APPENDIX D

COMMENTS UPON PROPOSED FLUE AND CHIMNEY EUROPEAN STANDARDS

Appendix D

Comments upon proposed European Standards for all types of Flues and Chimneys

1. European Standards are currently under preparation for most chimney products. These are or are intended to be:-

   EN 1457 Chimneys- Components- Clay/Ceramic flue liners. Published 1999
   EN 1806 Chimneys-Components-Clay/Ceramic flue blocks. Scheduled 2000.
   EN 1857 Chimneys- Components-Concrete Flue Liners. Scheduled 2000.
   EN 1858 Chimneys- Components-Concrete flue blocks. Scheduled 2000.

2. In light of the Expert Group's recommendation to adopt these standards (when they become available) within Approved Document J, the Expert Group felt it useful to offer the following comments upon the proposed standard for Concrete liners (prEN1857). These are offered with particular reference to the test results derived from this study and in the context of the UK situation.

3. PrEN1857 is a CEN Mandated Standard; it thus is anticipated that components complying with EN 1857 will be accepted to comply with the essential requirements of the Construction Products Directive (CPD), by virtue of the following criteria.

Mechanical Stability

4. This is judged by compressive strength. Some of the liners within the two test chimneys (A&B) showed very significant reduction in their strengths during the test work. (ie at the end they could be broken by hand); a loss that was much greater than expected. The standards should address the risk from this, wherever possible by direct measurement; assumptions and predictions as to post test strength should be used only when necessary. In particular, some members of the CRE Expert Group suggest the prEN 1857 consider thermally cycling liners under test up to three times, before compressive strength, the abrasion and leakage tests. No hard evidence can be offered for the need to perform such extended tests, but some concrete formulations are more susceptible to the effect of such cycling than others. It is suggested that the serious cost implications from failing to identify even a single defective product would substantially outweigh the additional cost arising from the modestly extended laboratory tests.

Fire Resistance

5. Any design of domestic solid fuel appliance carries the risk of creating a soot fire. Thus all chimney products suitable for solid fuel should be soot fire resistant. The Expert Group notes the very rapid rise in temperature of the concrete liner itself during the fire; this is due to radiant heat transfer from the burning soot. Actual rates are available in the experimental results. The ability to withstand high rates of temperature rise is believed to be critical in resisting chimney fires, as higher rates will cause increased thermal stresses through the thickness of the liner, and transference of these stresses to the fabric of the building. The details of the test procedures including flue gas temperature, flue gas radiance (if any) and flue gas flow rate will be critical. Both of the latter critically affect the rate of temperature rise of the liner. BSRIA are also aware of the importance of these rates of temperature rise as to the pass or fail categorization of a product. It is suggested that the rate of temperature

rise of the liner itself where tested to the standard is confirmed as adequate. The rate of rise of temperature of the liner will always be much lower than the gas, and be dependent upon the radiant component of the gas.

6. Approved Document J and prEN1857 and EN 1457 state that all liners for use over solid fuel appliances should have soot fire resistance.

Hygiene, Health and the Environment Gas Tightness/Leakage

7. The two classes of chimney that could be appropriate to the UK domestic solid fuel market are: -
   N1 max leakage 2 l/s/m^2 at 40Pa
   N2 max leakage 3 l/s/m^2 at 20Pa.

8. These leakage rates are very significant particularly in relationship to the total flue gas produced by a closed stove of say 5 kW output. Detailed calculations are outside the scope of this report, but initial estimates indicate flue gas temperature reductions in excess of 100°C with a 225mm liner of category N2 leakage rate. This is significant.

9. This highlights the need for designers and appliance manufacturers to carry out these calculations, and make judgements as to under which conditions their appliance will perform to specification. Advice should also be offered upon possible condensation in the flue.

10. It would further appear advantageous if appliance manufacturers could devise some simple methods of making recommendations as to the flue leakage category required for appliances in a range of typical installations.

11. The Expert Group recommends similar generic advice should be included within Approved Document J.

Heat Stress Resistance and Heat Shock

12. The European standards define the ability of a chimney liner to withstand a variety of flue gas temperatures by requiring the liner to be subject to hot flue gas, and then measuring the leakage rate. After the test this figure shall still be less than that allowed for the category i.e. N1or N2 for natural draught products.

13. In contrast to gas or oil where flue gas temperatures are essentially constant, the instantaneous flue gas temperature of any batch fed solid fuel appliance varies considerably with time. During and immediately after refuel the flue gas temperature falls to typically 100°C to 200°C, and then rises sharply as the fuel bed ignites. Rates of flue gas temperature rise with bituminous coal were measured up to 150°C per minute (although 100°C per minute was more usual). Volatiles are given off, the flue gas temperature rises to a peak (typically between 500°C and 800°C) and then slowly decays as the fuel within the appliance is consumed. The ratios of peak to 12 hour average flue temperatures vary significantly with fuel and appliance type. Wood and anthracite give lower peak flue temperatures than high volatile bituminous coal, due to long flame produced by the burning volatiles.

14. The peak flue temperatures for multi-fuel stoves (such as that used in the CRE testwork) tend to be higher than those found over conventional roomheaters fitted with throat plates. Peak temperatures recorded at CRE were 900°C, under misuse conditions, although the

average flue gas temperature for the day was still only 440°C. Typical average flue gas temperatures with bituminous coal were near 400°C. Values when fired with anthracite were a maximum flue gas of about 650°C, and an average flue gas temperature (Chimney B) of 400°C or slightly lower.

15. The Expert Group recommend manufacturers commence labeling their products with appropriate flue temperature category. In a similar fashion to the gas permeability rating, the Expert Group recommend generic advice should be included within Approved Document J.

16. High temperature excursions are considered to be covered by the requirement for liners for use with solid fuel to pass the soot fire or heat shock test. This is a 30-minute test with flue gas at 1000°C.

17. With regard to the detail of prEN1857 two possible areas for discussion are noted:-

    The minimum height of the test section is currently defined as 2m; 4m could be regarded as more realistic.

    A definition of the method of calculation of average flue gas temperature for the purposes of chimney classification for solid fuel appliances.

Abrasion Resistance

18. It is clearly important that the inside surface of any flue should not be excessively soft. The surface of the liner within Chimney B could easily be scored at the end of the test program. The current prEN1857 requires that, after sweeping with a defined (stiff) brush the liner shall not loose more than 0.03kg/m^2 (about 0.02mm). This test is carried out after the heat stress resistance test and heat shock test. Although no equivalent UK data is available, this is a very low level of material loss, and would appear acceptable, although the Expert Group recommends further investigations in this area. Chimney sweeps report poor long-term abrasion resistance with some UK liners, and this is considered to be worthy of monitoring. This may also be a function of the primitive equipment used by some sweeps and the Expert Group suggests the compilation of a simple code of practice on this subject.