

# **Quality assurance system manual for wood fuel entrepreneurs in Finland Model quality manual**

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## Preface

This model quality manual is based on the work carried out by the Trade Association of Finnish Forestry and Earth Moving Contractors within Wood Energy Technology Programme. Publication: ”Hakeyrittäjän laatu järjestelmä opas – Koneyrittäjä-julkaisut N:o 21” was written by Ms Kati Kuusisto, Mr Mikko Jäkälä and Mr Tapio Hirvikoski. The model quality manual for wood fuels was updated and the whole document was translated into English in the BioNorm project. Ms Eija Alakangas and Mr Petri Halonen of VTT Processes have produced the English version of the quality manual and the general description of forest wood production technologies in Finland.

This manual includes basic information on quality management system and it is based on the ISO 9001:2000 and ISO14101 standards. It also includes a model of company manual (Chapter 3) for small and medium-size entrepreneurs operating in Finland. The production of forest fuel therefore rests on private contractors. All logging machines and timber trucks are owned by contractors (entrepreneurs). These SMEs carry out different operations in the forest fuel supply chain. These entrepreneurs are usually subcontractors for large-scale fuel suppliers like Biowatti Oy, Vapo Oy or forest companies. This report is supporting also field trial for forest chip production chain of Vapo Ltd.

Jyväskylä, December 2004

VTT Processes

Trade Association of Finnish Forestry  
and Earth Moving Contractors

## Terminology

### **Bundled biofuel, bundle**

solid biofuels which has been bound together and where there is a lengthwise orientation of the material

### **Forest wood**

Woody biomass from forests and/or tree plantations

### **Forest haulage**

Transportation of timber from the forest to a long-distance route, usually on a lorry road

### **Forwarder**

A forest machine used for transporting timber from a cutting area to a transportation route, usually a forest road

### **Fuel wood; energy wood**

Wood fuel, in which the original composition of the wood is preserved

### **Harvester**

A forest machine, which fells, delimits, cross-cuts and measures trees

### **Hog fuel**

Fuel wood in the form of pieces of varying size and shape, produced by crushing with blunt tools such as rollers, hammers, or flails

### **Logging residues**

Woody biomass residues created during harvest of merchantable timber. Logging residues include tree tops with branches and can be salvaged fresh or after seasoning.

### **Over-size particles**

A batch of particles exceeding a specific limit value

### **Strip road (carriage road)**

A route cut and prepared for transporting timber in the forest

### **Scarifying**

Exposing mineral soil in patches for forest regeneration

### **Long-distance transportation**

Transportation of chips from intermediate landings to end-use facilities, usually by lorry

### **Stand marked for cutting**

An area or tree stand outlined or otherwise marked for felling

### **Stemwood**

Part of tree stem, branches removed

### **Stump**

Part of the tree stem below the felling cut. In total-tree utilisation the root system is included in the stump.

### **Thinning residues**

Woody biomass residues originating from thinning operations

### **Whole tree**

Felled, undelimited tree, excluding root system

### **Wood chips**

Chipped woody biomass as pieces of a defined particle size produced by mechanical treatment with sharp tools such as knives. Wood chips have a sub-rectangular shape with a typical length of 5 to 50 mm and a low thickness compared to other dimensions.

### **Wood fuels, wood-based fuels, wood-derived biofuels**

All types of biofuels originating directly or indirectly from woody biomass.

### **Wood-processing industry residues**

Woody biomass residues originating from the wood processing as well as the pulp and paper industries

### **Woody biomass**

Biomass from trees, bushes and shrubs

# 1. Production of forest fuels in Finland

## 1.1 Description of production methods

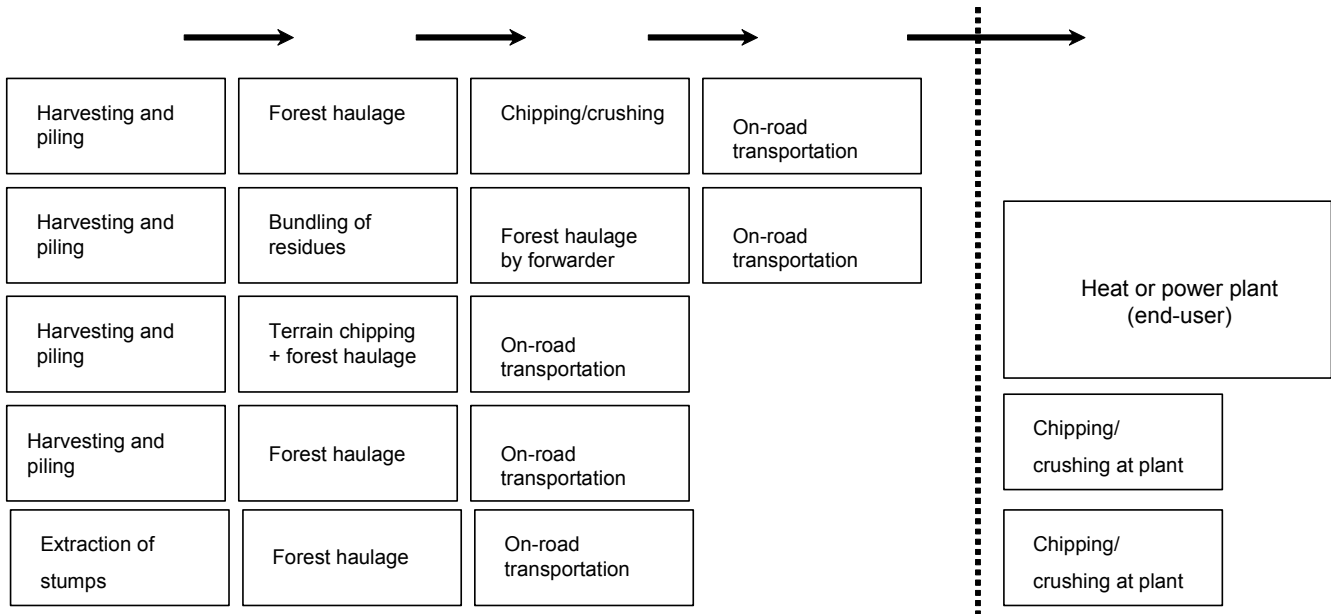


Figure 1. Forest wood supply chains.

In Finland the bioenergy markets are mostly local. There are a few diversified companies operating on the national level, like Biowatti Oy and Vapo Oy. These companies work on energy, wood processing and also biofuels business. They can exploit industrial wood residues from their own mills in the production of wood chips or pellets. They can integrate harvesting of logging residues into timber or pulp wood harvesting and in this way keep fuel prices competitive. Key operations are done by subcontractors, which are small enterprises carrying out some operations in the fuel supply chain. Also forest companies like UPM Kymmene purchase forest wood for their own power plants in connection with raw material procurement. There are almost 400 plants using forest chips in Finland.

In small-scale heating (< 1 MW) of municipal buildings like schools and small district heating plants, a special heating entrepreneurship model has been used in fuel procurement and also in the operation and maintenance of the boiler plants. Usually these entrepreneurs are co-operatives, harvesting small-sized wood of their own woodlots or purchasing industrial wood chips or cutter shavings from local wood processing industry. The number of these entrepreneurs in Finland has increased to 200, using annually about 300 000 m<sup>3</sup> loose wood chips.

In Finland a forest fuel production system consists of a sequence of individual operations performed to process biomass into commercial fuel and to transport it from source to plant (Fig. 1). The main phases of chip or hog procurement are purchase, cutting, off-road transport from stump to roadside, comminution, measurement, secondary transport from roadside to plant, and receiving and handling at the plant. A forest fuel production system is built around the comminution phase. The position of the chipper or crusher in the procurement chain largely determines the state of biomass during transportation and, consequently, whether subsequent machines are dependent on each other, i.e. whether the system is “hot” or “cool”. Comminution may take place at the road side or landing site, at the source, at a terminal, or at the plant where the chips are to be used. Four alternative production systems have been developed in the Wood Energy Technology Programme.

*Comminution at the source (terrain chipping)*, or in the terrain, requires a highly mobile chipper suitable for cross-country operations and equipped with a tippable 10–20 m<sup>3</sup> chip container. The chipper/crusher moves in the terrain on strip roads and transfers the biomass with its grapple loader to the feeder of the chipping device. When the chipper container is filled up, the load is hauled to the roadside and tipped into a truck container, which may be on the ground or on a truck trailer.

As a single machine carries out both the comminution of biomass and the haulage (off-road transport) of wood fuels, the cost of moving machines from site to site is reduced, and smaller logging sites become commercially viable. The use of containers weakens the interdependence between the chipper/crusher and the truck, although it is not entirely removed. Large landing areas are not needed, but a level and firm site is necessary for the truck containers.

For forest haulage, the chipper/crusher must be as light as possible, although its strength and stability may suffer. Even so, terrain chippers tend to be too heavy for use on soft soils, while use of crushing equipment in terrain is out of question. A terrain chipper requires flat and even ground and, because of its small load size and slow speed, its range being less than 300–400 m. Snow causes problems in the winter and results in increased moisture content of chips, unless the terrain chipper/crusher operates at a landing.

When large volumes of forest fuels are produced, the terrain chipping system becomes difficult to control. At present, the role of the system is diminishing.

*Comminution at a landing (chipping/crushing at roadside)* is performed in smaller operations with farm tractor-driven chippers and in large-scale operations primarily with heavy truck-mounted chippers or crushers. The biomass is hauled with forwarders to the

landing and bunched onto 4 to 5 m high piles. This facilitates operation in difficult terrain and in winter conditions and allows longer forest hauling distances. The forwarder operates independently of the chipper/crusher. The comminuted biomass from the chipper/crusher is blown directly into a 100 to 130 m<sup>3</sup> trailer truck, a process that makes the system hot and vulnerable, i.e. subsequent machines are dependent on each other. A wider landing area than in the alternative systems is required because of the large road-side inventories of biomass and the simultaneous presence of the chipper/crusher and the truck.

To avoid the system from over-heating, the *truck-mounted chipper/crusher and chip truck* can be replaced by a *single chipper/crusher truck*. This blows the chips directly into its own containers and then hauls the load to the plant. As the chipper/crusher truck is equipped with a chipping/crushing device and crane of its own, load capacity suffers and the operation radius around the plant is reduced.

Landing chippers/crushers do not operate in forest and hence can be heavier, stronger and more efficient than terrain chippers. If the biomass, such as stump and root wood, is contaminated by stones and soil, it is possible to use crushers that are more tolerant instead of chipper/crushers.

The close linkage of comminution and trucking results in waiting and stoppages and thus reduces the operational availability. On the other hand, the landing chipper/crushers are reliable and their technical availability is rather high. The system has so far kept its position as the basic solution of large-scale procurement of forest chips.

*Comminution at a terminal or plant* means that road transportation of the biomass takes place before the size reduction. The biomass is transported to the terminal or plant in the form of undelimited tree sections, whole small-trees, loose logging residues, bundles or stumps. Low bulk density restricts the operation radius, unless the biomass is bundled.

At large plants, comminution can be performed with efficient stationary crushers at low cost. At satellite terminals or smaller plants, the use of transportable chipper/crushers or crushers is more feasible, although the productivity of comminution is lower and the cost higher.

Comminution at the plant, based on the *bundling of logging residues* and crushing of bundles with stationary equipment, has been one of the key areas of technological development in the Wood Energy Technology Programme. In this system, logging residues are compressed and tied into 60–70 cm diameter, 3 m long bundles. A bundle of green residues weighs 500 kg and has an energy content of about 1 MWh (3.6 GJ).



Bundles are transported to the roadside using a conventional forwarder and on to plant with a conventional timber truck. About 65 bundles or 30 tons form one truck load. Whether it will be necessary, for safety reasons, to equip the truck with rear and side walls, is still an open question.

*Stump extraction* is the newest object of development, the aim being to develop harvesting methods and to survey changes in soil ecology and nutrients. The aim of stump extraction is also to reduce the infection of *Fomes annosus* (root rot) fungus in the soil and in the new tree generation. Stump extraction is combined with site preparation in order to create good conditions for planting or seeding. Dead and “spared” trees, small nature objects and valuable environments are preserved according to the general logging instructions.

Truck transport is the largest single cost factor in the procurement of logging residue chips, constituting up to one third of the total cost at the plant. As the use of forest fuels grows, the average distance and the cost of transport will also grow further.

Long-term maintenance of soil nutrient balance and the prevention of nutrients and metals (in particular aluminium) from leaching to ground waters and watercourses are of crucial significance. The recovery of logging residues and small whole trees reduces for a while the total amount of nutrients in the forest, and therefore, a part of logging residues (usually at least one third) is left in the forest to maintain the nutrient balance. In stump extraction, soil disturbance is minimised, and only an insignificant amount of metals (aluminium in particular) is dissolved in ground water. In fact, soil disturbance does not essentially deviate from that occurring in conventional soil preparation. Forest companies develop actively harvesting methods of forest biomass for different conditions, and the best management practices are employed. One of the aims is that the logging residues remaining in the forest are distributed more uniformly over the whole area than in conventional harvesting of timber.

Energy wood is not harvested from dry forest soils thin in humus, from peatlands or from soils where growth disturbances due to the lack of phosphorus, potassium or boron can be expected.

## **1.2 Control of fuel quality**

The quality of forest wood is dependent upon the source of the biomass and the techniques employed for comminution, handling and storage. Consistent particle size as well as low contents of moisture, foliage and ash each improves the efficiency and economy of combustion. However, different boilers demand different fuel properties.

The larger the plant, the more tolerant it usually is of random variations in fuel properties, mainly because large boilers employ the fluidized bed technology. Even so, knowledge of fuel properties and careful control of quality are essential to the operational reliability and efficient combustion of all boiler systems. The most important single quality factor is the moisture content of chips, as it affects the net calorific heating value, storage properties and transport costs of the fuel. Moisture content is thus a direct cost factor, and it is taken into account in the pricing of fuel. Excessive moisture content results in a price reduction, while a low one may bring a bonus.

The moisture content of fresh biomass must be reduced to obtain the full energy potential. Moisture is a critical fuel property, especially in wintertime, as the moisture content decreases only during the summer. Maintaining the reduced level of moisture during the autumn rains requires careful planning and timing of operations. During recent years, the procurement organisations have managed a better control of the moisture content, and truck loads of fuel with excessive 55–60% moisture content are no longer common. Nevertheless, energy is still lost because biomass arrives at the plant with an excess of moisture.

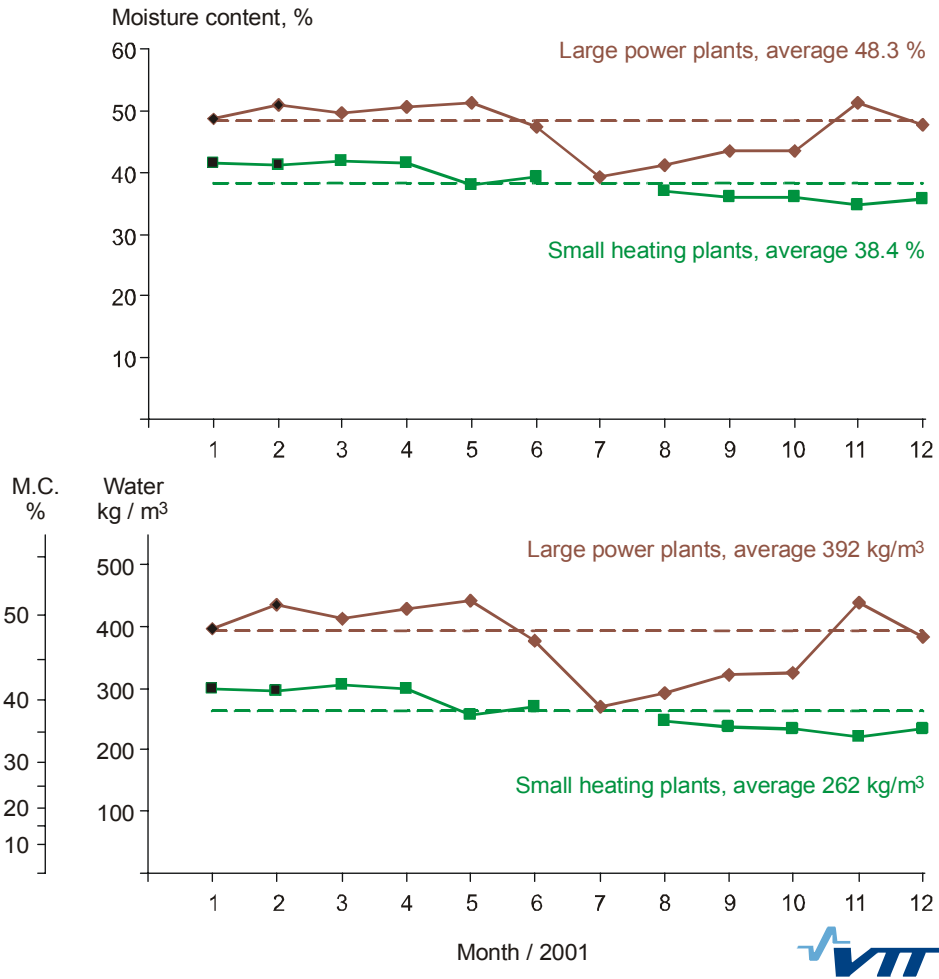


Figure 2. Seasonal variation of the moisture content (green mass basis) and bulk density of forest chips or hog fuel arriving at plant in 2001. Average of several plants. Source: VTT Processes.

Moisture content and particle size distribution are the most important quality factors in forest fuel production and use. VTT Processes has analysed quality of forest fuel in project, which was part of the Wood Energy Technology Programme (Fig.2 and 3).

The particle size of forest chips is usually less than 45 mm (95% of the particles are smaller) and even 30 mm. Drum chipper/crushers produce equal quality. Previously, long sticks and other oversized particles have caused problems, but have been reducing in recent years.

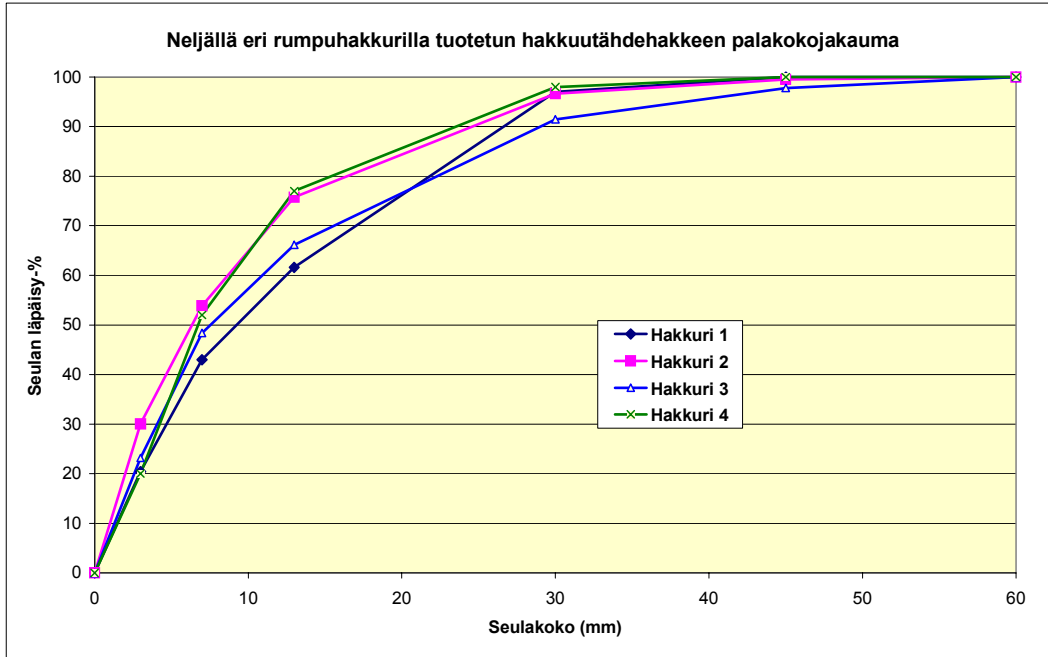


Figure 3. Particle size of forest fuel by four different drum chippers.

Source: VTT Processes.

(seulakoko = sieve size, seulan läpäisy = particles passed holes, hakkuri = chipper)

## 2. Introduction to the quality assurance system

### 2.1 What is quality and why should we aim at high quality

High quality is an essential tool of competition to the enterprise and its significance to the profitability of entrepreneurship will increase in the future. *High quality affects directly the profitability of the enterprise by decreasing costs and improving customer satisfaction.*

Investments on the development of quality will ensure success also in the long term. Achieving, maintaining and continuously improving the high quality requires commitment by management and whole personnel. In order to ensure quality, the personnel must be taught, what is quality, how is it achieved and further developed.

Today, quality as a concept includes, not just the quality of product, but also that of the company's performance. Hence, the quality can be divided as follows:

#### **Technical quality, i.e. quality of product**

- What does the client obtain?
- Quality is based on the enterprise's ability to response to the demands and expectations of the product and service set by the client.
- Quality of chips and work, and respecting environmental aspects.

#### **Quality of performance/functions**

- How the company is operating - cost savings.
- Work is carried out effectively and correctly at once.
- All unnecessary work will decrease the quality of organisation's description.
- Higher utilisation rate of machines and equipment, decreased loss of raw material and increased output.

Quality and productivity correlate strongly. Costs due to a lack of quality constitute approximately 15–35% of all costs. The improving quality offers to the enterprise a possibility to substantial cost savings. Production of high quality requires clear views, how quality objectives can be reached. Thus *a functional quality assurance system* is necessary.

## 2.2 How to attain a required quality

The high quality is based on the quality of enterprise's internal activities and image, i.e. what is client's impression of the quality of their products and operations.

In some cases the enterprise provides chipping services to only one major client. However, regardless of the number of clients, several interest groups (e.g. forest owners) exist, and the impression these interest groups have about the quality of operations is very important. The high quality is based on customer orientation. From this point of view employees working sequentially within the company can be seen as clients to each other.

### Customer orientation

- Demands and expectations of the clients are respected and operations are carried out in accordance with them.
- Quality is determined by the client.
- Client pays for product and service. Without the client there is no work or cash flow.
- The purpose of collecting feedback from clients is to develop continuously operations and quality of the company.

### Internal customship

- Quality covers every functions of the company.
- Within the company, the employees are clients to each other, i.e. each stage of operation is a client to the preceding stage and a deliverer to the ensuing stage.
- According to the "Correctly at once" principle, each stage of operation should be completed in a manner that the next stage can continue without disturbance or delay.
- Quality concerns every member of personnel in the enterprise and each employee shall be responsible for one's own work.
- Quality is improved by advance planning of operations and avoiding errors.

## 2.3 Quality assurance system

Quality assurance system is:

- *Written description* of enterprise's functional mode.
- *Way to act* and ensure the compliance with the requirements and to *improve operations continuously*.

If the quality system is too extensive and heavy, there is a danger that it remains distant at the practical level. When the quality system is built, the starting point should be enterprise's own needs, and the content and structure of the system should be adapted

according to these needs. A good quality system is practical, easy to use, and serves as a tool when developing quality of products and operations.

Quality assurance system consists of a quality assurance manual, which includes descriptions of the structure and main contents of the system, business presentation/description, quality policy and enterprise's values and quality objectives. A good quality assurance manual is clearly grouped, and issues are described shortly and accurately. Quality assurance manual should serve as a practical tool when carrying out work or orientating new employees to the enterprise. The quality assurance manual demonstrates to the client that the enterprise has a documented quality assurance system and that the enterprise is operating in accordance with this system.

A good quality assurance system covers the following subjects:

- Process management
- Improving productivity and cost-effectiveness of operation
- Ensuring customer satisfaction
- Ensuring high and even quality of products, services and work processes
- Supporting training and job control of the personnel
- Serving as an instrument for developing the enterprise and its operations
- Creating “mutual rules” to the enterprise
- Documentation on approved proceeding methods

## **2.4 Structure of quality assurance system**

The Trade Association of Finnish Forestry and Earth Moving Contractors (TAFSEC) has produced a quality assurance system form designed especially for small and medium-sized forestry service providers. The system form includes quality management, and descriptions of processes and modes of operation. With the quality assurance manual, the enterprise's positive attitude towards quality and operational development can be indicated to the client.

### **Quality management**

Quality management consists of company profile, operation, quality and environmental policies and description of the quality assurance system.

### **Process descriptions**

Entrepreneurship can be divided to different processes. Most important processes (e.g. quality control, information flows, contents of agreement) are described in the quality

assurance manual. Well formulated process descriptions clarify working procedures and act as an instrument of development.

### **Work instructions**

In this section modes of operation are described and instructions for high quality work are given. Work instructions and process descriptions ensure consistency and continuity of operation in case of personnel changes.

### **Quality records**

A quality assurance system includes various files, which must be appropriately registered and preserved at least a period of two years. These quality records include e.g. contracts, working site documents and feedback from clients. From these files the quality of operation and observance of the guidelines can be confirmed.

### **Reference information**

Reference information includes external material that affects operations of the enterprise. Reference information includes e.g. maintenance manuals of the machines, forest management guidelines and forestry legislation.

## **2.5 Why is a quality assurance system important?**

When the quality assurance system is structured correctly, it serves as an instrument, which helps the entrepreneur to manage, plan, carry out and supervise operations and control costs. Appropriate operation reduces unnecessary work and through this also the cost level of the enterprise significantly.

Benefits to the enterprise:

- Quality of products and services improve
- Quality assurance to the client
- Improved customer satisfaction
- Improved information flows and co-operation
- Independent responsibilities of the personnel increase
- Higher output of operations
- Improved control of costs quality
- Improved trust on the enterprise and its operations
- Improved corporate image



## **2.6 Contents of the quality assurance manual and its adaptation**

The Trade Association of Finnish Forestry and Earth Moving Contractors (TAFSEC) has developed a quality assurance model for comminution and long distance transport of wood fuels. The Finnish model is based on ISO9000:2000 and ISO14000. The construction of a quality assurance system begins with assembling the quality assurance manual. The quality assurance manual presented in this publication can be used as a model when preparing a quality assurance manual. The CEN TS for quality assurance is under preparation and this model manual is a part of field tests. Details and comprehension of the system should be modified according to the needs of the enterprise. All necessary amendments and instructions are made.

### **Description of business operations**

Short introduction to the enterprise and its operations: location, mission of business, etc.

### **Quality management**

This chapter includes general operation policy, to which the enterprise's mode of operation is based on. Operation policy also states essential operating principles of the enterprise: why the quality assurance system exists, how the quality requirements of the client are fulfilled, what is the target of continuous operation development. This operation policy must be recognised and understood by each member of the personnel. The management signs the operation policy and by this signature it also commits to its implementation.

### **Primary responsibilities**

Section points out and defines the organisation of the enterprise and how the responsibilities are distributed.

- Responsibilities of the management
- Who is responsible for quality assurance and what is included in the maintenance of quality assurance system
- Responsibilities of employees (further details in working instructions)

### **Training of the personnel and professional skill**

To ensure a required quality, the personnel should be skilled, and this is maintained by training. An employee-specific training directory is upheld.

- Training sheet as an appendix of the quality assurance manual
- Courses (name of the course, organiser, date) attended by the employee are marked in the training sheet.
- Training directory is not a fixed section of the quality assurance manual. It is a file of its own and kept in the office (quality record).

### **Information flows**

The purpose of this section is to give instructions and ensure liaison in each work stage. In the quality assurance manual, the information flows are also represented as diagram. The external information flow refers to the communication of the enterprise and liaison with external interest groups, e.g. clients, forest owners and subcontractors.

- How to give information about the enterprise to external interest groups
- What are the responsibilities of the client, e.g., in planning of the operation
- What is reported to work management
- Co-operation with the interest groups

The internal information flow comprises communication within the enterprise and between the entrepreneur and employees. Feedback from the work carried out is an important part of internal information flow.

- Dealing with problems and anticipation
- Information flow about working sites between employees
- Preservation of working site documents
- Quality assurance meetings
- Development discussions with employees

The feedback system is part of the information flow of quality assurance system. Feedback can be given to the client or collected from the client. Feedback from the client is filed (quality records) and used for assessing requirements and expectations of the client and to develop operation of the enterprise.

- Development feedback: the enterprise gives a defect report to the client, where the defect and its reason is described.
- Feedback from the client: the enterprise asks feedback about their operations 1 – 2 times a year.

### **Reliability of wood chip or hog fuel deliveries**

The entrepreneur describes how the enterprise secures undisturbed wood fuel deliveries.

### **Origin information of wood fuels**

If necessary, by monitoring the origin of wood fuel, it is possible to verify that wood fuel comes from domestic or international sources and from certified forests. Data on the origin is provided over the whole delivery process, from stump to end user facility.

### **Quality requirements for wood fuels**

Quality requirements (e.g. moisture content, average particle size, particle size distribution and energy density) for wood fuels should be classified and described, and recorded in the delivery contract or a separate form of quality guidelines for wood fuel type. Quality requirements for wood fuels are currently specified based on the FINBIO's guidelines, but in the future prCEN/TS 14961 will be used.

### **Quality assurance at working site**

Quality requirements for the product are agreed together with the client. By quality assurance at the working site, the enterprise minimises defects in quality and ensures attainment of the quality objectives set by the client. Working site documents are filed (quality records) from each working site.

- Each member of the personnel is responsible for the quality of his/her work
- Employee monitors proceeding of the work and makes amendments, if necessary
- The working site instructions given must be followed.

### **Working instructions**

Working instructions are prepared to guide the personnel of the enterprise to ensure high quality of products and services.

- Instructions cover each work stage, e.g. machine transports, harvesting, forest haulage, chipping/crushing, long distance transport and maintenance of the machinery.
- Instructions are prepared to guide personnel in different working situations.

## **Environmental issues**

Chipper/crusher entrepreneur and deliverer of wood fuels must follow the requirements of good environmental management. The quality assurance manual itself does not deal with environment issues in detail, the main information being presented as reference (e.g. forest management guidelines, forestry act).

## **Waste management**

Waste management issues given in the quality assurance manual are based on Waste Management Act, and the entrepreneur shall ensure the performance of waste management according to regulations. A waste management plan is created together with the quality assurance system.

- Maintenance waste and garbage are collected from working sites to a storage, where there are receivers for different kinds of waste
- Further processing of waste
- The enterprise shall file documents (3 years) about forwarding hazardous waste to a right instance.
- The enterprise shall have instructions for case of environmental accident.

## **Purchases**

The entrepreneur reports criteria used when purchasing new machines and when choosing suppliers and possible subcontractors. The procedure and basics of decision-making are described in the quality assurance manual.

## **Industrial safety**

Industrial safety issues connected to comminution:

- Client's responsibility as principal (Occupational health and safety act (Tsl) 34§).
- The enterprise shall prepare a strategy for industrial safety (Occupational health and safety act (Tsl) 9§ (form provided by FinnMetko Oy).
- The occupational safety manager shall be nominated.
- If the enterprise has more than 10 employees, a person in charge of safety shall be nominated.
- The employees shall be trained for work routines and especially risks (Occupational safety act /TyöturL. 34 §).
- Occupational health service shall be arranged.
- Operators/drivers shall have instructions for cases of emergency.
- Each harvesting machine/lorry shall have a first aid kit and a fire extinguisher.
- Vehicle-mounted cranes shall be inspected once a year. The inspection sheet is in the crane (sheets provided by FinnMetko Oy).

### **Reference information to be followed**

Reference information consists of complete handbooks and folders including essential information to operator/driver, e.g., quality guidelines for solid wood fuels by FINBIO.

### **Quality records**

Quality records include written documents about operations and quality assurance activities. Documents are listed and marked, where they can be found and for how long they shall be kept (for at least two years).

### **Contracts**

General instructions for preparation of a contract, including the list of contents, are collected to this section.

### **Office and economy**

Supervising operations of the enterprise, and attention to statutory social obligations.

### **Insurance**

Insurance coverage of the enterprise. The list of statutory and possible voluntary insurances should be available.

### **Evaluation of quality assurance system**

The quality assurance system should be maintained. The employee in charge of quality carries out an internal evaluation 1–2 times a year. The Quality Assurance System is assessed, and it is made sure that the normal practises correspond to written procedures. The appendix of the quality assurance manual assists in internal evaluation. The quality records should include documents indicating that the internal evaluation has been performed according to guidelines.

If modifications have been made in the quality assurance manual, dates shall be presented, and changes marked in each copy of quality assurance manual.

Once the quality assurance system functions well and is developed, it is possible to apply general approval for the system. E.g., the client can carry out an external evaluation, of which the entrepreneur receives feedback and certificate. The Quality Assurance System is assessed and evaluated, whether it corresponds to normal practises

at the working sites. Feedback and follow-up information as well as internal evaluation memoranda are examined and noted, whether the operation development has been carried out in accordance with them.

### **Equipment list**

The equipment of the enterprise, possibly including also auxiliary equipment, shall be listed.

## **2.7 Implementation and maintenance of quality assurance**

The personnel of the enterprise must be aware of the creation of the quality assurance system. Once the system is ready, a training session for personnel is arranged. The quality assurance manual is carefully examined, as each employee should know the quality policy of the enterprise and guidelines for his/her own work. The employees participate in the utilisation and development of the quality assurance system from the very beginning.

### **Implementation**

1. The decision of implementation and compliance with the quality assurance manual.
2. Quality assurance manual shall be made available to each employee of the enterprise
3. It is ensured that each machine/lorry have relevant reference information.
4. Agreement with the employees on collection and filing of the working-site documents
5. Introducing personnel directory
6. Introducing feedback system
7. Monitoring own operations (quality objectives)
8. Quality assurance meeting once a year, memorandum shall be prepared (quality assurance file)
9. Maintenance of quality assurance system
10. External auditing of quality assurance system.

## 3. Model of quality assurance manual

### 3.1 Importance of quality

Quality is today an essential requirement for the competitiveness of the enterprise. Quality requirements are increasing all the time due to clients becoming more and more aware of the concept of quality, and environmental requirements and competition are tightening. A high quality of the energy wood supply chain is a part of the quality requirements of the whole energy production industry.

The target of wood fuel supply chain should be that it always fulfils requirements and expectations set by the client. Quality is primarily determined by what has agreed with the client. One of the main requirements for high quality is that the wood fuel deliveries are carried out according to agreed schedules.

To secure that the enterprise is able to produce chips of sufficient quality, each employee shall understand that the quality of the enterprise's services and its competitiveness are dependent on his/her effort. Each employee should evaluate the quality of his/her own work at every stage of the supply chain.

To be able to meet continuously the quality requirements set, the enterprise has developed a quality assurance system for its operation. The Quality Assurance Manual prepared applying the SFS-ISO 9001 quality assurance standard and the SFS-ISO 14001 environment standard, including a model of a quality assurance system for enterprises, forms the basis for the quality assurance system of the enterprise. The quality assurance system of our enterprise is designed, in particular, for contract services in the energy field.

### Quality manual of the company

Company N.N  
Postal address (Street XX)  
FI-XXXX Town

#### Contact information:

Telephone (office/mobile): \_\_\_\_\_

Fax: \_\_\_\_\_

Email: \_\_\_\_\_

### 3.2 Description of business operations

Write a brief presentation of activities of your enterprise.

- field of operation
- region of operation
- start of operations
- number of employees
- co-operation partners, etc.

Enterprise Ltd operates as a chip producer and is responsible for energy wood comminution/whole supply chain. Wood fuel is produced as roadside chipping/terrain chipping/crushing at the end use facility.

### 3.3 Quality and environment policy of the enterprise

Quality Assurance Manual includes the description of our services. The purpose of our quality assurance system is to ensure quality of our services and products, and to intensify our operations and co-operation.

The enterprise management is engaged oneself to developing, maintaining and improving the quality and environment system. Our employees know and understand the quality and environment policy of the enterprise and follow the system. The enterprise management has made clear the significance of statutory regulations and quality and environment targets and the respective requirements to all employees.

Our aim is a customer-oriented operation. Our enterprise produces services related to energy field in such a way that the work and operations comply with the quality requirements of customers. The requirements for operations and the final product are agreed upon with the customers prior to starting the work.

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*Wood fuel entrepreneur working as a contractor obtains working site instructions from a member of the procurement organisation. Following and verification of these instructions and requirements are confirmed in a manner agreed upon by. The entrepreneur shall obtain a document (including working site instructions, possible changes and exceptional and problematic matters) from each working site (Occupational Safety Act 51 §).*

Or

---

*Wood fuel entrepreneur, responsible for direct deliveries utilises the working site instructions of industrial wood harvesting operation and plans and instructs his/her working sites independently. The entrepreneur shall obtain a document (including working site instructions, changes and exceptional and problematic issues) on each working site (Occupational Safety Act 14 § and 51 §).*



*Wood fuel entrepreneur is responsible for delivering chips in such a way, that the delivery client has always enough wood fuel at the place assigned by the client. Quality of wood fuels shall correspond to criteria agreed with the client. The wood fuel deliveries are measured as mutually agreed. Information about the origin of the wood fuel batch shall be available in the delivery note/quality declaration.*

The management is responsible for arranging such conditions, that high-quality work can be done with appropriate and applicable machines. The management focuses on the rationalisation of planning and operations and is responsible for the development of the quality system (management inspections).

Our employees follow and participate in the development of the quality assurance system. Our employees are responsible for the work and for the quality of the work they carry out.

We aim at customer-orientation in our operations and at fulfilling the quality requirements set by the client.

Our enterprise is pursuing to anticipation of problems and defects, and efficiency of operations.

We operate in accordance with the occupational safety standards given by the authorities and develop and maintain safe working conditions, equipment and working methods.

We understand our essential role in maintaining the diversity of environment and nature. We have always adequate protection equipment (e.g. equipment for oil destruction operations) with us, when operating at working sites.

Our employees are skilled, and we maintain and improve our skills when necessary.

Our entrepreneurship must be profitable to guarantee our high-quality mode of operation. We continuously develop it employing our own feedback and monitoring systems.

---

Name of enterpriser

Name of enterprise

### 3.4 Description of the quality and environment system

The structure of the quality and environment system for energy entrepreneurs is shown in the Figure 4.

**1. Quality and Environment Manual.** The manual contains a description of the control system of quality and environmental issues and general operation principles for enterprises.

**2. Quality Files.** The quality files contain data related on the operation of the quality system.

**3. References.** The references contain material and instructions related to working procedures, not included in the Quality Assurance Manual, as well as instructions for the operation of the enterprise. The references are divided, according to the purpose of use, into machinery and office versions.

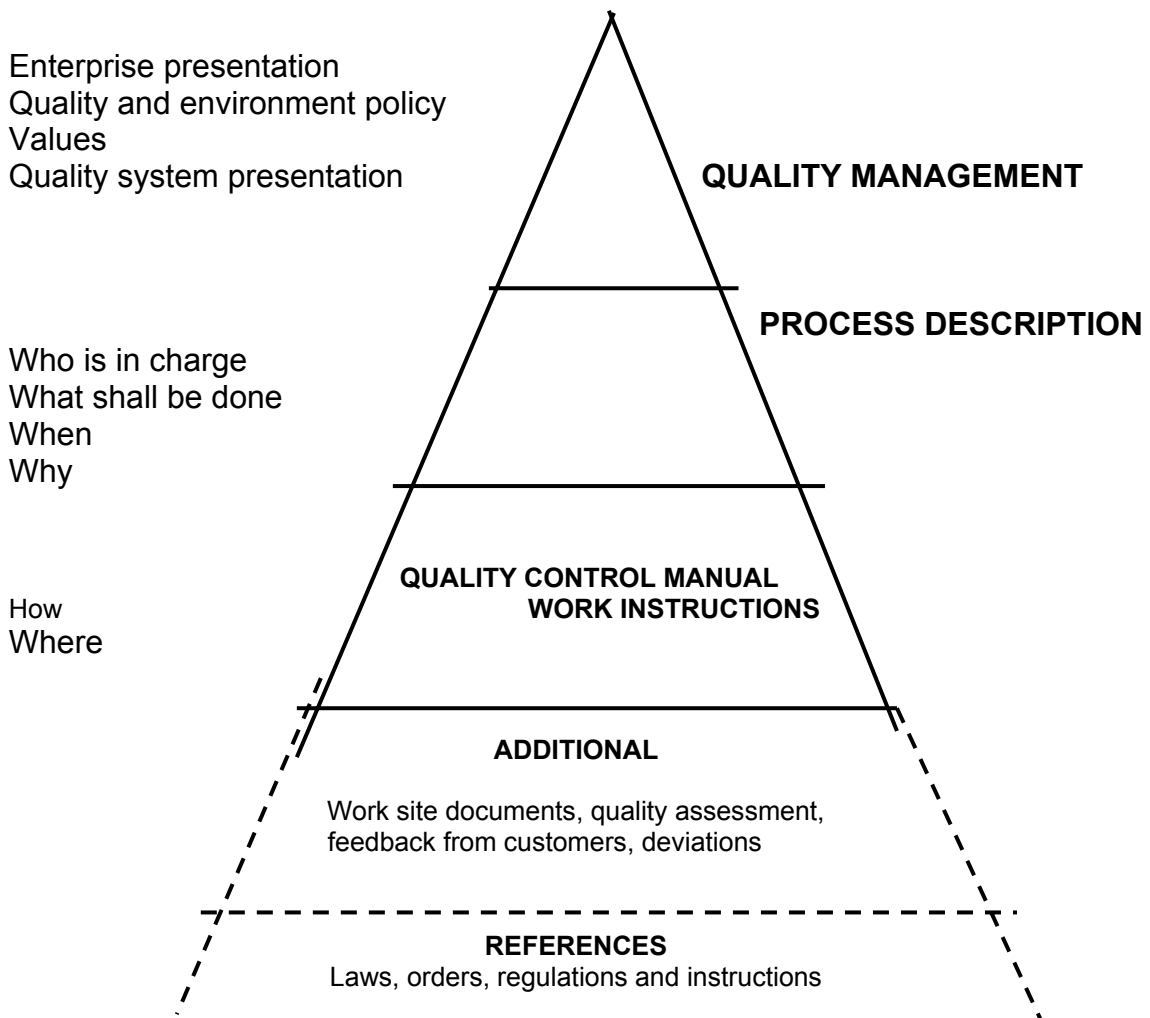


Figure 4. Structure of quality management and environmental system.

### 3.5 Delivery chain of energy wood

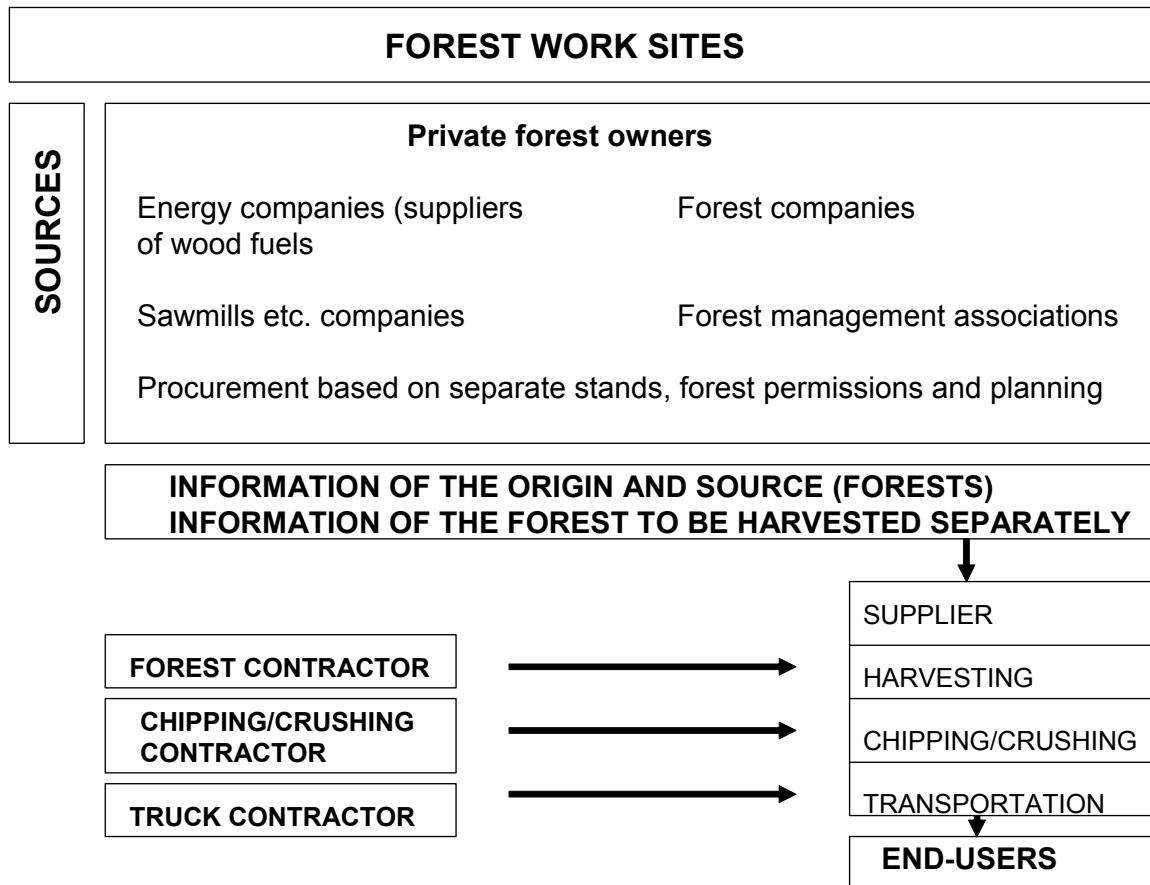


Figure 5. Wood fuel supply chain.

### 3.6 Primary responsibilities

#### Entrepreneur NN

- Tenders and contracts
- Financial planning
- Purchases/investments
- Decision-making
- Marketing
- Work site planning / timetables
- Organisation and planning of energy wood deliveries (entrepreneur in charge of direct deliveries)
- Subsidies for harvesting and haulage on small-sized trees
- Office routines
- Invoicing

- Payments
- Preliminary accounting
- Filing of working site documents
- Equipment maintenance and repairs
- Occupational safety
- Issues related to quality assurance system
- Environmental issues and waste management
- Entrepreneur partners
- Training decisions

### **Person in charge of quality assurance and environment NN**

- Efficient functioning of the Quality Assurance System
- Modification of and improvements in the Quality Assurance System
- Maintenance of training register
- Signing of quality system documents
- Control of quality objectives
- Gathering feedback
- Maintenance of quality records
- Quality meetings
- Assessing the Quality Assurance System (internal and external)

### **Accounting agency**

- Reporting, book-keeping, financial statements
- Payroll computation

### **Harvester operators**

- Advance strip road planning of logging sites
- Felling work
- Validation of measurements and calibration of measuring equipment
- Information transfer
- Felling, delimiting and harvesting of stems to heaps
- Collection of logging residues
- Site-specific environmental requirements
- Informing possible discrepancies to the forwarder operator (it depends on the organisation model if information is forwarded from one operator to another or through the central organisation)
- Minimisation of logging damages in the remaining tree stand

### **Forwarder operators**

- Advance planning of felling site
- Collection and short-distance haulage of energy wood
- Minimisation of damage in the remaining tree stand and on driving tracks
- Landing arrangements
- Formation of wood lots
- Wood pile labelling
- Landing site instructions for the chipping unit
- Time and site information for the forwarder/driver
- Piling

### **Chipper/crusher operator**

- Planning of chipping work
- Comminution
- Monitoring of chipper/crusher operation
- Clearing the landing after comminution
- Minimising damages at the landing site and on roads

### **Driver of wood fuel truck**

- Long-distance transports at the right time to the right place
- Unloading
- Minimising damages on roads
- Sampling at sites agreed
- Filling in delivery notes
- Filling in acceptance notes
- Customer service

### **Additional responsibilities of the operator/driver**

- General occupational safety
- Traffic management at landing site
- Machine/truck transfers
- Daily maintenance of the machine/truck/tools
- Scheduled maintenance and bigger repair work
- Waste management and environmental issues
- Information flow
- Quality issues, quality assurance
- Identification of faults/deviations

- Documentation

### **3.7 Training of personnel and professional skill**

The management defines and engages sufficient employee resources for the operation of the enterprise. Our enterprise pays special attention to initiating employees into their tasks, to their capability of co-operation and to their engagement to the job. The employees of our enterprise are chosen with care and they are qualified for their tasks. In this way, we ensure that no defects in quality occur and that our employees know their responsibility. We update our skills by participating in training events if need be. These needs are discussed at quality meetings. We keep employee-specific records of work-related-training (training form as Appendix 15).

### **3.8 Information flow**

#### **General**

Quality Assurance Manual shall always be available to the employee (i.e. in the machine/truck). The Entrepreneur can give the Quality Assurance Manual to the customer or other interest group.

The employees shall have all important telephone numbers at their disposal. The entrepreneur/employees are responsible for updating the numbers.

#### **External information flow**

#### **Work site planning**

A member of the procurement organisation/chipping entrepreneur sees to that energy wood harvesting is taken into account, when buying tree stands and preparing logging plans.

- In order to improve economy and profitability of operations, the cutting stands should always be marked close to each other
- Harvesting of logging residue and its terms should be considered in the contract of sale.
- Specific instructions for each logging site should be provided before starting the work.
- Machine operator shall be informed, which logging sites are also used for wood fuel harvesting
- Natural features shall be considered when marking a stand for cutting.

- Soft and stony grounds and special protected areas shall be left outside the stand marked for cutting
- As far as possible, clearing of undergrowth before harvesting (a factor affecting the quality of wood fuel)
- Landing site must be spacious enough, so that there is also space for logging residue piles and comminution (i.e. to chipper/crusher and chip lorry and their movements)
- Logging site plans shall always be ready before harvesting machines enter the site: outlines, routing, natural features, telephone and electric lines, landing areas and ploughing of forest roads in wintertime.

A member of the procurement organisation/chipping entrepreneur provides adequate instructions of logging sites to **machine operators** for operating their harvester or forwarder, and the operator goes through the instructions before starting the work.

- The harvester operator shall be informed about harvesting logging residue to heaps, and the forwarder operator about hauling logging residue to the landing site. The forwarder operator should also know the chipper/crusher type used in comminution (structure of piles)
- The forwarder operator shall inform the chipper/crusher operator about completing the forest haulage
- The operator shall write down (in the map or working instructions) exceptional incidents and changes occurred during working at the logging site
- Working instructions (including entries) shall be filed.

**Chipper/crusher operator and driver of wood fuel truck** are informed of working sites by a member of the procurement organisation /the entrepreneur.

- Working site instructions shall include: location of the working site, location of energy wood piles, turn-arounds, road network and bearing capacity.
- Comminution is carried out in co-operation with the chipper/crusher operator and the driver of chip lorry, either to the load space of the lorry or into a demountable container.

Drivers should address possible questions about working sites primarily to the member of procurement organisation or to the entrepreneur.

Operators/drivers should inform or ask additional instructions from the member of the procurement organisation or the entrepreneur:

- Damages in road network
- Landing site problems

- Depressions in thinning areas
- Unusual issues, detected natural features, etc.
- Machine breakdowns

In case of unusual incidents, operations at the working site must be interrupted.

Finally, the driver/entrepreneur delivers the measuring certificate of merchantable wood to the representative of the procurement organisation.

The workers represent our enterprise and act accordingly in their work. The forest owners are important customers to our enterprise, and hence, the employee should behave courteously in a businesslike manner and consider the wishes of the forest owner in his/her work as far as possible.

Visitors at the working site should be received in a kind businesslike manner.

- If necessary, representatives of the procurement organisation or the entrepreneur should be contacted.

Confidential information to outsiders is forbidden (e.g. wood quantities).

We develop co-operation with procurement organisation and customers

- Meetings
- Development discussion with personnel
- Feedback system

### **Information flow with the client** (entrepreneurs responsible for direct deliveries)

It is essential to the **clients** that wood chip deliveries proceed as undisturbedly as possible and are carried out as agreed in the contract, and hence, quality requirements, delivery quantities and timetables shall be kept to.

In order to avoid any misunderstandings and problems, the client shall be contacted when necessary.

- Notify client, if, e.g., due to a breakdown of machinery, wood chips/hog fuel cannot be delivered according to schedule. Back-up arrangements shall be agreed on with the client.

Our enterprise has ensured undisturbed chip deliveries in co-operation with other ones (description of co-operation: enterprise, contact person, equipment and co-operation) and/or with own spare equipment.



When delivering wood chips to the client the drivers of chip trucks are “visiting cards” of our enterprise, and hence they shall behave irreproachably in any circumstances.

The delivery customer provides energy contents/volume information based on origin information of the delivered wood fuel.

Our enterprise provides the origin information of delivered wood fuel to the wood supplier for accounting/accounts payments, according to stages of operation.

To maintain functional business relations it is vital, that we understand expectations and demands of the whole supply chain. We try to identify these expectations and demands and develop them on the basis of feedback from customers.

### **Internal information flow**

The whole personnel should be aware, who is responsible for information and which kind of information shall be obtained and given in different situations. Possible discrepancies and problems shall be discussed and solved immediately:

- Employees, entrepreneur, and if necessary, representatives of the procurement organisation and customer.
- Rectifying measures
- Avoiding similar discrepancies

### **Information flow between workers and entrepreneurs**

- Phone
- e-mail
- Note (on the seat of the working machine)
- Shift relay
- Work site discussions
- Quality discussions

The entrepreneur and employees consider quality issues regularly, 1–2 times a year, at quality meetings. There are development initiative forms available for the employees, and they participate in the development of the quality assurance system of the enterprise. We improve the performance of our quality system, i.a., with the aid of employee-specific initiatives. The most significant issues and feedback are discussed and improvements in the system decided at quality meetings. Memoranda on quality meetings are drawn up (Appendix 7).

Issues to be discussed at quality meetings are, i.a.

- Performance of and improvement in the quality system
- Employee-specific development initiatives (Appendix 5)
- Problematic issues and their avoidance
- Feedback
- Quality, occupational health and safety, and environmental issues
- Development discussions with the employees (Appendix 6)
- Training needs
- Internal evaluation of the quality system

### **Filing of work site documents**

Documents on working sites (quality files) are filed by the entrepreneur (Fig. 6).

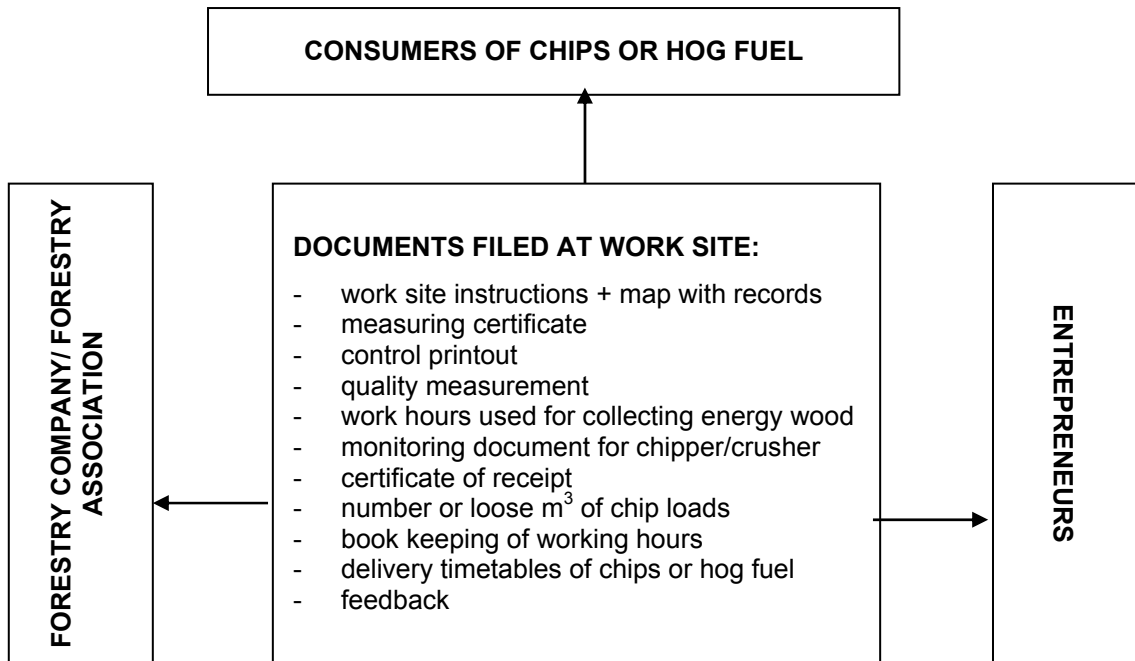


Figure 6. Documents filed at working sites.

### Operation in cases of emergency

Our enterprise pays special attention to handling and prevention of accidents and near to cases.

In cases of emergency and accidents, the enterprise shall attend to fluent flow of information.

Written operation instructions for cases of emergency and accidents, drawn up for the enterprise, are included in the Quality Assurance Manual.

- Communication when working alone (Communications)
- Measures in case of traffic accident (Instructions for transport truck/automobile)
- Measures in case of environmental damage (Waste management)
- Measures in case of fire (Equipment maintenance and repair)
- First aid instructions (Appendix 11)

When working alone in exceptional conditions, the operator shall maintain contact when starting and when finishing the work (repairs on terrain, working dangerously close to an electric line). N. B.: Demanding repairs should be done at the garage.

A report in writing shall be made on accidents. The report shall include the following issues: what happened and why, which actions were taken and whether these actions

were right. Furthermore, the consequences of the incident shall be assessed, and the work and operation instructions of the enterprise shall possibly be updated. Police and occupational health and safety authorities shall be informed about a serious occupational accident.

### 3.9 Information flow in the production of logging residue chips or hog fuel

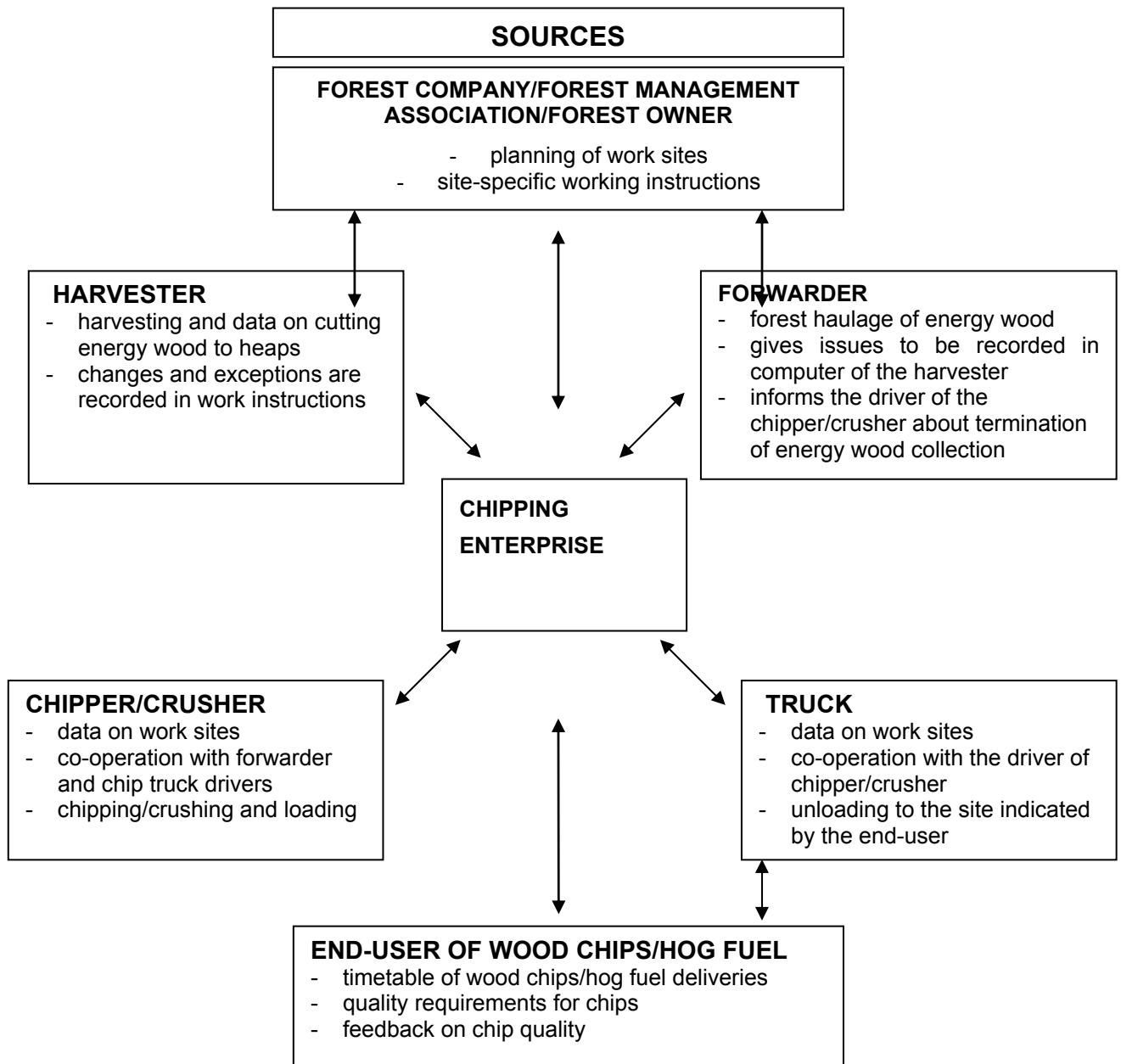


Figure 7. Information flow in the production of logging residue chips or hog fuel

### 3.10 Information flow in the production of wood chips from small sized trees

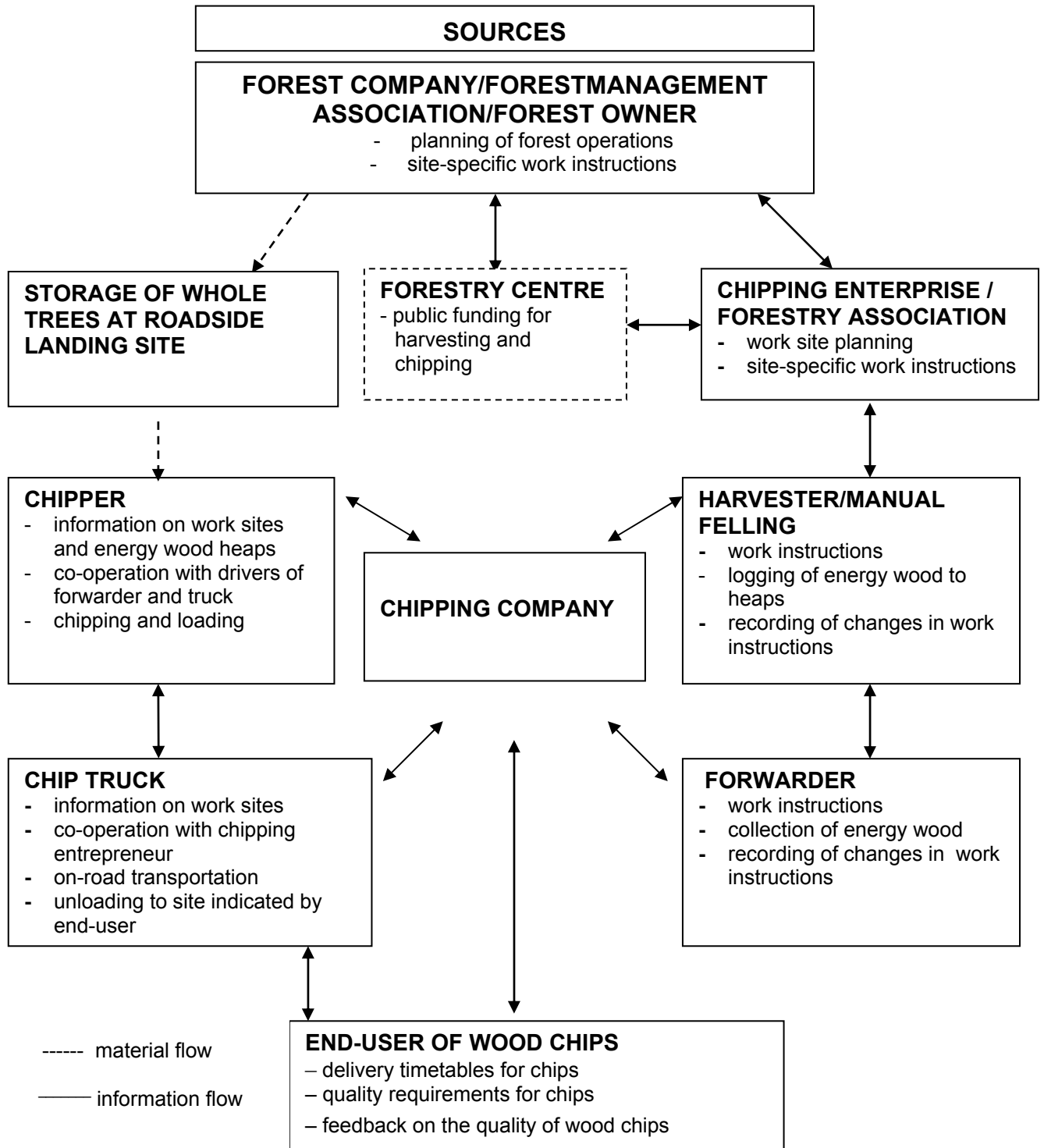


Figure 8. Information flow in production of wood chips from small-sized trees.

### 3.11 Information flow in chipping/crushing of residues from wood-processing industries

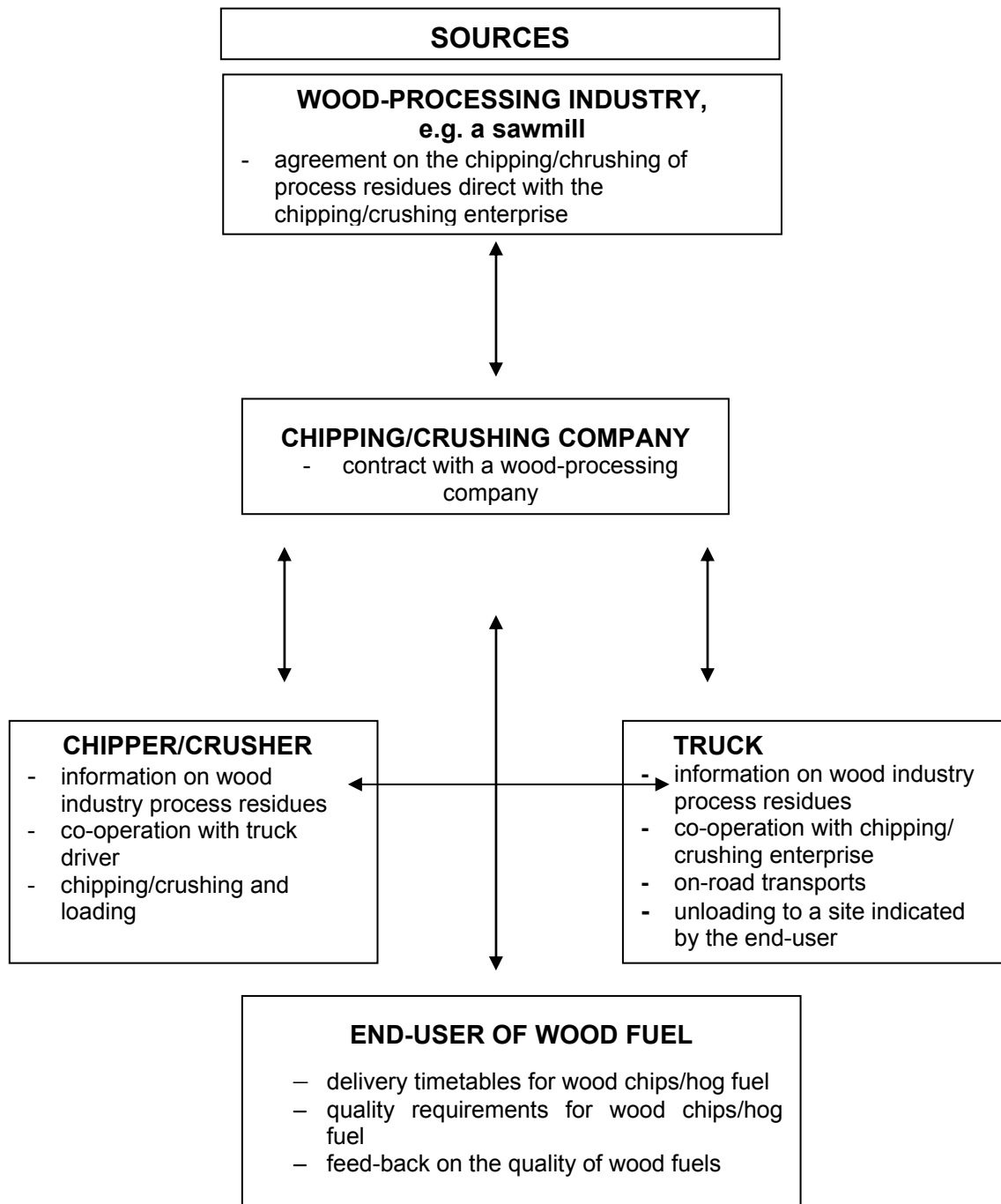


Figure 9. Information flow in chipping/crushing of residues from wood-processing industries

## **3.12 Feedback system**

### **Feedback**

The entrepreneur shall give development feedback in writing about issues to be improved to the customer (Appendix 2).

The entrepreneur shall ask for feedback about operations of his/her enterprise 1–2 times a year (Appendices 3 A and B) from customers.

Feedback received from forest owners is used in operational development (Appendix 4).

### **Discrepancies and their handling**

Discrepancies are issues or operations deviating from the agreement or the commission. Good working and operation instructions and training of employees are preventive measures used in our enterprise for preventing such deviations.

The enterprise responds to the feedback on deviations, obtained from the customer, quickly, searches for the reasons for the discrepancy and plans repair measures. Should these measures require new working instructions, these are drawn up and enclosed to the Quality Assurance Manual.

The management is informed about problematic sites and errors to develop and improve the operation of the enterprise.

Each employee is obliged to record an error, problem, or wrong working method for quality control (internal feedback on deviations, Appendix 8). This feedback is given only on serious deviations, while the small ones are corrected by oral instructions.

### **Correcting measures in discrepancies**

(error identified in the own operation of the enterprise)

1. An error/deviation is observed
2. Error/deviation or its getting worse is prevented
3. The extension, detrimental effects and reasons for the error/deviation are assessed.  
\*The customer shall obtain the work result meeting his/her order and requirements
4. The error is eliminated/corrected.  
\* Incorrect work is repaired, unless otherwise agreed with the customer.

5. Appropriate information about the error is distributed.
  - \*Enterprise, representative of the procurement organisation, customer
6. Recurrence of error is prevented
  - \* Record and updating in working instructions
  - \* Information to the employees
  - \* Discussion of discrepancies at quality meetings of the enterprise
  - \* Continuous follow-up of development feedback

### **3.13 Reliability of wood fuel deliveries**

Reliability of deliveries is one of the essential issues appreciated by customers, in addition to the high quality of wood fuels. Our enterprise delivers the agreed amount of wood fuels at the right time to the right place.

Our enterprise has ensured undisturbed deliveries of wood chips by employing process and communication procedures described in the Quality Assurance Manual, and through own spare equipment and co-operation with other companies. The co-operation enterprise/enterprises are described in further detail in the chapter on external communications, and in the criteria of co-operation enterprises in purchasing.

### **3.14 Quality requirements for wood fuel**

The quality of wood chips/hog fuel shall be homogeneous and meet the quality criteria. From the quality point of view it is important that energy wood is harvested without impurities and stored correctly without impurities in proper heaps. Quality assessments shall always be carried out according to an agreement with the client: who shall measure, where determination is done and proved, and who pays the costs.

Quality requirements for wood chips/hog fuel should be agreed upon with the customer, and requirements should be recorded in the delivery contract or a separate quality guideline form for wood fuels (Appendix 9).

### **3.15 Quality assurance at working site**

#### **General**

The employee shall carry out his work according to requirements. The quality is created during the work, not just by examining it after the work.



Each person working in separate stages of the supply chain assesses, whether his/her working performance leads to the required quality.

Energy wood harvesting is a demanding work. The worker in the next stage of harvesting chain is not able to mend mistakes done in previous stages. Dry energy wood of high quality ensures the cost-effectiveness of the harvesting chain.

### **Measuring equipment of the harvester**

The measuring accuracy of the harvester in harvesting of merchantable wood is controlled daily.

- Length and diameter
- Extreme position of sensors
- Measuring equipment in good trim according to visual inspection

Sampling control measurements shall be carried out according to the requirements ratified by the Ministry of Agriculture and Forestry for at least 5% of the stands marked for cutting and for all stands of more than 3 000 m<sup>3</sup>.

- Furthermore, in changing weather conditions or when the need arises

The sampling measurements and calibrations are recorded in a logbook.

### **Remaining stand**

- According to guidelines of the Forestry Development Centre (TAPIO), if not otherwise agreed
- Controlled by relascope.

### **Storage of merchantable wood**

- Wood is handled and stored in such a way that its consistency with the requirement is assured
- The wood piles are marked with the owner's brand according to the given instructions

### **Quality instructions at the working site**

- The operator of the harvester controls, by visual inspection, the harvesting trace, quality of wood and collection of energy wood to heaps, as well as performs logging in such a way that the driver of merchantable wood can transport the wood without stamping energy wood collected separately.

- The operator of merchantable wood shall not drive over energy wood heaps collected separately
- The operator of energy wood plans the storage heaps
  - storage date
  - storage/chipping/crushing site
- The operator collects as clean energy wood as possible (no impurities or snow) and makes the storage heaps according to requirements
- The operators monitor the ground bearing pressure in the wood stand and inform foremen when needed
- The operator chips/crushes the storage pile in correct chipping/crushing order
- The entrepreneur controls the work and quality at site
- The representative of the procurement organisation measures or controls the quality at site if desired
- The customer gives quality feedback on the work and on chips

#### **Final inspection at the working site**

- The final result of the work and the tidiness of the working site are assured in the final inspection

#### **Assignment of the work carried out**

- Finally, the operator/entrepreneur delivers a measuring certificate of merchantable wood to the representative of the procurement organisation.

### **3.16 Measuring and control equipment**

#### **Measuring and control equipment of the enterprise:**

- Measuring device of the harvester
- Callipers
- Measuring tape
- Relascope/stem number instructions
- GPS equipment
- Milometer of harvester /vehicle
- Measuring rod
- Instructions for pile measuring
- Volume-measuring tables
- Loader scale
- Mass sensor based on stretch slips

Devices are used and serviced according to instructions.

The accuracy of measuring devices shall be checked and when necessary readjusted. The check-up assures that the precision and reliability of measuring devices meet the requirements.

### **3.17 Identification of product and service**

#### **Identification of chips/hog fuel, i.e., information of origin and source**

The aim of identification of chips/hog fuel is to assure the origin (domestic origin, wood stand,) of wood chips/hog fuel/raw material.

The chipping/crushing entrepreneur always obtains seller-specific information on the origin of energy wood from the logging and procurement contracts.

The chipping/crushing entrepreneur always obtains seller-specific time and site information on the origin of separate harvesting of energy wood through the logging contracts.

In short-distance transports of energy wood, the storage lots are marked with seller-specific date and site information in the data processing system of the enterprise.

The enterprise prepares a delivery plan for chips/hog fuel deliveries, including seller-specific data on the origin of energy wood.

The operators of chipper/crusher and chip/hog fuel lorry shall have the delivery plan of chips available. On the basis of this plan, the operator of the chip lorry prepares an acceptance/delivery certificate on the basis of seller-specific information of energy wood.

The enterprise accounts for chip storages to the sellers of energy wood on the basis of acceptance certificates and seller-specific data on energy wood as agreed in the contracts.

#### **Identification and traceability of energy wood deliveries**

The retrieval of the delivery chain of energy wood is based on all the documents and data formed during the procedure from the acceptance of the order to the delivery, i.a.

- timetables and plans for chipping/crushing

- site-specific instructions and a map with records
- sampling check and calibration data (in the data storage of computer)
- measuring certificate
- control printout
- quality measurement
- track sheet of chipper/crusher
- amounts in bulk m<sup>3</sup> given in the acceptance certificate
- number or amounts in bulk m<sup>3</sup> of wood fuel loads
- accounting of working hours
- timetables of chip/crusher delivery
- feedback
- invoicing data

The aim of this data is to assure that the origin of product and invoicing concerning the delivery batch/lot are in accordance with the contract practice.

### **3.18 Material delivered by the customer**

The customer can hand over keys of delivery premises to the use of the enterprise. The operators of our chip/hog fuel trucks are responsible of the tidiness of delivery premises and locking of storage premises to each customer.

Handing over confidential data of customers to outsiders is forbidden. The operators of our enterprise know their responsibility for this issue.

### **3.19 Working instructions**

Working instructions are prepared for guiding the operator in different situations and the operator shall hence follow them. By following the working instructions we improve occupational safety and ensure the trouble-free operation of the enterprise and are spared from unnecessary costs. In case of problems, the working instructions should always be checked first.

- The employee shall always work carefully following work and safety instructions as well as to inform about safety disadvantages observed.
- In dangerous conditions, extreme caution should be exercised and when needed to use safety outfits.
- The employee shall attend to that his work does not cause danger to others working at the site or staying in the range of work.

- The work site shall be tidy and in working order. Final cleaning shall be carried out.

### **3.20 Instructions for logging and for harvesting logging residue to heaps**

#### **Harvesting**

- If necessary, the working site is marked with warning signs.
- Before starting the work, the harvester operator must acquaint with the working site instructions
- The harvester operator shall be especially careful when operating at the borders of the working site or on border lines of forest owners. If necessary, borderline trees shall be defined on terrain
- Boundary marks shall be taken into account, and the operator shall ensure that they will remain undamaged in their original locations
- When possible, wishes of the forest owner are considered in co-operation with the person in charge of the harvesting operation
- Key biotopes, natural features and reserved trees shall be considered
- Harvesting damages in the tree stand remaining at the working site should be minimized
- Harvesting should be performed well, so that the harvester does not have to return to the stand once again
- Telephone and electric lines shall be taken into account
- If needed warning signals shall be set up

#### **Piling and sorting of industrial wood**

- Different timber assortments clearly apart from each other
- Paint marking according to instructions/if necessary

#### **Harvesting of energy wood**

- The harvester operator determines, which parts of the stand are harvested apart
- The operator marks down the parts of the stand, where it was not possible to harvest energy wood
- The operator harvests logging residues/energy wood to heaps according to logging instructions agreed upon separately
- Depending on the harvester and/or the number of timber assortments, operator employs a single or double-sided harvesting method
- Stems are delimbed to separate formations next to the strip road

- Heaps shall be placed so that forest haulage of industrial wood can be carried out without stamping separately harvested logging residues or energy wood batches harvested to heaps
- Logging residue heaps/energy wood batches shall not be placed on the undergrowth
- Energy wood heaps shall be large enough to ensure efficient forest haulage
- When operating at the logging site, harvesting machines shall not drive over heaps
- On soft ground, the machine operator shall normally pile logging residue on the strip road to improve its bearing capacity (consequently, no more suitable for energy use).
- Tops and branches are piled paralleled to heaps or windrows

#### **Instructions for harvesting energy wood to heaps**

- Tops and branches shall be collected paralleled to heaps or ridges

### **3.21 Forest haulage guidelines**

#### **Forwarder work**

- The permission of the land owner is always needed when operating in forests. This permission is acquired by a member of the procurement organisation/chipping entrepreneur.
- Especially boundary marks shall be taken into account, and it shall be ensured that they will remain undamaged in their original locations
- If necessary, the electric line is marked with tape (or with warning signs), if the strip road goes under the line

#### **Industrial round wood piles**

- The landing site is established only on a location assigned by the person in charge of the harvesting operation. The location shall be easily accessible.
- Round wood piles shall be placed so that they do not interfere maintenance and use of the road
- Round wood piles shall not be placed too close to electric lines (safety distance): in case of this kind of situation, the person in charge of the harvesting operation shall be informed, and procedure and responsibilities agreed upon
- Different timber assortments are piled clearly apart from each other
- Round wood piles are marked according to guidelines

## Forest haulage of energy wood

- Before forest haulage, the location of landing, and piling technique (depends on chipper/crusher) shall be confirmed
- A special grapple for logging residue shall be used for harvesting logging residue
- Harvesting damages in the tree stand remaining at the working site should be minimized
- Tops shall be loaded paralleled
- Bottoms of logging residue heaps should not be collected too thoroughly to avoid impurities, snow
- Stamped/ impure logging residues shall be left at the site
- Decayed fallen trees and leave trees should be left at the site

## Storage of energy wood

- Logging residue/energy wood is stored according to the method required by the supply chain
- The forest road and the road edge must be bearing at landing site
- Distance between pile and edge of the road should be about 1 metre, if the terrain is flat
- It depends on the feeding method of chipper/crusher, if piles can be made on both sides of the road
- Piles should be made on flat surface, free of loose rocks and undergrowth
- Piles shall not be made on the opposite side of a drain
- Piling order (from road to forest)
- Piles should have upright walls and be uniform in order to minimise wetting (quality)
- Grapple loads must be laid up so, that the tops are set in parallel position
- The piles should be formed so that the comminution can be started from the logging residue/energy wood piled last.
- Snow/sand shall not land in the piles if the road is ploughed

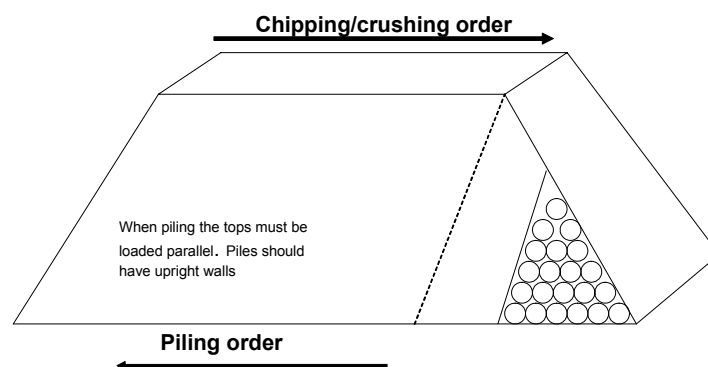


Figure 10. Storage of energy wood.

In piling, the heap is collected “slice by slice”, height about 6 m. The tops shall be paralleled in the heap (Fig. 10).

## **3.22 Guidelines for delivery trucks**

### **General**

- Transports are carried out in accordance with valid acts and regulations
- Wide load sign and lights when needed
- A delivery truck shall be used for transporting own harvesting machines
- The operator is responsible for the load
- Harvesting machines are moved as agreed separately
- After moving the harvesting machine the delivery truck is returned refuelled.

### **Transport instructions**

- Look for safe place to load and unload the machine without disturbing traffic
- Alarm light and blinker light should be used, when necessary
- When loading and unloading on a public road area, safety clothing of class 2 should be used
- The loaded harvesting machine is attached with tension chains
- Fuel tank shall be fastened with tension chains or with a loader
- Confirmation of routes and turn-arounds before transport
- Height and weight limitations of bridges as well as electric and telephone lines shall especially be considered when planning the transport route
- Fuel transports within the free limit of 1000 litres
- In case of problems, contact the entrepreneur

### **Measures in case of traffic accident**

- Find out what has happened and define the need of help
- Prevent additional damages
- Alarm help, the general alarm number is 112
- Calmly state your name and where you are calling from, your phone number, what has happened, and the need of help. Follow the instructions given by the Emergency Centre and do not hang up, until allowed.
- Write down the names and contact information of the parties involved
- Find out the insurance companies of the parties involved



### **3.23 Guidelines for chipping/crushing**

#### **Chipping/crushing**

- Chipping/crushing and loading of energy wood
- Only energy wood defined in instructions is chipped/crushed
- Correct feeding of wood to the chipper/crusher (steady material flow to the chipper/crusher, output and speed of chipper/crusher, blades and their condition, and chipper/crusher angle shall be considered)
- The chipper/crusher operator attends to that snow or impurities (stones, metal...) do not get into the chipper/crusher
- The chipper/crusher operator attends to keeping the quality of material chipped/crushed and the chipability of the heap
- Adjustments and condition of chipper blades or crusher affect the quality of chips
- Information of the batch of chips/hog fuel is marked in the track sheet
- Chipping/crushing should be carried out without disturbing traffic.

#### **Clearing of the landing site after chipping/crushing**

- The chipper/crusher operator is responsible for the tidiness of the working site during and after chipping, as well as for the trafficability of the road
- The chipper/crusher operator shall remove branches and other residues from the road area and drains
- Should the road or road area be damaged, the chipper/crusher operator shall inform the entrepreneur/member of the procurement organisation.

### **3.24 Long-distance transport and unloading of wood fuels**

- To ensure safe and undisturbed transports, the vehicle should be checked up before the transportation assignment
- The truck operator ensures that transportation is carried out according to acts and regulations applied for road transports and considering the prevailing weather conditions
- The truck operator unloads chips to the site assigned by the customer at the time agreed
- The truck operator is responsible for weighing the load, for volume and date information and also for sampling
- The truck operator is responsible for the tidiness of the delivery site and, depending on the client, also for customer-specific closing of the landing area

- The truck operator prepares the delivery note based on origin information. The delivery note of each load should be filed.
- The truck operator synchronises the delivery note with the sample and leaves them to a place agreed on with the customer.

### **3.25 Maintenance and repair of equipment**

The management earmarks sufficient resources for performing the work with appropriate and suitable machinery. We aim at an excellent reliability of operation by means of maintenance and repair instructions for our machine fleet.

Maintenance of the equipment is carried out according to the operating manuals.

- Employees maintain daily the machine/lorry operated
- Anticipated maintenance shall also be taken into account
- Machines are maintained at the end of the work shift. If the machine is operated only in one work shift, maintenance is done at the start and the end of the shift.
- The basic condition of the chipper/crusher and the particle size of wood fuels are checked during the maintenance to ensure a high quality of wood fuel
- Maintenance actions are registered in the maintenance manual
- Possible repair needs are written in notes, and the entrepreneur shall be informed about urgent cases
- Most important tools and also spare parts for parts most commonly broken, e.g. blades, should be available in the machine/truck
- Regular maintenance and more extensive repairs should be done at a garage
- The machines/trucks are kept clean. Operators and operators shall attend to the cleaning of vehicles according to given instructions
- The employee shall attend to the maintenance/inform about the need of maintenance for the vehicle he/she is using
- Environmental issues shall also be considered when maintaining, repairing or washing the machines/trucks
- Maintenance and changing of blades, and maintenance of blowers.

#### **Measures in case of fire**

- Rescue those in danger
- Alarm help, the general alarm number is 112
- Extinguish with the closest extinguisher
- Restrict the fire by closing doors and openings and by removing flammable materials to a safe place

- Guide the fire brigade to the site of fire

### **How to extinguish a fire**

- Extinguish upwind from the fire
- Suppress from below right up
- Direct water jet to the burning site
- Extinguish a liquid fire by spraying powder along the liquid surface
- Take the extinguisher **immediately** to maintenance.

## **3.26 Environmental issues**

### **Statutory requirements**

Knowledge of environmental legislation concerning the operation of the own enterprise and its observation are fundamental issues of environmental management. The starting level of the environmental system of the enterprise is defined by this legislation.

The employee in charge of quality follows yearly changes in environmental legislation and informs the personnel about changes. Information and extranet pages of the Association of Finnish Forestry and Earth Moving Contractors are utilised in this work. According to the principle of continuing improvement, our enterprise aims at a higher level of environmental protection.

Our activities are based, i.a., on the following acts, decrees, permissions, regulations and instructions:

- Act on Vehicle Taxes
- Special transports on public roads
- Decree on Transports of Dangerous Goods on Roads
- Waste Decree
- Waste Act
- Chemicals Decree
- Chemicals Act
- Municipal instructions for waste management
- Act on Combating Insect and Fungus Damage
- Act on Compensating for Environmental Damage
- Nature Conservation Act
- Act on Off-road Transports
- Forest Act
- Antiquities Act

- Rescue Act
- Fuel Pay Act
- Employment Accident Act
- Road Transports Act
- Employment Collective Agreement
- Occupational legislation
- Council of State Decision on Communication in Wood Harvesting Work
- Occupational Health Care Act
- Occupational Safety Act
- Transports of Dangerous Goods on Roads
- Water Act
- Council of State Decision on the Choice and Use of Personal Protective Equipment at Work
- Council of State Decision on Regulations of Wood Harvesting Work
- Council of State Decision on the Safety of Wood Harvesting Work
- Council of State Decision on Safe Use and Inspection of Work Machinery and other Equipment
- Council of State Decision on the Application of Work Safety Act in the Treatment and Spreading of Pesticides in Forest Work
- Council of State Decision on Safe Use of Tools
- Council of State Decision on Oil Waste Management
- Environmental Protection Decree
- Environmental Protection Act

### **Operating principles in environmental issues**

Our aim in environmental issues is to guide the employees of our enterprise in considering environmental safety in all operations.

Significant environmental issues or damages related to machine contract work, controlled and prevented by our enterprise, include

- Preservation of multiformity in forest nature
- Fuel transports and storage, spillages to soil and watercourses
- Oil changes, oil spillages to soil and watercourses
- Storage of waste oils, deliveries to further treatment
- Wastes and waste management

Our employees know the environmental policy and targets of our enterprise and are aware of their own role and responsibility in environmental issues. Our aim is to preserve the multiformity of forest nature, and we consider the requirements of good environmental management in our operations. We know the contents of training material published by the Forestry Development Centre of Finland (TAPIO) and consider valuable nature

environments in our work. The wood chips delivered by us are produced from wood harvested from certified forests.

We are participating in the regional certification system of forests (FFCS) and are engaged to meet the requirements of forest certification criteria.

We operate at forest sites in accordance with environmental requirements and working instructions of the procurement organisation. The representative of the procurement organisation records the environmentally valuable sites in the working instructions, and these records shall be considered in the work.

Groundwater catchment areas shall be recorded in the instructions for the working site. We operate especially carefully in the vicinity of watercourses and on groundwater catchment areas.

### **3.27 Waste management**

Our enterprise has a waste management plan for use to monitor and develop issues related to waste management. The employee responsible of waste management: NN.

We aim at reducing the amount of waste in our enterprise by eliminating unnecessary consumption and by favouring durable products as far as possible.

Particular attention shall be paid to the machine service site:

- The service site shall not be placed in the vicinity of drains or depressions connected with brooks or watercourses.
- If the working site is located on a groundwater catchment area, the service site shall be placed outside the groundwater catchment area as far as possible.
- More extensive maintenance duties shall always be performed outside groundwater catchment areas.

The working site shall be tidied up after finishing the work. Maintenance wastes and garbage are removed from working sites to the garage, where there are several receivers for different types of waste.

- Waste oil container
- Filters and other oily hazardous waste
- Garbage

Hazardous wastes

- Hazardous wastes of different type shall not be combined with each other

- Hazardous waste shall be delivered for further processing at least once a year

#### Further processing of waste

- Waste oil is collected by Ekokem Oy
- Solid hazardous waste is delivered to a place assigned by the municipality
- Garbage is collected regularly by a municipal garbage lorry (contract).

Broken tubes are delivered to a place agreed on /to a container at the garage or to the company they were bought from.

- Recyclable parts are reclaimed
- Metallic parts are forwarded to metal scrap collection
- Rubber tubes are disposed either to problem waste or garbage.

#### Fuels

- Fuels are transported and stored in appropriate containers
- Fuel shall not be spilled to nature in refuelling
- The condition of fuel and lubricant containers shall be controlled

#### Recycling and emissions

- Tyres are delivered to retail dealers for recycling
- Emissions caused by machines/lorries are controlled by maintenance.

Equipment for oil destruction shall always be available for employees operating at working sites.

- Oil destruction cloths/rugs
- In addition refuse sacks and a shovel.

Environmental damages are reported to the environment centre (or fire authorities) and/or to the person in charge of operation

- E.g., oil leakage, if the operator/driver him-/herself cannot remove it
- Especially water systems and ground-water catchment areas shall be observed.

#### **Measures in case of environmental damage**

- Assess the situation and start prevention work
- Alarm the regional alarm centre, the general alarm number is 112 in Finland
- Keep calm, state your own name and phone number, where you call from, what has happened and where, and need of help.
- Prevent the damage from widening
- Inform entrepreneur and/or the person in charge of the operation
- Organise necessary guidance to the site of damage

## 3.28 Purchases

The management defines, acquires and maintains sufficient resources. Purchasers and their authorisations and kinds are explained in section Primary responsibilities.

### Selection criteria of products/services

- Issues to be considered when buying new equipment include, i.a., price and quality, availability of maintenance and spare parts for the equipment, future exchange value of equipment, durability criteria like maintainability and availability, CE-mark
- Companies supplying services and products of good quality should be chosen. The final decision is made by the entrepreneur. The selection procedure shall be based on price and quality comparisons, time of delivery and experiences. The operators have also got instructions for buying accessories. We favour durable products in our purchases.
- Subcontractors shall be chosen on the basis of, e.g., applicability of their equipment, work quality, quality assurance, reliability of operation, professional ability, ability to co-operate, and meeting of social obligations.
- The entrepreneur supervises the capability of the deliverers and sub-contractors to produce good quality and to meet the criteria required. The accuracy of service and work shall be equal to those required by the enterprise.
- An acceptance inspection of the products shall be carried out to be sure that the enterprise has obtained a correct product by the date agreed upon. If errors or deficits are detected in acceptance inspections, the enterprise shall proceed in accordance with the instructions for notices of defect.

### Instructions for the notice of defect

- Deliver a written notice of defect
- Identify the error in detail and clearly
- Present your claim for the defect
  - repair of defect
  - new delivery
  - price reduction
  - annulment of purchase/agreement
  - claim for compensation
- As the buyer, you have a right of withholding the payment of purchase price for the part equivalent to your claim for compensation
- If cancelling the purchase, inform the seller, where the goods can be collected and to which account the seller has to refund the purchase price paid.
- Set a clear deadline for your requirements

- Record the measures taken

### 3.29 Industrial safety

The entrepreneur is responsible for all obligations of industrial safety to enterprises, employees and activities, enacted for the employer by laws and decrees.

The entrepreneur and his/her employees are well familiar with the valid industrial safety regulations, operate in accordance with them and use protective and safety equipment as well as CE-marked auxiliary equipment of working machines.

The employees are initiated into the conditions of the work site, as well as into work site specific liabilities, communication procedures and working instructions.

- Our enterprise has prepared a programme for occupational safety to monitor and develop occupational safety issues (Occupational safety act /TyöturL. 9 §)
- NN acts as labour protection manager
- Employees are trained for their work routines and especially risk sites and situations (Occupational safety act /TyöturL. 34 §)
- Occupational health service is arranged in accordance with the occupational health act at the local health centre
- Operators/drivers have got instructions in case of emergency (Appendix 11)
- There is a first aid kit, fire extinguisher and safety distance sticker in each harvesting machine/truck
  - The operator/driver sees to that the fire extinguishers are checked in appropriate manner
- The employees carrying out hot work shall have a hot work permit
- When operating at logging sites, class 2 type safety clothing shall be used
- When operating at chipping sites, employees shall be supplied with respirators
- Our enterprise participates in activities maintaining working capacity together with employees
- Natural conditions shall be considered in the work.
- Safety instructions shall be considered when handling stump treatment agents
- Instructions of operation safety for chemicals and materials of risk category shall be followed, and the materials shall be stored in accordance with the instructions.
- Machines, equipment and hoisting equipment shall meet the requirements of work safety
- The workers in road areas shall have taken the course Road Safety 1.
- Vehicle-mounted cranes shall be checked once a year. The inspection form is in the crane (the decision of the Council of State concerning the safe use of instruments (tsl 852/99 § 77)



### **3.30 Reference information to be followed**

#### **In each machine/lorry**

- Telephone directory
- Electric line safety distance stickers or guidelines
- Operating and maintenance manuals
- Possible customer-specific information folder.

#### **Additionally in harvesters**

- Factory and sawmill specific timber assortment, measure and quality guidelines
- Description cards of the Forestry Development Centre (TAPIO)
- Thinning models/guidelines, Local Forestry Centre
- Relascope including the chart
- Harvesting and forest haulage manual for harvesting energy wood

#### **Additionally in forwarders**

- Factory and sawmill specific timber assortment, measure and quality instructions
- Description cards of the Forestry Development Centre (TAPIO)
- Crane inspection certificate
- Piling guides for energy wood
- Harvesting and forest haulage manual for harvesting energy wood.

#### **In chipper/crusher**

- Quality requirements
- Customer-specific instructions
- Track sheet of the chipper/crusher
- Monitoring document on the chipper/crusher

#### **In wood fuel truck**

- Customer-specific instructions
- Heating plant specific instructions for wood fuel deliveries
- Delivery notes

#### **Office**

- Quality assurance manual for solid wood fuels, by FINBIO and in the future Technical specifications of the CEN/TC 335
- Fuel chips/hog fuel production from regeneration felling, by Forestry Development Centre (TAPIO)
- Trade union contracts
- Insurance certificates
- General guidelines for agreements in forest transportation and contracting
- Literature and instructions related to the work

- Acts and decrees: [www.finlex.fi](http://www.finlex.fi)

### 3.31 Quality records

The Quality Assurance System includes quality data for controlling that the quality requirements set by our enterprise and agreed upon with our customers are met.

The employee in charge of quality assurance accepts and signs the documents included in the Quality Assurance System. He/she controls that the quality records included in the quality assurance system are up-to-date and available at the work sites, where required. The employee in charge of quality assurance also sees to the filing of quality records. The files shall remain readable and identifiable and be available when required.

File	Safekeeping	Records schedule
------	-------------	------------------

1. Delivery schedules and plans for wood chips/hog fuel
2. Working site instructions
3. Copies of measuring certificate
4. Sampling validation certificate
5. Forwarder track sheet
6. Chipper/truck track sheet
7. Number of wood deliveries or volume (loose m<sup>3</sup>)
8. Results of quality determinations
9. Feedback from customers
10. Feedback from production plants
11. Complaints and notes
12. Industrial safety minutes
13. Minutes of quality and development meetings
14. Memoranda of enterprise's internal auditing
15. Evaluation minutes of external auditing
16. Waste management plan
17. Programme for occupational safety
18. Employee training directory
19. Contract agreement
20. Co-operation agreements between enterprises

### 3.32 Contracts

Only written contracts are used.

Draft contract is first examined by the entrepreneur, and it is also assured, whether contents of the contract can be fulfilled. Before signing the contract is reviewed with the customer or supplier of raw material to ensure similar interpretation of the contract. In case some new aspects arise, it might be necessary to delay signing and review the new situation and its influence on entrepreneur's operations and prices. Responsibilities of parties are thoroughly negotiated. Additional price for work that the contract does not cover is agreed on.

#### Contents of agreement

- Contracting parties (persons authorized)
- The tasks covered by the agreement (tasks are recorded precisely)
- Equipment
- Amount of work
- Price of work in sufficient detail
- Bases of payments, and remittances
- Right to invoice for additional work, and procedures of invoicing
- Obligations of the entrepreneur and the customer, determination of responsibilities
- Quality requirements and quality assurance complied with
- General contractual terms in the field, MYSE 91
- Validity period of agreement
- Sanctions of operation contrary to agreement
- Notice of termination
- Processing of dispute cases
- Signature and date

#### Delivery agreements for wood fuels (enterpriser responsible for direct deliveries)

Invitations to tender are answered as far as possible. If the enterprise does not participate in the competitive bidding, it is conventional to send a letter of regret to the customer.

In the stage of competitive bidding, the client shall provide the contractor with the data required for calculating the contract price. The client is liable for the correctness of data and plans given to the bidder and for not hiding any factor being of essential significance to the calculation of tender calculation.

Invitation to tender -> Work schedule and calculation -> Tender -> Contract in writing

When preparing the tender, the tender shall assure that it is able to carry out the contract: on schedule, technically, quantitatively, qualitatively and economically.

The contracts are normally made in writing, while an oral agreement may be sufficient with a farm batch/single delivery. The contracts are made for energy or cubic content, and the method of measuring delivery batches is agreed on customer-oriented. The amount and quality of wood chips are defined customer-oriented. Contracts for heating seasons are specified with a weekly or monthly delivery plan. In the contract, the transfer of ownership of chips to customers is also agreed on.

### **3.33 Follow-up of operations**

Our aim is to continuously develop the operation on the basis of feedback and follow-up information. All employees participate actively in the development of operation. We follow our operation at a sufficient accuracy to be able to guide our operation and ensure a profitable level of operation

- Outputs
- Quantities
- Hauling distance
- Delivery moisture of wood chips/hog fuel
- Follow-up of costs and income on a monthly and yearly level (bookkeeping reports and financial statements)
- Follow-up of the profitability and of the solvency ratio of the enterprise (financial statements).
- Liquidity of enterprise, planning of cash flows (accounting, loan repayments)
- Planning of investments (follow-up of profitability and solvency ratio, and continuity of entrepreneurship)

We follow legislation and instructions of authorities and changes in these independently and through the information of the Trade Association of Finnish Forestry and Earth Moving Contractors.

Our enterprise attends to its statutory social responsibilities, i.a.

- Employee pension insurance payments
- Taxation
- Value Added Taxes (VAT)
- Self-employed person's pension insurance payments

## **Quality assessment**

We follow, control and develop our operations with the aid of a designed quality assessment system, consisting of the following factors:

- Owner satisfaction
- Customer satisfaction
- Personnel satisfaction

The quality assessment system of the enterprise is described in further detail in Appendix 12.

## **Other quality and environment control**

- Quality measurements at the working sites of the procurement organisation
- Wood product specific quality targets set by the procurement organisation
- Customer feedback
- Feedback on internal and external deviations
- Targets of error reduction
- Follow-up of the condition of machine fleet
- Reduction of waste amount
- Environmental training
- Readiness and operation in situations of emergency
- Zero tolerance of accidents

## **3.34 Risk management**

Risk management creates a total conception of risks threatening the enterprise and clears up how damages due to risks can be minimized. Our enterprise has surveyed the risks of entrepreneurial activities prior to insuring and taken an insurance cover for present needs.

### **Risk types:**

- Personnel risks
- Business risks
- Product risks
- Contract and liability risks
- Environmental risks
- Property and fire risks

**The entrepreneur has to insurance his/her enterprise and personnel as follows:**

- Traffic risk insurance
- Fire insurance
- Accident insurance
- Life insurance
- TEL, Employees' pension insurance contribution by employers, and LEL, Employees' pension insurance contribution both by employers and employees
- YEL, Pension insurance contribution paid by self-employed persons
- Unemployment insurance
- National pensions insurance

**Voluntary insurances, e.g.:**

- Burglary and vandalism insurance
- Liability insurance
- Legal expenses insurance
- Business interruption insurance

### **3.35 Auditing of quality assurance system**

#### **Internal evaluation of the Quality Assurance System**

Internal evaluation consists of continuous monitoring of daily operations, handling of quality slips and internal auditing of quality assurance system.

The entrepreneur carries out an internal evaluation 1–2 times a year (Appendix 13). This ensures that the system is efficient, in working order and can be applied to normal practise. In evaluation, the Quality Assurance System is assessed and made sure that normal practises correspond to written procedures. So-called management inspection is also carried out to recognise possible defects, achievements and development subjects.

In the management inspection, outputs and documents of the Quality Assurance System are also examined and the realisation of the principle of sustained development is followed up.

- Applicability of quality and environment policies
- Feedback from clients and procurement organisation
- Feedback on discrepancies, and correcting measures
- Quality assurance documents and follow-up feedback
- Targets for and measuring of quality and environment
- Fields of development
- Summaries of internal audits
- Minutes of external audits

If revising the Quality Assurance Manual, the date of revision shall be marked in the top edge of the page concerned. Revisions shall be made in all copies of the Quality Assurance Manual. In connection with the internal audit and management inspection, the employee in charge of quality fills in the form presented in Appendix 13. The results of inspection, changes made in the Quality Assurance Manual are recorded, and the form is dated and signed. The employees are informed about changes in the Quality Assurance Manual.

### **External evaluation**

The procurement organisation/client can carry out an evaluation of entrepreneur's Quality Assurance System, of which the entrepreneur receives feedback and a certificate. Auditing performed by the client is a **shared review of contracting parties**, where enterprise's competence and obligations in **ensuring quality** is assessed. If necessary, the auditor may present possible defects in Quality Assurance System.

### **General audit programme**

Written Quality Assurance Manual, including:

- Quality policy
- Content and structure of Quality Assurance System
- Internal quality targets
- Personnel and responsibilities
- Equipment

Quality Assurance System manual

- Office pack (entrepreneur)
- Machine packs
- Reference files at the office and machines
- Quality records

Determination of Quality Assurance System performance

- Guidelines and performance of information flows
- Feedback received from clients
- Registering possible problems and abnormalities
- Memoranda of quality meetings
- Development proposals suggested to the client
- Development plans for the personnel

Statement of written quality assurance

- Is operation carried out according to written Quality Assurance System.

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## Appendix 1. Inventory of equipment

<u>Equipment</u>	<u>Trademark and model</u>	<u>Manufacturing year</u>
Chipper	Hakki	2000
Forwarding unit	ValCat75	2001
Long-distance transport unit	VolSi123	2000

### **Reserve Equipment**

<u>Equipment</u>	<u>Trademark and model</u>	<u>Manufacturing year</u>
Chipper	Chip 324	1995

## Appendix 2. Development feedback to procurement organisation

Raw material supplier

Recipient: \_\_\_\_\_ Date: \_\_\_\_\_

We have detected following problems / flaws / issues requiring further development.

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Work site / stand marked for cutting:

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---

Description of the problem / flaw:

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Causes of the problem / flaw (in our opinion):

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Preventing recurrence of the problem / flaw (measures, suggestions):

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How has the matter been handled so far?:

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### Appendix 3 A. Feedback from client

Date: \_\_\_\_\_

Would you please evaluate our enterprise so that we can further develop our operations. The feedback is gathered 1 – 2 times per year.

Even at its best (5) you should give at least one suggestion how to further develop our operations.

Submitter of the feedback / client / person:

	Good	Poor	Comments:
Information flow	5 4 3 2 1		_____
Following schedules	5 4 3 2 1		_____
Wood fuel supplier's			
▪ Professional skills	5 4 3 2 1		_____
▪ Ability to co-operate	5 4 3 2 1		_____
Security of deliveries	5 4 3 2 1		_____
Flexibility	5 4 3 2 1		_____
Fuel quality	5 4 3 2 1		_____
Environmental issues	5 4 3 2 1		_____
Service ability	5 4 3 2 1		_____
Quality of operations (processes)	5 4 3 2 1		_____
Industrial safety (operations + equipment)	5 4 3 2 1		_____
Applicability of equipment	5 4 3 2 1		_____
Whole enterprise (process control)	5 4 3 2 1		_____

Additional comments, wishes, improvement suggestions:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Appendix 3 B. Feedback from procurement organisation

Date:

(raw material supplier e.g. forest department of forest company)

We ask representative of procurement organisation to evaluate our enterprise so that we can further develop our operations. The feedback is gathered 1 – 2 times per year.

Even at its best (5) you should give at least one suggestion how to further develop our operations.

Submitter of the feedback / client / person:

	Good	Poor	Comments:
Information flow	5 4 3 2 1		_____
Promptness (schedules)	5 4 3 2 1		_____
Management			
▪ Professional skills	5 4 3 2 1		_____
▪ Ability to co-operate	5 4 3 2 1		_____
Operators /drivers			
▪ Professional skills	5 4 3 2 1		_____
▪ Ability to co-operate	5 4 3 2 1		_____
Chip quality	5 4 3 2 1		_____
Security of deliveries	5 4 3 2 1		_____
Environmental issues	5 4 3 2 1		_____
Quality of operations (processes)	5 4 3 2 1		_____
Occupational safety (operations + equipment)	5 4 3 2 1		_____
Equipment			
▪ Applicability	5 4 3 2 1		_____
▪ Condition	5 4 3 2 1		_____
▪ Auxiliary equipment	5 4 3 2 1		_____
Whole enterprise (process control)	5 4 3 2 1		_____

Additional comments, wishes, improvements, suggestions:

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#### Appendix 4. Feedback from forest owner/representative of forest owner

We have carried out logging and forwarding in the stand marked for cutting in an agreed manner.

The work was carried out by

- logging:
- forwarding:
- chipping:

We do hope that the quality of our work has met your expectations.

Would you please answer this feedback questionnaire and return it, so that we can further develop our operations.

Please give us your opinion!

1. Logging  
Working quality  I am satisfied  I am dissatisfied

Explanation: \_\_\_\_\_

2. Forwarding  
Working quality  I am satisfied  I am dissatisfied

Explanation: \_\_\_\_\_

3. Environmental issues / tidiness  I am satisfied  I am dissatisfied

Explanation: \_\_\_\_\_

4. Generally  I am satisfied  I am dissatisfied

Additional feedback:

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## Appendix 5. Employee-specific suggestion of development

Our employees participate in the development of the Quality Assurance System of our enterprise. We utilise suggestions of development for improving the operability of our Quality Assurance System and for developing our enterprise activities. Suggestions of development are discussed with the employees at quality meetings.

Employee \_\_\_\_\_ Date \_\_\_\_\_

Issue/operation concerned:

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Suggestion of development for improving an issue/operation in the enterprise:

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Suggestion for operation instructions to be recorded in the Quality Assurance System:

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## Appendix 6. Assessment of job satisfaction and employee-specific quality

Part A (job satisfaction) can be used for assessing the job satisfaction of the Quality Assessment Study. Parts A and B (employee-specific quality) can be used as the basis of development discussions between the employer and the employee

Employee's name: \_\_\_\_\_ Date : \_\_\_\_\_

How satisfied you are with your work features? \_\_\_\_\_

Scale:

5 very satisfied, 4 satisfied, 3 neither satisfied nor unsatisfied, 2 unsatisfied, 1 very unsatisfied

### Part A:

JOB SATISFACTION	satisfied	unsatisfied
Continuity of employment	5 4 3 2 1	
Wage and other employment job-related advantages	5 4 3 2 1	
Personal development at work	5 4 3 2 1	
Fellow employees	5 4 3 2 1	
Appraisal and treatment obtained from supervisors of customer	5 4 3 2 1	
Support and instructions obtained from supervisors of customer	5 4 3 2 1	
Appraisal and treatment obtained from the management of your own enterprise	5 4 3 2 1	
Support and instructions obtained from management of your own enterprise	5 4 3 2 1	
Chances of becoming acquainted with other people through your work	5 4 3 2 1	
Alternatives of working independently in your job	5 4 3 2 1	
Challenges of your job	5 4 3 2 1	
Variability of your job	5 4 3 2 1	
Quality of available tools	5 4 3 2 1	
Atmosphere of your working environment	5 4 3 2 1	
Feedback from management and fellow employees	5 4 3 2 1	
Training alternatives	5 4 3 2 1	

Part B

PERSONAL QUALITY

Employee's name: \_\_\_\_\_ Date: \_\_\_\_\_

Assess your satisfaction with the quality of your work.

Scale:

5 very satisfied, 4 satisfied, 3 neither satisfied nor unsatisfied, 2 unsatisfied, 1 very unsatisfied

INDIVIDUAL QUALITY

	satisfied / unsatisfied				
ability to avoid mistakes	5	4	3	2	1
responsibility for own work	5	4	3	2	1
thoroughness at work	5	4	3	2	1
quality-consciousness	5	4	3	2	1
capability of co-operation	5	4	3	2	1
efficiency at work	5	4	3	2	1
precision at work	5	4	3	2	1
initiative	5	4	3	2	1
ability to prevent errors	5	4	3	2	1
cost-consciousness	5	4	3	2	1
professional skills	5	4	3	2	1
ability to learn from mistakes	5	4	3	2	1
ambitions to develop own skills	5	4	3	2	1

Comments:

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## Appendix 7. Memorandum on quality management meeting

Site: \_\_\_\_\_

Date: \_\_\_\_\_

Participants: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

### Issues discussed:

Functionality of and improvements in the quality assurance system:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Feedback from customers:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Deviating feedback:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Development initiatives:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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Issues of occupational safety and environment:

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Quality assessment and other control:

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Training needs:

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Other issues to be discussed at the meeting:

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Date: \_\_\_\_\_

Employee in charge of quality: \_\_\_\_\_

## Appendix 8. Internal feedback on deviations

The feedback form is filled in, if a **deviation / error/ problem / deficiency** is observed in the operations of the enterprise.

Each employee is obliged to record his/her observations. Feedback is discussed at quality meetings and the operation concerned is improved.

Work site: \_\_\_\_\_

Employee: \_\_\_\_\_ Date \_\_\_\_\_

- Deviation:
- Errors in instructions
  - Errors in the work
  - Problems in equipment
  - Problems and mistakes in service and repair
  - Deficiencies and problems in communications
  - Accident
  - Environmental damage
  - Other \_\_\_\_\_
  - Other \_\_\_\_\_

Description of deviation / error:

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Actions for minimizing the deviation / error:

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Reasons for deviation / error:

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Prevention of error recurrence (measures, proposals):

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Signature: \_\_\_\_\_

## Appendix 9. Quality assurance for wood chips/hog fuel

### Quality specification to be agreed on with the client.

Representative of customer: \_\_\_\_\_

Entrepreneur: \_\_\_\_\_

Object of delivery: \_\_\_\_\_

### Issues crucial to the quality of wood chips:

Moisture content \_\_\_\_\_

Particle size \_\_\_\_\_

Particle size distribution \_\_\_\_\_

Green matter content \_\_\_\_\_

Energy density \_\_\_\_\_

\_\_\_\_\_

- Object of delivery
- Logging residue chips or hog fuel
  - Chips or hog fuel from delimbed stemwood
  - Whole-tree chips or hog fuel
  - Chips from industrial process waste

The chips/hog fuel shall not contain long branches, stones, peat or metal!

Other issues to be considered: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Place and date: \_\_\_\_\_ / \_\_\_\_\_

\_\_\_\_\_  
Signature of entrepreneur

\_\_\_\_\_  
Signature of customer's agent

## Appendix 10. Initiation of employee into work

Enterprise: \_\_\_\_\_

Employer: \_\_\_\_\_

Employee: \_\_\_\_\_

### Items to be considered:

1. Orientation in the workplace
2. Presentation of personnel
3. Presentation of work premises and practices
4. Presentation of supervisors
5. Regulations and instructions given by customer
6. Presentation of working site
7. Typical risks and problems related to work
8. Working instructions + map of working site
9. Job-specific initiation
10. Instructions for operation and maintenance of machines and equipment
11. Presentation of materials used in the work
12. Use of personal protective equipment
13. Order and tidiness of working site
15. Information about occupational safety regulations
16. Fire safety, fire-fighting equipment, hot work operations
17. Products hazardous to health
18. Duty to inform about deficiencies and malfunctions
19. Issues related to payments of wages and salaries and to working hours
20. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Initiation performed: \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_  
Trainer's signature

\_\_\_\_\_  
Trainee's signature

## Appendix 11. Emergency first-aid instructions

In an emergency, act quickly, calmly and systematically.

### **Make an emergency call!**

#### **General emergency exchange is 112**

- Who is calling?
- What has happened?
- Where has happened?
- Hold on the phone until permitted to hang up.

#### **Start first aid immediately!**

Stop **large bleeding** by any means! The wound is bound with a compression bandage. The patient is kept in a lying position with legs elevated.

If the patient **does not breathe**, start artificial respiration. Blow in the pace of your own breathing; watch for chest to rise and fall. Check *cardiac function* on carotid artery. If no pulse, start cardiac massage:

#### **If only one helper, the rhythm is:**

- **2 successful blows, 15 presses**
- **2 blows, 15 presses**

#### **If two helpers presents, the rhythm is:**

- **2 successful blows, 5 presses**
- **1 blow, 5 presses**

Revival is continued until the victim recovers or professional first aid arrives.

The **shock patient** is pale, cold-sweaty and loosing **consciousness**. This status may develop fatal.

Keep the patient in a lying position with legs elevated. Give first aid according to the cause, e.g., stop bleeding. Keep the patient warm. Try to calm the patient down, do not leave alone.

### **First-aid of burns**

#### **General**

- Assess the situation and save those in danger
- Make an alarm and give first aid
- Start fire fighting and prevent additional damages
- Call for additional help and inform supervisors
- Guide the fire fighting crew to site

Extinguish your clothing by suppression or by rolling on the ground.

Cool the burns IMMEDIATELY with cold water. Small burns can be cooled long, large ones only a couple of minutes to prevent hypothermia.

Cover the burns with clean dressing or bandage. Do not apply any ointments and do not burst blisters.

Keep burned area elevated during transport and protect the patient from cold.

## Appendix 12. Quality assessment factors of enterprise

<b>Critical issues of success</b>	<b>Target issues</b>	<b>Indicators</b>	<b>Follow-up intervals and implementation</b>
Owner's satisfaction	Profitability	Operating margin ratio, % Net profit, % Profit, %	Quarterly reports, co-operation with accountancy firm
	Solvency	Dept-equity ratio Solvency ratio	Quarterly reports, co-operation with accountancy firm
	Productivity	Loose m <sup>3</sup> /time unit (e.g. service hour)	
	Efficiency of resource use	Utilization degree (%)	Monthly, harvesting quantities or other applications and calculations
	Output	€/time unit (e.g. working hour)	
	Production amount	Loose m <sup>3</sup> /time unit (e.g. service hour)	
	Fuel delivered	Delivery moisture content (e.g. for load)	
Customer's satisfaction	Customer's loyalty	Customer's feedback (points)	Once a year
Employees' satisfaction	Commitment of employees (low employee turnover)	Employee's feedback (points)	Once a year

## Appendix 13. Quality system assessment of entrepreneur

(1 – 2 times a year)

OK Update required

### General

- Is a quality system handbook available and up-to-date?
- Are the liabilities and risks updated and unambiguous?
- Are the employees aware of operation policy and ready to follow it?
- Is the latest version of quality system handbook available to all interest groups?

### Feedback and follow-up

- Were quality meetings with employees organized, memoranda?
- Was feedback from customers collected?
- Was feedback from forest owners collected?
- Were improvement measures taken, which kind?
- Were errors/problems processed with employees?
- Is there follow-up of own activities: output, euros, quality criteria?

### Worksite

- Are the operations described and instructed correctly in the quality system handbook?
- Are the environmental issues considered sufficiently?
- Is occupational safety at worksite duly considered?
- Has the quality assurance at worksite been sufficient?

### Environmental issues and waste management

- Does the waste management meet the municipal waste management regulations?
- Is the waste management described and instructed correctly in the quality system manual?

### Personnel

- Is the employee register up-to-date?
- Is the new employee initiated thoroughly into the job?
- Is the personnel motivated?
- Are information and communication in the enterprise run smoothly?

### Documents

- Are quality files up-to-date and duly recorded?

### Equipment

- Is due maintenance of machines and motor vehicle fleet secured?
- Were extensive maintenances of equipment recorded in the maintenance manual?
- Is the occupational safety of equipment operations sufficiently considered?
- Are all reference data of equipment given in the quality system manual available?



**Follow-up of operations**

- Is the follow-up of operations sufficient?
- Were the quality assurance factors defined and followed?
- Is purchasing defined correctly in the manual?
- Are investments planned carefully?
- Are sufficient instructions available for different agreement issues?
- Were management inspections and their results recorded?
- Does the quality system of the enterprise tally with reality?

**Changes made in the Quality Assurance Manual:**

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**Results of assessment:**

Improvements in the system:

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Resources required:

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Other:

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Date: \_\_\_\_ / \_\_\_\_ 20

Employee in charge of quality and environment: \_\_\_\_\_

## Appendix 14. Form for annual assessments

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Please assess your contentment with the features of your job and with the quality of your personal working.

Grading system: 5 very satisfied, 4 satisfied, 3 neither satisfied nor dissatisfied, 2 dissatisfied, 1 very dissatisfied

<b>Work satisfaction</b>	very satisfied    very unsatisfied				
Persistency of job	5	4	3	2	1
Wage and other job benefits	5	4	3	2	1
Personal development in the work	5	4	3	2	1
Fellow workers	5	4	3	2	1
Appreciation and treatment from the supervisors of the customer	5	4	3	2	1
Support and guidance from the supervisors of the customer	5	4	3	2	1
Appreciation and treatment from the supervisors of the employer	5	4	3	2	1
Support and guidance from the supervisors of the employer	5	4	3	2	1
Possibility of getting acquainted with other people at work	5	4	3	2	1
Possibility of working creatively and independently	5	4	3	2	1
Challenges offered by your job	5	4	3	2	1
Versatility of your job	5	4	3	2	1
Quality of available tools	5	4	3	2	1
Satisfaction with your working environment	5	4	3	2	1
Extent of feedback from supervisors and fellow workers	5	4	3	2	1

Comments:

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<b>Quality of personal working</b>	very satisfied	unsatisfied
Ability of avoiding errors	5 4 3 2 1	
Responsibility for own job	5 4 3 2 1	
Carefulness at work	5 4 3 2 1	
Quality consciousness	5 4 3 2 1	
Ability to co-operate	5 4 3 2 1	
Work efficiency	5 4 3 2 1	
Rigorousness/time-keeping at work	5 4 3 2 1	
Initiative/self-help	5 4 3 2 1	
Prevention of errors	5 4 3 2 1	
Cost awareness	5 4 3 2 1	
Professional skill	5 4 3 2 1	
Ability to learn from errors	5 4 3 2 1	
Ambition to self-development	5 4 3 2 1	

Comments:

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High satisfaction at work is both a means of quality development and one target of quality development. Only satisfied personnel can bring in high quality.

## Appendix 15. Register of the personnel training

Name: \_\_\_\_\_

Date of birth: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone/mobile telephone: \_\_\_\_\_

Basic education: \_\_\_\_\_

Work career:

Employee

Work/Machine

Duration

_____		
_____		
_____		
_____		
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## Appendix 16. Connections with the SFS-ISO 9001 Quality Standard

<u>Requirements for the Quality Standard System Standard entry</u>	<u>Quality Standard Manual entry</u>
<b>4 Quality Management System</b>	
4.1 General requirements	
4.2 Requirements on documentation	
4.2.2 Quality Assurance Manual	Description of quality and environment system
4.2.3 Document control	Quality files, Internal assessment of quality and environment system
4.2.4 Quality record control	Quality data
<b>5 Management responsibilities</b>	
5.1 Management commitment	Quality and environment policy
5.2 Customer orientation	Feedback and follow-up system. Delivery reliability of wood chips
5.3 Quality policy	Quality and environment policy
5.4 Planning	
5.4.1 Quality targets	Follow-up of operation
5.4.2 Design of quality control system	Design of quality control system Description of quality control system Evaluation of quality control system
5.5 Responsibilities, authorities and communication	
5.5.1 Responsibilities and authorities	Primary responsibilities and authorities
5.5.2 Representative of management	Primary responsibilities and authorities
5.5.3 Internal communications	Information flow
5.6 Management inspections	
5.6.1 General	
5.6.2 Basic data for inspection	Assessment of quality and environment system
5.6.3 Results of inspection	Assessment of quality and environment system
<b>6 Resource management</b>	
6.1 Resource allocation	Personnel skills and training, Purchasing, Equipment maintenance and repair
6.2 Personnel resources	
6.2.1 General	
6.2.2 Qualification, awareness and training	Personnel professional skills and training,
6.3 Infrastructure	Purchasing, Occupational health and safety
6.4 Work environment	Occupational health and safety

## 7 Product execution

7.1	Planning of product implement	Delivery chain of energy wood
7.2	Customer-specific processes	Information flow, Work site quality control
7.2.1	Definition of product requirements	Quality requirements for wood fuel, Work site quality assurance, Contract issues
7.2.2	Inspection of product requirements	Quality requirements for wood fuel, Contract issues
7.2.3	Communication with customer	Information flow
7.3	Planning and development (product design)	Product design not included in the Quality Assurance Manual
7.3.1	Design of planning and development	
7.3.2	Basic data of planning and development	
7.3.3	Results of planning and development	
7.3.4	Inspection of planning and development	
7.3.5	Verification of planning and development	
7.3.6	Qualification of planning and development	
7.3.7	Control of changes in planning and development	
7.4.	Purchasing	
7.4.1	Purchasing process	Purchasing
7.4.2	Purchasing data	Purchasing
7.4.3	Verification of purchased product	Purchasing
7.5	Production and development of service	
7.5.1	Control of production and development of services	Work site quality assurance, Work instructions
7.5.2	Acceptance of production and service processes	Not in Quality Assurance Manual
7.5.3	Identifiability and traceability	Identification of product and service
7.5.4	Customer's property	Material submitted by the customer
7.5.5	Storage of product	Quality assurance at site. Working instructions
7.6	Control of measuring and monitoring equipment	Measuring and monitoring equipment Quality assurance at site

## 8 Measuring, analysing and improvement

8.1	General	
8.2	Monitoring and measuring	
8.2.1	Customer satisfaction	Feedback and control system
8.2.2	Internal audit	Assessment of quality and environment system
8.2.3	Process control and measurement	Quality assurance at work site. Control of operations
8.2.4	Product control and measurement	Quality assurance at work site. Control of operations. Work instructions
8.3	Control of deviating product	Feedback and follow-up system

8.4	Data analysis	Assessment of quality and environment system
8.5	Improvements	
8.5.1	Continuous improvement	Assessment of quality and environment system
8.5.2	Corrective measures	Feedback and follow-up system
8.5.3	Preventive measures	Feedback and follow-up system

## Appendix 17. Uniformities with SFS-ISO 14001 environment standard

### Requirements for environmental system

#### Standard paragraph:

#### Chapter in environment manual

<b>4 Requirements for environmental system</b>	
4.1 General requirements	
4.2 Environmental policy	Quality and environmental policy
<b>4.3 Planning</b>	
4.3.1 Environmental issues	Environmental issues
4.3.2 Statutory and other requirements	Statutory requirements
4.3.3 Aims and targets	Follow-up of operation
4.3.4 Management programmes of environmental issues	Not included in the environment manual
<b>4.4 Implementation and operations of system</b>	
4.4.1 Organisation and responsibilities	Primary responsibilities and authorisations
4.4.2 Training, awareness and qualifications	Skills and training of employees
4.4.3 Information transfer	Information transfer
4.4.4 Documentation of environmental system	Description of quality and environmental system
4.4.5 Control of documents	Quality files
4.4.6 Control of operations	Quality assurance at work site. Working instructions. Service and repair of machines. Waste management
4.4.7 Preparedness and operation in cases of emergency	Information transfer
<b>4.5 Inspections and repair procedures</b>	
4.5.1 Supervision and measurements	Quality assurance at work site. Supervision of operations
4.5.2 Deviations and corrective and preventive operations	Feedback and follow-up system
4.5.3 Data files	Quality data files
4.5.4 Audit of environmental system	Assessment of quality and environment system
<b>4.6 Management inspection</b>	Assessment of quality and environment system