obligates the employer to provide employees in permanent employment with the following equipment:

- 1–2 pieces of CE-approved forest worker suits when operating chainsaws
- clearing saw operator trousers and forest worker shirt when operating clearing saws
- a CE-approved headgear package including a helmet, hearing protectors,
- eye and face shield, a skull cap and neck protector when operating a chainsaw or clearing saw

- CE-approved forest worker safety shoes when operating a chainsaw: rubber and leather shoes, a pair of each
- other safety shoes suitable for the work as agreed locally for other tasks
- raincoat and rain suit
- headgear protecting against sunlight
- three pairs of protective gloves
- mid layer suit
- turning strap for felling
- break jacket

The employer shall procure the necessary safety and protective equipment in accordance with the aforementioned list for employees on a fixed-term contract working with clearing saws or chainsaws. The employer must purchase new equipment or repair current equipment if it becomes unusable in normal work.

When handling and applying plant protection products, the employer shall provide employees with personal protective equipment in accordance with the occupational safety and health regulations. (19)

3.6 Risk of accidents

Forest planting and clearing work involves an apparent risk of accidents (classification of accident hazards: minor, apparent, special). The required level of first-aid preparedness includes:

- one person with first aid training per shift or site per fewer than ten employees
- a portable first aid kit with compression bandages, wound care supplies and a tourniquet, if training to use one has been acquired
- for a specific reason, the first aid kit may contain an adder bite pack and employees' personal allergy medications must be included (e.g. for insect bites)
- employees must be instructed on what to do in the event of an accident and how to call for additional assistance
- the 112 Suomi app must be installed on phones
- proven practices for safe work are followed when performing work. For example, reports are made when work is begun and when exiting the site. If there are several consecutive shifts, employees from different shifts will meet each other when a new shift begins.

3.7 Night work

The collective agreement for the forestry industry (1 Feb 2022–3 Jan 2024) defines night work as work performed between 10 p.m. and 6 a.m. (19). In most cases, night work is carried out during hot periods at the initiative of employees. It is exceptional for employers to decide on night shifts. Medical examinations are required if:

- the number of night shifts exceeds 30 per year.
- Medical examinations may be carried in case of work with fewer night shifts for specific reasons related to an individual or the working conditions. (9)

In the industry, it is a widespread practice to work at night during hot weather and the busiest planting times. There is no particular need for medical examinations due to night work. However, if night work is carried out on the basis of a working conditions survey, an assessment of the health impact of night work may be part of **the initial examination** or subsequent **periodic examinations**. The objectives of **an initial examination** for night work are an assessment of the employee's suitability for night work in situations where the employee has illnesses or symptoms that increase the health hazards of night work; providing information about the adverse effects of night work and their prevention and an assessment of the initial health status of employees performing night work. The following conditions can be an obstacle to night work: sleep disorders, digestive disorders, cardiovascular diseases, endocrinological diseases, neurological diseases; mental diseases, breast cancer and severe kidney failure. Before starting night work, the above medical contraindications must be clarified, and health advice given in a medical examination. (9) During **the initial examination**, particular attention should be paid to whether it is possible for the employee to work at night.

4 Protective equipment and personal protective equipment

Equipment required when operating a clearing saw:

- helmet and a skull cap in cold weather
- eye protectors: safety goggles and/or visor
- hearing protectors
- neck protector
- clearing saw harness
- high-visibility vest or clothing and a work suit appropriate to the circumstances; cut-resistant trousers
- sturdy, long footwear, preferably forest worker's safety shoes
- forest worker's safety gloves and cut-resistant gloves for handling blades
- first aid kit
- mobile phone with the 112 Suomi app (20).

Training material for planting and clearing work in the forestry industry – a guide for employees with good advice on how to work safely. The manual is available in Finnish, Estonian, Hungarian, Estonian, Ukrainian, and Russian. (21)

5 References

1. Työterveyshuoltolaki: opas työterveyshuoltolain soveltajille. Sosiaali- ja terveysministeriön oppaita 2004:12. Sosiaali- ja terveysministeriö, Helsinki. <https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/71799/Opp200412.pdf?sequence=1&isAllowed=y>
2. Työterveyshuoltolaki 1383/2001. <https://finlex.fi/fi/laki/ajantasa/2001/20011383>
3. Riskien arviointi työpaikalla –työkirja (päivitykset 3.10.2023). Vaarojen tunnistaminen ja riskien arviointi. Sosiaali- ja terveysministeriö, Työsuojeluosasto Työturvallisuuskeskus 2023. <https://ttk.fi/tyoturvaluus/vastuutja-velvoitteet/tyonantajan-yleiset-velvollisuudet/vaarojen-tunnistaminen-ja-riskien-arviointi/>

4. Kela. Voimassa olevat etuusohjeet. Työterveyshuolto 1.11.2023. <https://www.kela.fi/kelan-etuusohjeet-ohjeet-etuuksittain> (hakukenttään työterveyshuolto)
5. Työturvallisuuslaki 738/2002. <https://www.finlex.fi/fi/laki/ajantasa/2002/20020738>
6. Vinkit onnistuneeseen metsän istutukseen. <https://www.mhy.fi/istutusohje>
7. Kemidigi. Kasvinsuojeluaineet. TUKES. <https://www.kemidigi.fi/kasvinsuojeluainerekisteri/haku>
8. Metsänhoidon suositukset. Taimikon varhaisperkaus. <https://metsanhoidonsuosituks.fi/fi/toimenpiteet/taimikon-varhaisperkaus/toteutus>
9. Karvala K, Leino T, Oksa P, Santonen T, Sainio M, Latvala J ja Uitti J (toim.), 2019. Altistelähtöinen työterveysseuranta. Työterveyslaitos, Duodecim. Helsinki.
10. Käsitärinä. Työterveyslaitos. <https://www.ttl.fi/teemat/tyoturvallisuus/altistuminen-tyoympariston-haittatekijoille/fysikaaliset-altisteet-tyopaikalla/tarina/kasitarina>
11. Raivaussahalla tuottavasti ja turvallisesti. Työturvallisuuskeskus, metsäalan työalatoimi-kunta, 2020. <https://ttk.fi/wp-content/uploads/2022/06/Raivaussahalla-tuottavasti-ja-turvallisesti.pdf>
12. Tärinä. Työterveyslaitos. <https://www.ttl.fi/teemat/tyoturvallisuus/altistuminen-tyoympariston-haittatekijoille/fysikaaliset-altisteet-tyopaikalla/tarina>
13. Terveystarkastukset erityistä sairastumisen vaaraa aiheuttavissa töissä. Työterveyslaitos. <https://www.ttl.fi/teemat/tyoterveys/tyoterveyshuolto/terveystarkastukset/terveystarkastukset-erityista-sairastumisen-vaaraa-aiheuttavissa-toissa>
14. Hallmark with Zeon technology. Syngenta. Käyttöturvallisuustiedote, versio 3.1, 7.9.2021. Kemikaalituoterekisteri. Hakukenttään Hallmark Zeon. Käyttöturvallisuustiedote aukeaa liitetiedostosta. <https://www.kemidigi.fi/kemikaalihaku>
15. Karate Zeon. Syngenta. Käyttöturvallisuustiedote, versio 4.2, 26.6.2023. Kemikaalituoterekisteri. Hakukenttään Karate Zeon. Käyttöturvallisuustiedote aukeaa liitetiedostosta. <https://www.kemidigi.fi/kemikaalihaku>
16. Maatilan Syhalotriini 2 Myyntipäilyksen teksti. 11.2.2015. https://www.kasvinsuojelu.fi/wp-content/uploads/2016/11/Maatilan_Syhalotriini_2_kayttoohje.pdf
17. Imprid Skog. Kasvinsuojeluainerekisteri. <https://www.kemidigi.fi/kasvinsuojeluainerekisteri/valmiste/16000>
18. Lisääntymiselle vaaralliset aineet. Työsuojelu.fi. <https://tyosuojelu.fi/tyoolot/kemialliset-tekijat/syopavaara/lisaantymiselle-vaaralliset>
19. Metsäalan työehtosopimus, 1.2.2022 - 31.1.2024. https://ttsmetsa.fi/moodle/pluginfile.php/44/mod_resource/content/2/Mets%C3%A4-tes%202022%20-%202024.pdf
20. Valtioneuvoston asetus puunkorjuutyön turvallisuudesta 749/2001. <https://finlex.fi/fi/laki/alkup/2001/20010749>
21. Perehdytysmateriaali metsäalan istutus- ja raivaussahatoihin - Tapio. <https://tapio.fi/oppaat-ja-tyovalineet/perehdytysmateriaali-metsaalan-istutus-ja-raivaussahatoihin/>