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APPENDIX

DRAWINGS
1. **INTRODUCTION**

The Remedial Demonstration program showed that radon daughter concentrations (WL) could be reduced in houses by closing the route of entry of soil gas containing radon. By using temporary closures including urethane foam and caulking compounds, 23 out of 31 houses showed a significant reduction in WL over the test period of 6 weeks. Subsequently, 6 houses had the temporary closure made permanent and monitoring shows that the average WL in these houses is now below the primary criterion of 0.02 WL.

2. **SURVEY**

A survey of 135 of the 138 houses for which remedial work access agreements have been signed showed that the principal routes of entry of soil gas containing radon were the untrapped weeping tile discharge which was usually brought into the floor drain or sump, and the wall/floor joint. Other entry routes discovered were abandoned plumbing lines, uncaulked service entries, gaps between slab and under-floor heating systems, and fissures through exposed rock in basements.

Table I shows the distribution of house substructure/weeping tile connection.
3. PROPOSED REMEDIAL TREATMENTS

A number of methods for closing the routes of entry have been developed based on experience gained in the demonstration program and current tests on materials and methods underway in a development program. Each specific closure method is

Approved materials are listed in Appendix 1.

3.1 Fix No. 1. Replacing Floor Drain

The untrapped weeping tile connection to the floor drain will be closed by replacing the floor drain with a built-up unit which incorporates wet traps between the weeping tile and the floor drain, and between the floor drain and sewer. The wet trap will be primed by a line connected to the cold water system. See Figure 1.
3.2  Fix No. 2. Modifying Sump

The sump pit will be removed and replaced by an approved commercial plastic unit set into concrete. A wet trap primed by a line connected to the cold water system will be inserted between the weeping tile and the sump. See Figure 2.

3.3  Fix No. 3. Closing Wall/Floor Joint

The joint will be closed by one of the following methods:

(a) The floor will be cut back to form a 'V' notch against the wall. A line of approved caulk will be laid over the crack at the base of the 'V' and the floor made good with an approved concrete patching compound. See Figure 3.

(b) The joint will be thoroughly cleaned and all paint removed from the surfaces adjacent to the joint. An approved adhesive material will then be applied to the joint to close the crack. A protective coating will be placed over the material.

These methods will also be used to close the joints between the floor and concrete columns, furnaces, oil tanks etc.

3.4  Fix No. 4. Closing Cracks and Openings Through Poured Concrete Surfaces

Cracks which penetrate the floor or outside walls will be opened up where necessary, cleaned, primed and filled with an approved permanent filler.
Openings which penetrate the floor or walls will be opened up, cleaned, primed and filled with an approved permanent filler.

Abandoned service lines will be removed or cut back and filled or capped.

3.5 **Fix No. 5. Sealing Exterior Walls**

Where poured concrete basement walls are extensively cracked and it would be uneconomical to repair each crack from the inside face of the wall, the exterior face will be exposed, the surface cleaned and, where necessary, repaired. The prepared surface will be treated with an approved coating, the excavated area backfilled and landscaping restored.

3.6 **Fix No. 6. Covering Exposed Earth in Crawl Spaces**

The treatment will depend upon the access to the crawl space. Preparation will consist of exposing the foundation walls if cracked and filling the cracks, followed by coating the walls with a sealing coat which extends to the underside of one of the protective layers described below:

a) Where concrete can be supplied easily - the surface will be levelled and topped with 3 inches of sand and a layer of (6 mil.) plastic sheeting. Concrete reinforced with wire mesh will be poured over this to a depth of 3 inches. The perimeter and all joints in the concrete will be closed by an approved pourable joint filler.
b) Where it is difficult to supply concrete, an approved plastic liner will be laid over the initial 3 inches of sand topping and sealed to the crawl space walls. Protection will be provided by a further 3 inches of sand.

3.7 Fix No. 7. Covering Exposed Rock in Basement

a) Where the rock is in good condition, the crevices and open bedding planes will be opened up, cleaned and treated with an approved coating.

b) Where the rock is in poor condition, crevices and bedding planes will be treated as drainage paths and covered with free-draining fibrous material. The drainage paths will be led to a collection point and hence to the sewer or sump through a primed wet trap. The rock surface and all junctions to wall and slabs will be covered in concrete or similar protective material.

3.8 Concrete Block Basements

Concrete block basements may require additional measures to those listed above, since the blocks are laid with their cavities intercommunicating. As a result, if soil gas enters the wall cavity at one place, it may pass into the house at any connection to the inside of the house, such as unfilled cavities in the top course of blocks beneath the plate, or cracks in or between the blocks.

If the cavities of a concrete block wall are found to be a significant route of entry for soil gas, they will require the following treatments:
3.8.1 Fix No. 8. Coating Masonry Walls

Where concrete walls are extensively cracked and it would be uneconomical to repair each crack or the face of the wall, the basement walls will be cleaned and prepared by the removal of dust, dirt etc. The walls will then be covered with an approved coating.

3.8.2 Fix No. 9. Filling Block Walls

Each cell in each block in the vicinity of the route of entry will be injected with an approved grout. Where necessary the extent of grouting will be limited by injecting closed cell foam. Where possible air vents, protected against the entry of water and insects, will be installed on each exterior wall.

3.9. Other Measures

The parallel development program may show that materials and methods currently in use in the construction field can be adapted to the remedial work. These techniques will be applied to houses in an in-house program and the engineering merits and costs evaluated against those presently in use. The most appropriate and economic methods and materials will be incorporated into the program.

4. ASSOCIATED WORK

4.1 Unfinished Basements

In unfinished basements the following work will be required to expose all cracks, openings and joints that are to be filled:

a) loose material moved out of basement
b) lower section of stair or last two steps cut and removed

c) oil tank moved away from wall

d) hot water heater moved away from wall and reconnected

e) laundry sinks moved away from wall

f) wall cupboards moved away from wall

4.2 Finished Basements

In finished basement areas the following additional work will be required to expose the areas to be treated:

a) Removal of Basement Rooms

Where remedial action is required on floors or walls concealed by existing finish, the floor and wall finish will be removed to the extent necessary to carry out the work, and subsequently replaced or renewed. The work will include the removal, storage and replacement of furnishings and utilities.

b) When it is believed that it is only necessary to close the periphery joint, the wall finish may be cut some 4 inches above slab level (removing a section of the floor if it is raised) rather than a complete removal. The plate and studs exposed will be removed with the upper section of the studs being held in place by impact nailing. On completion of the joint treatment, the wall studding will be replaced and the cut section covered by a new baseboard. If a raised floor has been cut it will be replaced together with new or existing floor covering.
APPENDIX

Approved Material (to date)

Exterior Coatings - PRC Permapol 305 Membrane Coating manufactured by PRC Chemical Corporation of Canada Ltd.
- Tremprooof 90V manufactured by Temco Canada Ltd.

Caulking Compound - Spred Acrylic Latex manufactured by Glidden Co.

Ready Mix Concrete - Sakcrete manufactured by Flintkote

Bonding Agent - Daraweld manufactured by Grace

Patching Compound - Sikatop Repair Mortar 122 manufactured by Sika Chemicals of Canada Ltd.

Patching Mortar - Thorite manufactured by Standard Drywall Products
- Top & Bond manufactured by Flintkote

Drainage Material - Terrafix 370 RS manufactured by Erosion Control Products Inc.

Joint Membrane - PRC Permapol 305 manufactured by PRC Chemical Corporation of Canada Ltd.

Joint Filler - PRC 230 Pourable Rubber Caulk manufactured by PRC Chemical Corporation of Canada Ltd.

Note: Manufacturer to be checked for instructions and primer.
fig. 2

sump alteration
EXIST. CONC. FOUNDATION WALL

2" W. X 2" D. TROUGH BROKEN OUT BY SAW OR IMPACT HAMMER

CLEAN OUT TROUGH BY AIR OR WATER

PPO PERMABOND 505 COATING ON FOUNDATION WALL DOWN TO BOTTOM OF TROUGH

PATCHING MATERIAL

EXIST. CONC. FLOOR SLAB

closing of wall/floor joint chip out method