UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
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MASTER

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Dear John:

AI 01-76 PR 06010

This is our letter progress report for our project under Interagency Agreement EA77-A-01-6010 entitled "Evaluation and Improvement of Codes and Standards Related to the Use of Fuelwood" for the period July 1, 1980, to September 30, 1980. Progress in the program is described below.

Typical Operating Conditions of Existing Wood-Burning Appliances

The report describing this phase of the program is currently receiving review by the NBS Editorial Review Board. It should be approved for final publication shortly. The report will be issued as an NBSIR in November.

Clearances to Combustibles and Wall/Floor Protection

Tests have been performed on several generic wall protection systems that are currently not included in the codes. The two attached figures illustrate two different results. A 1/8" sheet of unpainted aluminum placed on 1" spacers to allow an air gap between the metal and the combustible surface provides an effective heat shield. With temperatures on the unprotected surface as high as 175°C, temperatures on the wall surface protected with the sheet metal was never higher than 37°C. However, tests of a calcium silicate board mounted flush on the surface shows little protection from the heat. The air-space seems to provide the most effective protection regardless of the material used to shield the wall. Tests are continuing.

Chimney Creosoting and Chimney Fires

The data from the two chimney fires is being analyzed. The attached figures illustrate the results of the tests. The maximum flue gas temperatures and inner pipe metal surface temperatures were not greatly different for the two chimneys tested. However, the outer pipe surface temperature (the pipe exposed to surrounding combustibles) was considerably higher during the test of the air-insulated chimney than those measured for the solid-packed chimney. The maximum temperatures on the surfaces of the solid-packed and air-insulated chimneys were 222°C and 420°C, respectively. While this does not necessarily present a fire hazard on surrounding combustibles for chimneys that are installed properly, an air-insulated chimney installed without sufficient clearances may present a greater risk of fire than a solid-packed chimney.

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Profiles of temperatures measured during the two tests also show some interesting results. The time of occurrence of maximum temperature at different heights indicated that the fire burned from the bottom to the top in both chimneys. The duration of the fire was longer in the solid-packed chimney than in the air-insulated chimney.

Fireplace Inserts

The report from Auburn University describing the design review of fireplace inserts is being printed as an NBS Grants and Contracts Report (GCR). It provides a definition of a fireplace insert as:

"A fireplace insert is a space-heating device with a self-contained fire-box designed to burn solid-fuel and intended to be installed in an existing fireplace. A fireplace insert is intended to be operated with the fuel loading and ash removal openings closed so as to maintain some control of the airflow into the fire chamber."

Using this definition, inserts were then classified according to the following observable physical characteristics:

- 1) Single-box or double-box firebox construction.
- 2) Glass doors or metal doors.
- 3) Positive or nonpositive flue connection.
- 4) Natural or fan-forced convection.

Underwriters Laboratories has provided a detailed set of construction drawings for a masonry fireplace based on a review of codes and recommended practices. The design is intended to be typical of current and past construction practices which satisfy minimum code requirements. All materials are being procured by UL for shipment to Auburn to insure uniformity in materials and construction.

In the next quarter, construction of the fireplaces will be completed and testing should begin. A special report by Underwriters Laboratories on the design review of fireplaces will be completed.

Reporting

In addition to the reports detailed above, two reports were completed in the last quarter under the program. A short publication was forwarded to DOE describing the NBS program objectives, current status, and future plans. The report is currently in NBS review and will be published shortly. "An Annotated Bibliography for Wood Combustion in the Residential Sector" was received from Pyros. The draft describes almost 500 publications related to wood-heating and should provide an excellent resource document. The draft is being reviewed and will be revised and published in final form as an NBS-GCR in the next quarter.

Emissions

During the last quarter Dick Gann attended the Wood Combustion Group Meeting held at EPA, Research Triangle Park.

A literature survey of wood chemistry has been started. To date it appears that the majority of wood chemistry has been done in the paper and pulp industry at low temperatures. There is a body of literature on pyrolysis of cellulose and some literature on wood pyrolysis from wood alcohol (methanol) technology. Some modeling work has been done regarding building fires in wood structures. In summary, the literature on the combustion chemistry and physics of wood is limited, scattered, and of little use in the emissions program.

Experimental work has started on characterization of chars generated by smoldering of fibrous woody material. This work will be combined with some characterization of chars from wood and cellulose pyrolysis in nitrogen.

Sincerely,

Richard D. Peacock
Product Flammability Research
Fire Performance Evaluation Division
Center for Fire Research

5 Enclosures

'NBS STANDARD' RADIANT STOVE TESTS
TEMPERATURES ON COMBUSTIBLE WALL SURFACE

'NBS STANDARD' RADIANT STOVE TESTS
TEMPERATURES ON COMBUSTIBLE WALL SURFACE

TEMPERATURE PROFILE ON INNER CHIMNEY PIPE SURFACE
DURING CREOSOTE FIRE TEST OF AIR-INSULATED CHIMNEY

TEMPERATURE PROFILE ON INNER CHIMNEY PIPE SURFACE
DURING CREOSOTE FIRE TEST OF SOLID-PACKED CHIMNEY

Temperature Profiles in Two Factory-Built Chimneys During Creosote Burnout Tests