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Pellet Fuels Institute

Residential/Commercial Densified Fuel

QA/QC Handbook

Status November 3, 2017

1 QA/QC HANDBOOK BACKGROUND AND GOAL

This manual provides quality control and quality assurance procedures for the production of graded residential/commercial densified fuels. For the purpose of the *PFI Residential/Commercial Densified Fuel Standards Program*, this manual is to be considered the minimum requirements for qualified densified fuel production facilities.

To assure consistent quality of graded densified fuel leaving the production facility, this manual covers all aspects of densified fuel quality management.

For the purpose of quality marking, three densified fuel grades have been defined by *PFI Standard Specifications for Residential/Commercial Densified Fuel*. It is the intent of this document that densified fuel production facilities identify the grade(s) they intend to produce and develop appropriate QA/QC practices using this manual as a guide to assure that the minimum QA/QC requirements are met and to assure that the final product is in compliance with the specific requirements for the intended grade(s).

This manual provides the following essential components:

- Entities involved in the accreditation and qualification process
- Grade options for quality marked product
- Minimum requirements for the quality management of graded residential/commercial densified fuel production
- The qualification and monitoring process for densified fuel producers
- Labeling requirements for quality marked product

This manual will be reviewed and revised as necessary.

2 APPLICABILITY

This PFI Residential/Commercial Densified Fuel QA/QC Handbook applies to all densified fuel production facilities that intend to use the PFI Quality Mark on their product.

3 REFERENCE DOCUMENTS

PFI Standard Specifications for Residential/Commercial Densified Fuel

ALSC Residential/Commercial Densified Fuel Enforcement Regulations

PFI Residential/Commercial Densified Fuel Standards Program

4 DEFINITIONS

4.1 Accredited Auditing Agency

As part of the *PFI Residential/Commercial Densified Fuel Standards Program*, auditing agencies are accredited by an accreditation body to implement and enforce the program by performing audits in accordance with the *ALSC Residential/Commercial Densified Fuel Enforcement Regulation* and other applicable documents.

4.2 Accredited Testing Laboratory

As part of the *PFI Residential/Commercial Densified Fuel Standards Program*, testing laboratories are accredited by an accreditation body to assure that testing is being conducted in accordance with *PFI Standard Specifications for Residential/Commercial Densified Fuel* and that testing services are being provided in accordance with the *ALSC Residential/Commercial Densified Fuel Enforcement Regulations* and other appropriate documents.

4.3 Additives

Any substance other than cellulosic material that has been intentionally introduced into the fuel feed stock prior to pellet extrusion (except steam/water). Grease or other lubricants that are introduced into the fuel processing stream as part of normal mill operations are not considered additives.

4.4 Accreditation Body

As part of the *PFI Residential/Commercial Densified Fuel Standards Program*, an accreditation body is selected to implement, enforce, and oversee the Standards Program. PFI has selected the American Lumber Standard Committee (ALSC) as the accreditation body. The accreditation body accredits auditing agencies and testing laboratories as well as evaluates accreditation effectiveness of each in accordance with the *ALSC Residential/Commercial Densified Fuel Enforcement Regulations* and other applicable documents. Effectiveness is evaluated by means of inspections performed by accredited auditing agencies, qualified

densified fuel production facilities, and accredited testing laboratories. The accreditation body also maintains a densified fuel laboratory proficiency program for all accredited testing laboratories.

4.5 Chemically Treated Materials

Any feed stock material (cellulosic or otherwise) that contains any bonding agent, resin, preservative, surface coating or other finish, or any other chemical compound that has been added to the material is not acceptable. Grease or other lubricants that are introduced into the fuel processing stream as part of the maintenance operations are not considered as chemically treated materials. Incidental chemical contamination from the marking of logs and lumber is not considered as chemically treated.

5 PRODUCT QUALITY GRADE CLASSIFICATIONS

The PFI Residential/Commercial Densified Fuel Standards Program covers the three grades of densified fuel that are defined in Table 1 of *PFI Standard Specifications for Residential/Commercial Densified Fuel*. As the basis for any densified fuel production facility's quality management program it is imperative that the facility identify the grade(s) intended for production. Grade classifications are as follows:

- Premium
- Standard
- Utility

If a densified fuel production facility decides to produce more than one grade of product, the quality management system must account for the differences in materials, production requirements, inspections, testing requirements, documentation, record keeping, etc. This does not apply to multiple product brands (e.g., if the same grade of product is marketed under two or more brands.).

For densified fuel producers that have more than one physical plant location, each plant location must have its own quality management program. In addition, each plant location is required to qualify independently.

6 QUALITY MANAGEMENT OF DENSIFIED FUEL PRODUCTION

6.1 Overview

It is required that each densified fuel production facility that intends to participate under the *PFI Residential/Commercial Densified Fuel Standards Program* develop a written quality management program that is approved by an accredited auditing agency for monitoring the production process and verify through testing and auditing that final product meets the specifications of the intended grade(s) as outlined in *PFI Standard Specifications for Residential/Commercial Densified Fuel*. The essential components of a quality management program for densified fuel production facilities include:

- Defining responsibility and authority throughout the organization
- Training of affected employees
- Documentation to track processes and test data
- Record keeping
- Managing changes to the programs
- Controlling the quality of raw materials
- Defining necessary equipment and operating processes
- Quality control and quality assurance processes
- Third party inspections and monitoring
- Disposition of nonconforming materials and products
- Corrective actions for identified deficiencies
- Requirements for proper packaging, storage, handling, transport, and delivery
- Labeling of quality marked product

6.2 Quality Responsibility and Authority

Production facility management is responsible for establishing densified fuel production quality policy. Management must have a means of measuring quality performance and monitoring applicable quality standards. Production facility management must appoint an employee, trained in quality control procedures, as a quality manager. To minimize conflicts of interest, the quality manager should not be in charge of production or finance.

The quality management program must identify who makes decisions if the quality manager is absent as well as outline a hierarchy of the reporting structure.

6.3 Training

The quality management plan must specify that quality training is required on an as needed basis at a minimum annually for all involved employees. Training must cover production requirements as well as applicable standards and specifications.

6.4 Documentation

The quality manager must ensure the orderly documentation of operating processes that have an effect on the quality of the densified fuel produced. Documentation must encompass the following components:

- Administrative: organizational structure, job descriptions outlining quality responsibilities, training records
- Raw materials receiving: date, quantity, name of the supplier, type of material, origin, inspection status – meets or does not meet raw material requirements, free of chemically treated materials, material accepted or rejected
- The production process: date, time/hours of operation, tons produced, raw material characteristics, additives used (type as well as dosage), equipment used, quality control monitoring inspection results, description of any nonconformance, disposition of nonconforming product, description of mechanical deficiencies (type of malfunction, measures taken, etc.)
- Quality verification of finished product: test results demonstrating product is in compliance with grade requirements, disposition of product that does not meet grade requirements
- Periodic inspections: equipment inspections, inspections for contaminants or moisture intrusion, inspections of product storage areas
- Customer complaints: date, description of complaint, investigation findings, measures taken to remedy any deficiencies, etc.

Documentation must be kept up-to-date and regularly presented to management. Discovered defects are to be immediately disclosed to the responsible employees and to be remedied.

6.5 Records

Information to be recorded includes all quality documents, forms, inspection instructions, standard operating procedures, testing procedures, testing reports, and data generated to provide the above listed documentation as well as any additional records necessary to demonstrate the effective operation of the quality management system. Records must be available for review for auditing purposes (internal or external).

Records shall be retained for a minimum of 5 years. Storage containers shall be clearly marked as to contents and retention dates.

6.6 Management of Change

Changes to product specifications and production practices shall be documented. The quality manager shall assure that all affected employees are informed and trained accordingly.

6.7 Raw Material Control

When raw materials are received their adequacy must be checked by a receiving inspection to verify that they are in compliance with the minimum specifications deemed necessary for the densified fuel producer to meet the intended grade requirements. Adequacy may also be demonstrated through supplier certification to the minimum specifications. Chemically treated materials as defined in section 4.5 must not be accepted as raw material for PFI quality marked densified fuel. Construction waste debris and post-consumer recycled wood may only be used if the materials are verified to be clean in accordance with the procedures outlined in Appendix A.

6.8 Equipment and Operating Processes

The production facility must have adequate equipment for the production of densified fuel at its disposal. The function and condition of this equipment must be regularly inspected.

Contaminates of the raw materials or final product by foreign substances such as soil, stones, or other debris must be excluded. Handling areas, silos, conveyor equipment, storage containers, and transport vehicles must be regularly checked for soil and/or debris. Equipment is to be cleaned if necessary to prevent contamination. This also applies to co-mingling of densified fuel products. Quality marked densified fuel must not be allowed to co-mingle with non-quality marked product. Quality marked densified fuel of one grade co-mingled with another grade must be quality marked to the lowest quality grade present.

In the case of malfunctions in the production process, it must be identified as to what quantity of densified fuel was produced up until the malfunction was noticed. This densified fuel must be evaluated for grade compliance or it must not be allowed to be sold as quality marked product. After maintenance work has been completed, the densified fuel must undergo a quality inspection as defined in section 6.9.

6.9 Quality Control and Quality Assurance Testing

Quality control and quality assurance testing must be performed to demonstrate densified fuel compliance with the intended grade specifications. Quality control testing may be performed at the production facility provided appropriate laboratory testing equipment is provided to assure compliance with the established methods and provided an accredited testing laboratory is periodically used (at least twice annually) as a quality assurance measure to verify the accuracy of in-house testing equipment and methods. Conversely an accredited testing laboratory must be used for quality control and quality assurance testing if in-house laboratory testing equipment is not provided. Fines content is to be determined at the production facility by the fuel producer. The fines determination shall reflect the amount of fines at the mill gate as product is shipped. This is to be done by measuring the fines content of bagged product and/or through bulk load outs.

The frequency and location of sampling and testing for quality control purposes must be sufficient to mitigate reasonable doubts concerning pellet quality compliance with grade specifications. When reasonable doubts concerning the pellet quality exist, the accredited auditing agency can stipulate more frequent internal inspections.

Testing for in-house quality control purposes should be conducted in accordance with the methods outlined in *PFI Standard Specifications for Residential/Commercial Densified Fuel*, however alternate test methods may be used to expedite production data provided the alternate test methods used are periodically cross-checked (at least twice annually) with established methods for accuracy. Testing for quality assurance purposes must be conducted in accordance with the methods outlined in *PFI Standard Specifications for Residential/Commercial Densified Fuel*.

All measuring and test equipment used at the densified fuel production facility to determine densified fuel conformance to specified grade requirements must be maintained and calibrated in accordance with manufacturer specifications and/or other applicable standards.

6.10 Third Party Inspections and Monitoring

Densified fuel production facilities must submit to third party audits in accordance with *ALSC Residential/Commercial Densified Fuel Enforcement Regulations*. Third party audits are to be performed on a monthly basis. Auditors shall collect samples at a frequency of one sample per thousand tons of product produced since the last audit, but not less than one sample per audit. Samples shall consist of one (1) bag of densified fuel taken directly from the bagging line and/or other recent production (produced since the last audit). Audit samples shall be collected evenly throughout inventory that has been produced since the last audit. For bulk shipments, samples shall be collected at transfer points after the pellet cooler. Bags shall be date stamped and/or numbered by the bagging system to assure time or quantity separation of the samples.

Audit samples are to be analyzed for all normative properties as specified in Table 1 of *PFI Standard Specifications for Residential/Commercial Densified Fuel* with the exception of heavy metals, which are to be tested at a minimum of once annually. Additional audit samples may be tested for heavy metals at the inspector's discretion if the inspector suspects the use of chemically treated materials as defined in section 4.5 or if the inspector suspects the use of construction waste debris or post-consumer recycled wood. The minimum annual test for heavy metals is to be conducted at a time of the inspector's choosing, however the test is to be invoiced at the beginning of the year and results are not to be disclosed until the end of the year unless results are failing, which would initiate further investigation and/or corrective actions. Passing results are kept blind so as not to alert pellet fuel producers that their annual metals testing has been conducted. A heavy metals test is also required as part of the initial qualification of the pellet production facility.

If at any time the test results of an audit sample exceed the limits provided in Table 1 of *PFI Standard Specifications for Residential/Commercial Densified Fuel* the affected materials will be further evaluated to potentially include the testing of additional samples and the producer will now be required to have at least one audit sample tested for heavy metals each month until there are 3 consecutive months where no exceedances of heavy metals are found. Affected product will be dispositioned based on the inspection and reinspection conformance criterial outlined in section 6.12.

If three consecutive months of unannounced audits demonstrate the production facility to be within full compliance of the PFI Standards Program, including all program documents, and incorporate the use of an in-house laboratory as outlined in section 6.11, then the sampling frequency will drop to consist of one sample per audit as a minimum and one additional sample for every 5,000 tons of production. For example, if a facility produces 4,999 tons or less in a single audit period then 1 sample is pulled, if the facility produces between 5,000 and 9,999 tons within a single audit period then two samples are pulled, if a facility produces between 10,000 and 14,999 tons within a single audit period then three samples are pulled etc. If after reducing the sample frequency non-conformances are identified through the monthly audit and/or through audit samples then the audit and testing frequency will return to one sample per 1,000 tons of production until the producer again demonstrates compliance over three consecutive monthly unannounced audits without deficiencies.

Program requirement, including auditing and/or testing frequencies will be reviewed at least every 5 years to assure a proper level of program oversight. Program requirements will ultimately be based on the level of conformance that can be achieved by the production facilities.

6.11 In-House Laboratory and QA/QC Requirements Necessary to Qualify for and Maintain Reduced Audit Sample Testing Frequencies

In order to qualify for and maintain the reduced audit sample testing frequencies specified in section 6.10, production facilities must establish an in-house testing lab that is capable of testing for bulk density, fines, length, diameter, durability, and moisture. All tests must be verified to provide accurate results by cross checking with an ALSC accredited lab as outlined in section 6.9. In addition, the in-house test data must also demonstrate that the facility is within compliance of the grade requirements. Samples must be collected at least twice per day or once per shift whichever generates the larger number of samples. Samples shall consist of bags of product as would typically be shipped or directly from a bulk load out if bulk delivery is performed. Further, all data is to be provided in a format that is easy to review and made available to the auditor during monthly inspections.

6.12 Inspection and Reinspection Conformance Criteria

For the purpose of audit samples, the densified fuel producer shall be considered conforming if 90% of the audit samples are in compliance with all grade criteria

as defined in Table 1 of *PFI Standard Specifications for Residential/Commercial Densified Fuel*. If up to 10% of the densified fuel producer's product does exceed the range specified in Table 1 of *PFI Standard Specifications for Residential/Commercial Densified Fuel* it may not exceed the range by more than 10% with the exception of durability, which may not exceed the range by more than 2%.

For the purpose of reinspections, the densified fuel producer shall be considered conforming if the product does not exceed any of the ranges specified in Table 1 by more than 10% with the exception of durability, which may not exceed the range by more than 2%. Non-conformance in terms of physical specification parameters that could reasonably be concluded to have resulted from improper handling or storage after the product has left the manufacturer's site will not be considered in this conformance determination. This will most commonly be seen as elevated moisture, excessive fines and/or reduced durability resulting from condensation or exposure to the elements or other moisture sources.

6.13 Nonconforming Materials

All raw materials and finished products that are found to be nonconforming against specified requirements must be identified, documented, segregated (if possible), evaluated and dispositioned to prevent unintended use or delivery. This applies to raw materials, in-process product, final product, and customer returned product.

6.14 Corrective Action Requests

A Corrective Action Request (CAR) may be the result of internal or external observations affecting product quality. A CAR form must be initiated as promptly as practicable to correct assignable conditions that could result in defective product.

Findings that identify assignable conditions that are adverse to quality must be corrected on an expedited, high priority basis.

The quality manager shall monitor progress of the corrective action. Initial review of the adequacy of improvements and corrections and the monitoring of the effectiveness of actions taken shall be recorded. The review and monitoring schedule shall be determined by the quality manager.

6.15 Product Storage, Handling, and Delivery

To assure the consistent quality of densified fuel leaving the production facility, quality marked product must be packaged, stored, handled, transported, and/or delivered in a manner that will maintain the integrity of the densified fuel

produced. The minimum requirements for quality marked densified fuel packaging, storage, handling, transport, and delivery are as follows:

- Densified fuel must not be exposed to moisture, e.g., through contact with condensed water, rain or snow.
- Handling areas, silos, conveyor equipment, storage containers, and transport vehicles must be regularly checked for soil and/or debris. Equipment is to be cleaned if necessary to prevent contamination.
- Quality marked densified fuel must not be allowed to co-mingle with non-quality marked product. Quality marked densified fuel of one grade co-mingled with another grade must be quality marked to the lowest quality grade present.

7 QUALIFICATION OF RESIDENTIAL/COMMERCIAL DENSIFIED FUEL

Upon completion of the implementation of a written quality management system based on *PFI Residential/Commercial Densified Fuel QA/QC Handbook*, densified fuel production facilities can pursue qualification through accredited auditing agencies. A list of accredited auditing agencies can be found on PFI's website at the following address:

www.pelletheat.org

To gain qualification, prospective densified fuel production facilities must enter into an agreement with an accredited auditing agency. The accredited auditing agency will issue an application as well as a copy of *PFI Residential/Commercial Densified Fuel QA/QC Handbook* and *PFI Standard Specifications for Residential/Commercial Densified Fuel*. The prospective densified fuel production facility must complete and submit the application to the accredited auditing agency. Upon approval of the application by the accredited auditing agency an initial audit of the densified fuel production facility will be performed by the accredited auditing agency to verify compliance with *PFI Residential/Commercial Densified Fuel QA/QC Handbook*, *PFI Standard Specifications for Residential/Commercial Densified Fuel*, and the facility written quality management system. If deficiencies are found during the audit the applicant must demonstrate to the accredited auditing agency that corrective measures have been taken. Once all deficiencies have been corrected the accredited auditing agency will issue a document to the applicant.

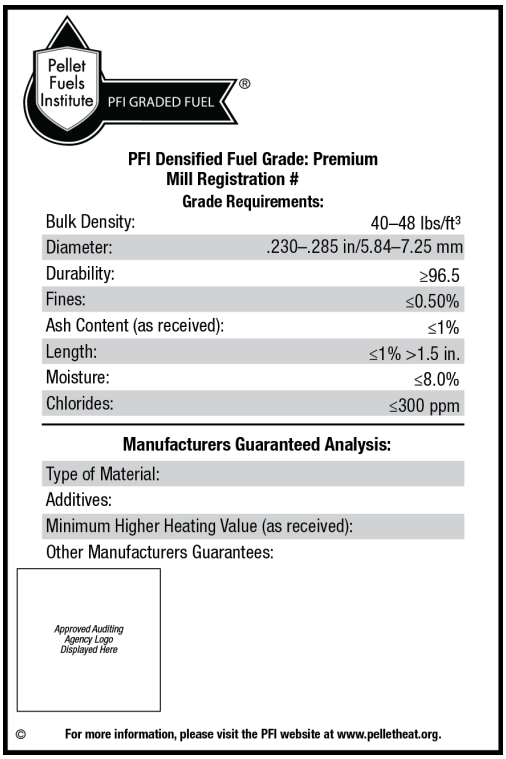
Qualified densified fuel production facilities are monitored by the accredited auditing agency in accordance with the *ALSC Residential/Commercial Densified Fuel Enforcement Regulations* and other applicable documents. As part of this monitoring

process densified fuel production facilities are audited initially as well as periodically thereafter.

8 LABELING OF QUALITY MARKED PRODUCT

When a facility demonstrates they have met all requirements of the standards program through an accredited agency the facility acquires the right to use a Quality Mark to label the product(s) and to use for advertising purposes. The Quality Mark must be exclusively used in direct connection with the qualified product(s). Densified fuel production facilities who manufacture quality marked and non-quality marked products must avoid the impression that the complete production and traded quantities are qualified.

A Quality Mark must be displayed as follows:



This Quality Mark will incorporate an accreditation body approved accredited auditing agency logo on the left, lower third of the label. The Quality Mark will be displayed on the front, lower third of the bag. In the case of bulk shipments the quality mark shall be provided with commercial documentation. Additives may not exceed two percent by weight and the additive type must be stated. Materials must also be disclosed. Material classifications may include: hardwood, softwood, mixed hardwood and softwood,

agricultural grasses, nutshells, etc. Higher heating value is to be stated on an as-received basis and must reflect a minimum BTU guarantee that is demonstrable through audit samples. Densified fuel producers may provide additional guarantees on the Quality Mark for other grade parameters outlined in Table 1 as well as the notes provided with Table 1 of *PFI Standard Specifications for Residential/Commercial Densified Fuel* provided they can reliably demonstrate their claim through the audited samples collected at the production facility. An example of such a guarantee is as follows: Ash Content (As-Received): <0.50%

Densified fuel production facilities that are not qualified in accordance with this program are not authorized to use the Quality Mark.

Annex A.1

Rules of the Mark

1. The mark shall be 3.5 inches wide and 5.25 inches tall with a maximum allowable variance of +/- 5%.

2. Location: the mark shall be located in lower 1/3 of the primary label display area, i.e. the lower 1/3 of the front panel of the bag.

3. The mark must be representation of the image below, that is:
    a. Utilize a Helvetica font
    b. Must include the PFI Standards Program logo in the upper left corner and the approved auditing agency logo on the bottom (justified left).
    c. Meet color requirements: black, screened gray (black) and white are preferred, however other colors may be utilized in the interest of using colors common to the rest of the bag design.

4. The American Lumber Standard Committee will assign each auditing agency a range of registration numbers to assure that each mill is assigned a unique registration number. It is up to the auditing agency to assign the registration number to the production facilities under their supervision.

5. When assigning the type of material it is intended that the materials be specified in broad classes such as hardwood, softwood, blended hardwood and softwood, agricultural grasses, nut shells, etc. It is allowable, but not required, to specify a specific species or type of agricultural product.

6. Manufacturer guarantees in the quality mark may only relate to items in Table 1 and the notes of Table 1 of the Pellet Fuels Institute (PFI) Standard Specification for Residential/Commercial Densified Fuel.

7. For bulk shipments, it is intended that a reproduction of the Quality Mark be provided with commercial documentation. The size of the quality mark does not need to adhere to the bag size of 3.5 x 5.25 inches, however care should be taken to properly represent the quantity of densified fuel that the Quality Mark applies to and should not inadvertently be implied to represent other materials (non-qualified materials) purchased with the same shipment.

PFI Residential/Commercial Densified Fuel QA/QC Handbook

Appendix A

Pellet Fuels Institute

Standard Operating Procedure for:

Sorting Construction Waste Debris & Post Consumer Recycled Wood

Content to be Determined: