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METHODS OF SAMPLING COAL DELIVERIES

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-- Mines Branch Instructions --

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(Prepared for the use of Government Departments when purchasing coal under specification).

When payment for steam coal is to be based on the quality of coal, as shown by the analysis of the sample submitted, it is essential that the greatest possible care be taken to insure that the sample is representative of the coal delivered.

The basic principle of sampling is to take a sufficiently large gross sample of several hundred pounds, and after crushing and intimate mixing, reduce the same by suitable means to about ten pounds, half of which is despatched for laboratory analysis and the other half retained for arbitrational examination in case of dispute.

The gross sample must be representative of the various kinds of material present, that is, the distribution of the various substances such as lump, bone, slate, pyrites and other constituents which go to make up the mass, must be maintained without any change in their relative proportions as originally present.

Amount of Gross Sample.

In procuring a representative sample a large element of safety resides in the quantity taken. In general the larger the amount, the more representative it will be. However, conditions differ. It is easier, for example, to procure an even sample from a carload of screenings than from a carload or other mass of lump or run of mine coal. In the latter case larger amounts should be taken than in the former.

Alternate Method of Sampling Slack or Small-sized Coal.

For sampling slack or small-sized coal, the "pipe" method may be used. A 5-1/2 foot length of 2-1/2" boiler tube may be

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The limits of practicability for the proper handling of the sample must, however, be considered. In general the gross sample should weigh 200--600 lbs. Doubtless 200 lbs. of screenings, taken with fairly good distribution thruout the unloading of a 40 or 50 ton car, will yield a very true sample. The difficulties increase with the increase of the size of the particles, as in the case of lump or mine run coal. If mechanical appliances for grinding are available, the larger amount should be taken, but a smaller sample well crushed down before quartering is better than a greater mass quartered down while the particles are still in large pieces.

Sampling a Carload:

A car of coal may be sampled to the best advantage in the process of unloading. An occasional half shovelful should be thrown into a proper receptacle so that by the time the car is unloaded approximately 200 lbs. evenly distributed thruout the load, will have been taken. This will mean about one half shovelful for every ten full scoops. They are best taken in the process of shovelling from the bottom of the car, since the top coal rolls down and mixes fairly evenly with the bottom. It should be kept in mind in taking a sample there must be obtained the different sizes of coal, fine and coarse in their proper proportions, from the entire cross section of the mass and also an even distribution of the sample lengthwise of the car. The sample thus obtained should be treated as outlined below under the heading "Mixing and Reducing the Gross Sample."

Sampling a Car Without Unloading or Sampling a Pile.

The finer particles of a coal mass are higher in ash and have a greater specific gravity than the larger lumps. They are therefore more likely to separate by gravity from the coarser material. On this account, if a car is to be sampled without unloading, or a pile of coal is to be sampled, it is necessary to take the sample from different depths. This may be done by digging three trenches, one near each end and one near the middle, taking the sample at different depths at sufficient intervals across the exposed faces to make the 200 lb. sample representative. These trenches should go down nearly to the bottom of the mass and each size be taken as nearly as possible in its proper proportion. Lump and run of mine lots are much more difficult to sample than screenings, but it should be noted that the quality of screenings in a car may vary greatly as not infrequently a car is loaded from two or more bins containing coal of different size and composition. After obtaining the gross sample, the methods to be followed are the same as those described below.

Alternate Method of Sampling Slack or Small-sized Coal.

For sampling slack or small-sized coal, the "pipe" method may be used. A 5-1/2 foot length of 2-1/2" boiler tube may be used for the purpose. The pipe must be prepared by providing on one end a toothed and sharpened cutting edge. A cup or header may be placed on the other end of the pipe to permit driving into the coal by means of a sledge. Holes driven into the

pipe near the header will permit the insertion of a rod by which the pipe may be given a quarter turn after each blow of the hammer. These holes also permit the escape of air which otherwise would be forced through the coal, carrying with it dust which should form a portion of the sample. This sampling pipe must be used to make borings at regular intervals over the car-load, a sufficient number of borings being taken to secure a sample of not less than 200 lbs. per car. After the pipe has been driven into the coal nearly to the header, it must be withdrawn carefully. The core which it contains may be emptied into a bucket by tapping the pipe with a hammer, and the gross sample thus obtained should be treated as follows:

Mixing and Reducing the Gross Sample.

Successive crushing, mixing and reduction should be carried out until the sample has been reduced to 10 lbs. of 1/8 inch coal. Mixing should be carried out by coning and re-coning as illustrated in the accompanying plate reproduction (from U.S. Bureau of Mines). Quantities of less than 125 lbs. should be mixed by placing on a suitable cloth or canvas about 6' by 8' and rolling sample back and forth by raising first one end of the cloth and then the other. Fifteen or twenty such alterations may be considered sufficient to effect an even mix.

When thoroughly mixed the sample shall be coned by gathering together the four corners of the cloth. The cone shall then be flattened, the apex being pressed vertically downwards with a shovel or board, so that when the pile has been quartered, each quarter shall contain the material originally in it. The flattened mass, which shall be of uniform thickness and diameter, shall then be marked into quarters along two diameters at right angles to each other. The reduction of the sample is then effected by discarding diagonally opposite quarters. The space vacated by these two quarters must be swept clean before proceeding with the next crushing and mixing.

Ratio of Size to Mass in the Gross Sample.

Assuming that the sample as taken is made up of the various kinds of material in proper proportion, an important item is to maintain those variables in their ratios thruout the process of reducing the gross amount to a small working or laboratory sample as above outlined.

The final ratio of sizes should be determined by the method available for grinding. If a power crusher is available the entire sample should be put through the mill and reduced to pass a 1/4" screen. If the crushing must be done by hand, the first reduction in size should be such that the entire mass will pass through a 1 inch screen. When by quartering, the sample is reduced to 100 lbs., the size of the particles should be further reduced to pass a 1/2 inch screen, and with a 50 lb. sample the crushing should be carried to 1/4 inch.

The following table indicates the permissible sizes in the various stages of reduction:

<u>Wt. of Sample to be divided (pounds)</u>	<u>Largest size of coal and impurities allowed before division.</u>
500	1 inch
250	3/4 "
125	3/2 "
60	1/4 "
30	1/8 "

Care should be taken to prevent the loss of any of the ingredients of the sample, or the admixture of foreign matter, and likewise great care should be taken to guard against loss of moisture in the process of collecting and reducing the sample.

Disposition of Final Sample for Analysis.

When the sample has been reduced in the above manner to approximately 10 lbs., this quantity shall be divided into two equal parts, and each part placed in containers suitable for transportation and sealed. One sample shall be forwarded to the testing laboratory, and the other to be held in reserve, to be analyzed in the event of dispute, damage or loss, to the corresponding sample.

Composite Samples.

When it is desired to make a composite sample from as high as 5 carloads, the large 200--600 lbs. sample from each car may be put in a single pile before proceeding to mix, quarter and reduce the size of the coal particles, for the final laboratory sample as described above. Where laboratory samples have been prepared from single carloads and when it is afterwards desired to have a main sample represent a shipment of two or more carloads, the preliminary single carload samples may be united as a final composite sample to be forwarded to the laboratory for analysis.

Sample Container and the Filling of Same.

Each final 5 lb. sample should be immediately placed in a container and sealed air tight. The coal should be firmly packed in the container so as to occupy as much of the space as possible, as in this way air is more nearly excluded. This packing is best accomplished by shaking or jarring the container repeatedly and vigorously while filling it with the crushed sample.

Different kinds of containers may be used providing they can be made air tight. Ordinary glass jars as used for preserving fruit, when properly sealed and packed are satisfactory, but metal cans with screw-top lids are preferable. As a two quart sealer will hold about 2-1/2 lbs. of crushed coal, the five pound laboratory sample may be shipped in two glass sealers of this capacity. A metal can 4-1/2" outside diameter by 12" high will hold 5 lbs. of crushed coal. Such a container may be shipped by parcel post as its overall weight will come well within the 11 lbs. maximum

parcel post weight. A galvanized iron metal can, of the above dimensions fitted with a standard screw cap of 3" diameter (by 1" high) is recommended by the Mines Branch.

Sealing the Container and Description of Sample.

When glass jars are used the usual rubber washer should be inserted in the proper place to insure the container being air tight. Similarly a washer or a disc of rubber should be inserted in the screw cap of the metal container so that when screwed down tight, all air is excluded from the container. As a further protection to insure air tightness, the cap when in place and screwed down, may be wrapped carefully with several layers of adhesive tape. The sample may be designated either by placing a sample mark or other designation on the label, pasted on the outside of the container, or by inserting a paper giving description, etc., in an envelope and placed inside of the container just before sealing. The double precaution of describing the sample both on the outside label and in an inside envelope is advisable.

Descriptive Labels.

Special attention should be given to filling out standard forms or labels. The following form is recommended:

DEPARTMENT OF

Coal delivered to
(Institution, etc.)

Container No. Sample No.....

Name of Contractor

Coal, kind and size

No. of tons represented by this sample

Date of delivery Date of making sample

Other details and remarks

.....

.....

Signed:

First stage in the preparation of 1,000-pound sample.



Crush 1,000-pound sample on hard, clean surface to 1" size



1,000-pound sample crushed to 1" and coned



Mix by forming long pile. A—spreading out first shovelful. B—long pile completed



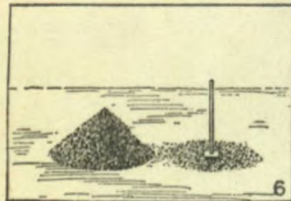
Halving by alternate shovel method. Shovelfuls 1, 3, 5, etc., reserved as 5, A; 2, 4, 6, etc., rejected as 5, B



Long pile divided into two parts; A—reserve; B—reject

NOTE
SELECT A HARD, CLEAN SURFACE, FREE OF CRACKS AND PROTECTED FROM RAIN, SNOW, WIND, AND BEATING SUN. DO NOT LET CINDERS, SAND, CHIPPINGS FROM FLOOR, OR ANY OTHER FOREIGN MATTER GET INTO THE SAMPLE. PROTECT SAMPLE FROM LOSS OR GAIN IN MOISTURE

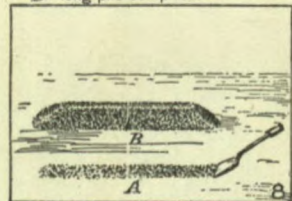
Second stage



Crush 500-pound sample (fig. 5, A) to 3/4" size



500 pounds crushed to 3/4" and coned



Mix by forming long pile. A—spreading out first shovelful. B—long pile completed



Halving by alternate shovel method. Shovelfuls 1, 3, 5, etc., reserved as 10, A; 2, 4, 6, etc., rejected as 10, B

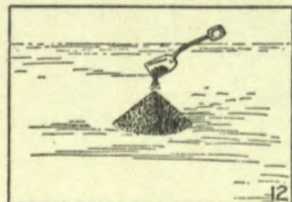


Long pile divided into two parts; A—reserve; B—reject

Third stage



Crush 250-pound sample (fig. 10, A) to 1/2" size



250-pounds crushed to 1/2" and coned



Mix by forming new cone



Quarter after flattening cone

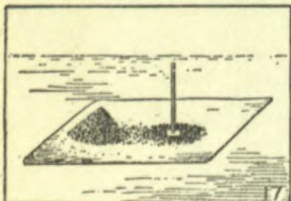


Sample divided into quarters

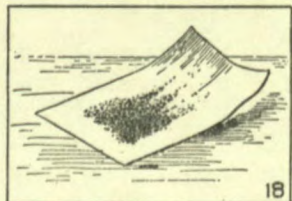


Retain opposite quarters A, A. Reject quarters B, B

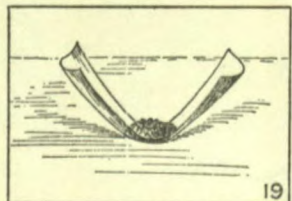
Fourth stage.



Crush 125-pound sample (fig. 16: A, A) on blanket to 3/8" size



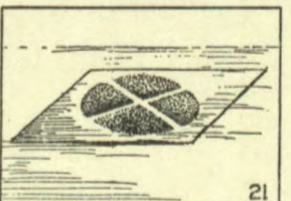
Mix by rolling on blanket



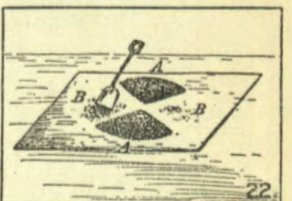
Form cone after mixing



Quarter after flattening cone

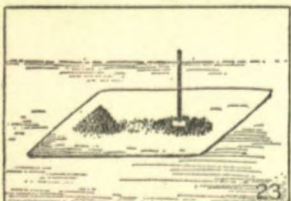


Sample divided into quarters



Retain opposite quarters A, A. Reject quarters B, B

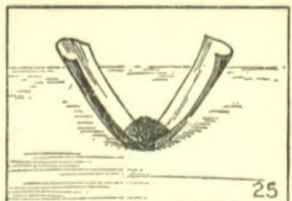
Fifth stage.



Crush 60-pound sample (fig. 22: A, A) to 1/4" size



Mix by rolling on blanket



Form cone after mixing



Quarter after flattening cone

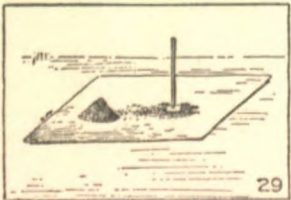


Sample divided into quarters



Retain opposite quarters A, A. Reject quarters B, B

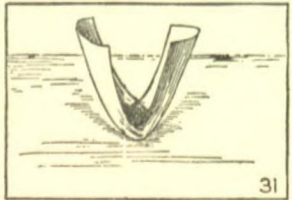
Sixth stage.



Crush 30-pound sample (fig. 28: A, A) to 3/16" or 4-mesh size



Mix by rolling on blanket



Form cone after mixing



Quarter after flattening cone



Sample divided into quarters



Fill two 5-pound sample containers from A, A, one for laboratory, one for reserve

METHOD OF PREPARING A SAMPLE OF COAL BY HAND. THE NECESSARY TOOLS ARE A SHOVEL, TAMPER, BLANKET MEASURING ABOUT 6 BY 8 FEET, BROOM, AND RAKE. THE COAL IS RAKED WHILE BEING CRUSHED, SO THAT ALL LUMPS WILL BE CRUSHED. FLOOR OR BLANKET IS SWEEPED CLEAN OF DISCARDED COAL EACH TIME AFTER SAMPLE IS HALVED OR QUARTERED.