Improved Material Testing Procedures (DWQ 9007)

Progress Report to the Department of the Environment
July to December 1992
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SUMMARY

The Drinking Water Inspectorate operates a statutory approval scheme for materials used in contact with water supplies and chemicals used in water treatment processes. A new EC approval scheme is under discussion and the European Committee for Standardisation (CEN) is drafting standards for testing procedures for the scheme. This contract was established to provide information on current approval schemes in other countries and on the developments within CEN, and to provide experimental data and technical advice to enable the adoption of the most appropriate test procedures and approval schemes.

During the last six months the evaluation of the results from the CEN TC164/WG3/AHG2 interlaboratory study on migration tests on factory-made products, has been completed and the results, which have been reported to the AHG2, are presented in this report.

Within CEN committees, two draft standards are in preparation for leaching tests on plastic pipes. One, specific to plastic pipes, has been developed by TC 155/WG2 (Plastic Pipes) and the other, which also covers other products, is being drafted by TC 164/WG3/AHG2. The two proposed procedures have been reviewed and the likely effects of the different conditions on test results assessed in a separate document (DoE 3304, January 1993)

Other developments within CEN Committees on the testing and approval of products for use in contact with drinking water are summarised in this report.
1. BACKGROUND

Organic and inorganic impurities from products in contact with water supplies may leach into water and pose a threat to consumers and impair water quality generally. In the UK the Drinking Water Inspectorate operates a statutory scheme which assesses and, where appropriate, gives approval (on behalf of the Secretary of State) to the use of chemicals used in water treatment processes and to materials used in constructing water treatment works and distribution systems. Data from laboratory and field tests are used by an expert committee (CCM) to assess whether any effects on water quality resulting from the use of a product would be unacceptable. It is therefore important that, for a range of different products and various usage, appropriate test conditions are devised, validated and well-documented and that the quality and quantity of the data obtained from the tests are adequate to allow realistic assessment.

A number of EC and other countries operate approval schemes which differ in a number of aspects from the UK scheme and from each other. There are differences in test conditions, parameters which are measured, assessment of the test results, products covered by the schemes, nature of the approval bodies and other aspects. Consequently, an approval in one country usually does not usually enable the product to be used in an other country.

The Construction Products Directive (89/106/EEC) (CPD), aimed principally at building and construction products, was introduced to ensure an open market and set minimum requirements, including those concerning health and the environment. The elimination of technical barriers to trade is to be achieved by utilising harmonised European Standards. The European Committee for Standardisation (CEN) has been given a mandate by the Commission to draft appropriate harmonised standards. Working Group 3 of the Technical Committee 164 (Water Supply) (TC164/WG3) is preparing standards relating to the effects of materials on water quality and Working Group 9 of the same Committee is drafting standards for chemicals in water treatment. It has been recognised that any proposed improvements in testing and assessment procedures in the UK, need to be synchronised with developments in CEN.

2. OBJECTIVES AND PROGRAMME OF WORK

This contract has the following objectives:

1. To assess the approval schemes used in EC and other countries and identify features which should be incorporated into a UK scheme.

2. Review implications of CEN/EC developments for UK materials' testing and approval.

3. To establish testing needs and devise, validate and recommend modified testing procedures.
3. OBJECTIVES FOR THE PERIOD COVERED

The objectives of the work performed between July and December 1992 were:

1. To complete the evaluation of results from the CEN interlaboratory study to assess the suitability of the proposed standard migration test procedure for factory-made products and report the results to AHG2.

2. To continue involvement in CEN work, concentrating on providing experimental data and advise on drafting migration test procedures and on the interpretation of test results in relation to conditions of approval.

3. To review Draft pr EN852-1 'Test method for migration for plastic pipes' developed by CEN TC155 and compare it with the draft standard which has been produced by TC 164 WG3 AHG2.

4. To continue gathering information on approval schemes in other countries.

4. PROGRESS

4.1 Introduction

This report presents WRc results of the interlaboratory study and summarises recent progress in the development of CEN standards, in accordance with objectives 1 and 2. A separate report has been prepared (DoE 3304, January 1993) on the Draft pr EN 852-1 (Objective 3). Since there has been no work during this reporting period in gathering further information on approval schemes in other countries (Objective 4), this aspect is not covered by this report.

The last Progress Report (DoE 3154, July 1992) outlined possible experimental work for this period under review, in particular, providing the necessary data to AHG2 to enable the selection of realistic migration test conditions for site-applied products and participating in further CEN interlaboratory studies on leaching tests for other products, such as cementitious and site-applied products. However, no such work has yet been agreed by AHG 2.

4.2 CEN TC 164/WG3/AHG2 Interlaboratory Study

4.2.1 Objectives of the study

Within the AHG2 a standard migration test for factory-made products has been drafted. Before forwarding the draft for acceptance, information was needed on the comparability of results from the proposed test. For this purpose, an interlaboratory study was undertaken in which different products were tested in accordance with the proposed test method and the leachates analysed for determinands agreed by the AHG2. A list of the
products and the determinands is given in a previous Progress Report (DoE 3004, January 1992). It was not possible before the study was completed, to agree on criteria by which the test method could be judged as suitable or not. The following eight testing institutes agreed to participate in the study:

- CRECEP, Centre de Recherche et de contrôlè de Eaux, Paris, France
- CRPAM, Centre de Recherche de Pont-à-Mousson, Pont-à-Mousson, France
- Danish Teknologisk Institut (DTI), Aarhus, Denmark
- DVGW - Forschungsstelle am Engler-Bunte-Institut, Karlsruhe, Germany
- KIWA NV, Research Division, Nieuwegein, The Netherlands
- LHRSP, Laboratoire Hygiène Recherche Santé Publique, Vandoluvre les Nancy, France
- VTT, Technical Research Centre of Finland, Espoo, Finland
- WRc Medmenham, UK

4.2.2 Test samples

The samples were provided by two of the participating laboratories, KIWA and Engler Bunte Institute. The samples were delivered to WRc over a period of three months and upon receipt stored at ambient temperature in the dark. The migration study on the epoxy resin (metal plates coated with epoxy resin) was begun on the 20 January and the migration studies on the PVC pipes, GRP pipe section and EPDM rubber sheets was begun on the 2 April 1992. Information on the test samples are summarised in Table 4.1.
Table 4.1 Test samples for CEN TC 164/WG3/AHG2 interlaboratory study

<table>
<thead>
<tr>
<th>Product</th>
<th>Test samples</th>
<th>Received from</th>
<th>Date received</th>
<th>WRc Ref:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy Resin coating</td>
<td>4 fully coated metal plates (20 x 15 cm)</td>
<td>KIWA</td>
<td>14 Jan 1992</td>
<td>CEN/EP</td>
</tr>
<tr>
<td>Grey PVC pipe 75 mm o.d.</td>
<td>2 lengths of pipe</td>
<td>Engler Bunte Institute</td>
<td>3 April 1992</td>
<td>CEN/LP</td>
</tr>
<tr>
<td>Grey PVC pipe 32 mm o.d.</td>
<td>2 lengths of pipe</td>
<td>Engler Bunte Institute</td>
<td>3 April 1992</td>
<td>CEN/SP</td>
</tr>
<tr>
<td>Glass-reinforced polyester pipe</td>
<td>1 pipe segment + 1 pipe segment coated with clear resin</td>
<td>KIWA</td>
<td>March 1992</td>
<td>CEN/GRP/A</td>
</tr>
<tr>
<td>Rubber</td>
<td>5 square sheets (20 x 20 cm)</td>
<td>Engler Bunte Institute</td>
<td>3 April 1992</td>
<td>CEN/RUB</td>
</tr>
</tbody>
</table>

* Sample of GRP coated with clear resin.

The samples of GRP represented sections of large diameter pipes. In practice the outside and edges of the pipe would not come into contact with potable water. To prevent the outside and edges from leaching they were coated with an inert silicone putty (provided by KIWA).

Because of the limited quantity of test samples provided, it was not always possible to test at the recommended sample surface area to volume of test water ratio (S/V) of 1 cm ml\(^{-2}\). Detailed information on the samples and S/V ratios tested are given in Appendix A.

4.2.3 Methods

The tests performed in accordance with the relevant conditions of the draft migration test method ‘Water supply - Influence of materials on water quality; Part 2: Influence due to migration’ sixth draft, November 1991, prepared by the Ad Hoc Group 2 of TC164/WG3. The test method is for factory made or factory applied products. The products tested were for cold water systems and the test protocol was three successive periods of 72 hours stagnation in deionised activated carbon filtered water.
The products were tested under conditions suitable for factory-made products for cold water systems (test temperature 23 ± 2 °C), but only with unchlorinated test water, either by immersing test samples in test water in glass vessels or, in case of narrow pipes, filling lengths of the pipe with the test water.

The following analytical methods were used for the analysis of the leachates for the specified determinands:

(a) Total organic carbon, TOC: routine determination by persulphate/UV oxidation instrumental method

(b) Monohydric phenols: standard 4-Aminoantipyrine (pH 10) SCA method

(c) Secondary aliphatic amines - spectrophotometric method provided by KIWA

(d) Primary aromatic amines - spectrophotometric method provided by KIWA

(e) Styrene, alkylbenzenes and dimethylphthalate were determined by GC-MS in the extracts used also for 'general scan' GC-MS analysis

(f) Epoxy resin constituents diglycidylethers of bisphenol A and bisphenol F - an HPLC based method developed in WRc

(g) Cobalt - routine determination by inductively coupled plasma spectrometry

(h) Lead - routine determination by atomic absorption

(i) ‘General scan’ GC-MS - established WRc semiquantitative method based on extraction of acidified samples, internal standards added with DCM and GC-MS examination of the concentrated extracts.

The interlaboratory study specified the required detection limit for each determinand and listed the recommended type of the analytical method to be used. The KIWA methods c) and d) (together with analytical standards) and the WRc methods f) and i) were circulated to all participants at the beginning of the study. For the other determinands in-house methods were used.

The new methods were set up and validated before the test commenced. Quality control analytical samples were analysed with each batch of leachates for each determinand, where appropriate.

Details on test samples, sample storage and test conditions for each product are given in Appendix A.

4.2.2 Results

A summary of the WRc results (migration values) for the specific determinands was already presented in the previous Progress Report (DoE 3154, July 1992). Detailed results
were reported to the Convenor of AHG2 before the last meeting of the Group in October and an updated version of the report is enclosed in Appendix A. (A copy of the updated version has also been sent to the Convenor of AHG2).

Seven of the eight participating laboratories sent at least some results to the Convenor before the last meeting of the Group. However only WRC provided all the required data in the agreed format. A preliminary summary of the available results was circulated at the meeting, indicating a fair degree of agreement but also some major differences. Any discussion on the outcome of the study and reasons for the differences was postponed until the next meeting in February, before which the other laboratories were asked to bring their data up to the WRC’s standard.

4.2.5 Discussion

From the factory made products, the GRP pipes and other large diameter pipes where the outside surface (which is not in contact with drinking water) is from different material than the inner surface, present the main problem with test samples. The draft standard recommends several arrangements on how to test such products, though none of these is regarded as entirely satisfactory. Another approach, recommended by KIWA, was used for this study, i.e. the parts of the test sample not in contact with drinking water were covered with a silicone putty to prevent leaching of interfering compounds and the pipe segment was immersed in a test vessel. However this covering material itself could give rise to undesirable leaching. The results did show elevated TOC levels in the GRP procedural blanks and several compounds originating from the putty were detected by GC-MS though the levels, relatively to those in the leachates, were low. There was no interference with the specified determinands. It is not yet known what test arrangements have been used by the other participating laboratories nor how the results compare.

Results for spiked control samples were not very satisfactory for some of the specified determinands, particularly those determined by GC-MS (recoveries ≤ 50%). Human error in preparing the standard solutions cannot be excluded even though the records were correct. Inadequate calibration of the GC-MS system or losses from the sample itself during the stagnation periods are other possible explanations.

According to the draft standard, all analysis should be performed after each stagnation period on duplicate test samples with two test waters. For each test temperature this represents 12 samples of leachates and three to six procedural blanks for each parameter, including GC-MS analysis. In view of the costs of the GC-MS analysis, particularly the cost of identification of the peaks, and bearing in mind the purpose of including the general scan GC-MS (as a safety step to detect unsuspected compounds, that may leach), it should be considered how best to specify the GC-MS requirements to provide adequate information at reasonable cost. During this study all extracts were prepared, as specified, but for all products (except the epoxy resin coating) only the extracts from the first and the third stagnation periods were submitted for peak identification.

The GC-MS analysis of the PVC pipes leachates did not detect any significant compounds even after the first stagnation period. Considerable leaching of benzyl alcohol
was detected in the leachates from the epoxy coating, which was consistent with the high TOC values, though it did not account for all the TOC concentrations found. For GRP pipes the specified determinant dimethyl phthalate was not detected, but the general scan GC-MS detected the presence of dibutyl phthalate. Complex chromatograms of unknown peaks were obtained from the rubber leachates. Without considerable additional work it was not possible to correlate the peaks for the duplicate samples and for the different stagnation period, as was done for the other products.

4.3 Progress in the development of CEN standards

During the period under review there was only one meeting of TC 164/WG3/AHG2 (migration tests) and one of the AHG4 (‘positive lists’).

At the previous meeting of the AHG2 in June a proposal was put forward to TC164/WG3 to prepare separate standards for factory-made and site-applied products. As there was no response, due to cancellation of the last WG3 meeting, it was not possible to progress along these lines.

The convenor was to contact, via TC164/WG3, appropriate Technical Committees preparing Product Standards. This has not yet happened.

Characteristics of test waters for cementitious products were again discussed and there were doubts that the proposed low-hardness water could be prepared. It was decided to check the calculations and prepare the water in a laboratory. Other laboratories may then be asked to prepare both test waters in accordance with the proposed specifications.

An interlaboratory test on cementitious products will need to be carried out. The convenor agreed to prepare a proposal (which cements to tests, what to measure, etc) for discussion at the next meeting in February.

There was a concern about the different contents and formats of the related draft standards being produced by AHGs within TC164/WG3. A resolution was prepared for the WG3 proposing setting up a Drafting Committee to assure consistency and compatibility of the Standards.

The TC155/WG2 is preparing a proposal for correction factors for pipes. The Group felt that it should not wait any longer and should consider in detail whether the proposed approach for pipes was acceptable and, if so, extend it to other products. After the next meeting of TC155/WG2 in December, the convenor should prepare a Draft of the Part 2.2 for discussion at the next meeting.

At the meeting of the AHG4, the discussion concentrated on the following: an updated inventory of positive lists, future positive lists, future European approval criteria (in particular whether to have one universal list, as for materials in contact with food, or a separate list for each type of polymer), how to include migration limits for chemicals that are not starting materials and on what basis are the migration limits set in different countries.
It is still not at all clear who is to set up the European approval system, what should be the criteria for approval, how should they be set up and who should do it and, also, what would need to be tested. PC6 is planning to hold a seminar on this next year and it was thought unlikely that any real progress could be made until after the seminar.

After a lengthy discussion it was agreed that, although the AHG4 did not have a specific mandate for this, it should put forward a discussion document proposing a well-argued approval system. UK and France should also provide more written information on the experience and value of using GC-MS analysis as a part of an approval system, in particular on what is found and how are the results assessed.

5. INTERIM CONCLUSIONS

1. Interlaboratory study on proposed migration tests for factory-made products has been completed and the results reported to CEN TC164/WG3/AHG2.

2. The contract enabled WRc to provide the best set of data of the eight participating laboratories.

3. Three problems, which need to be addressed in future, were encountered during the study, i.e. test arrangements for heterogenous large diameter pipes, low recoveries of some of the specified determinands and high cost of the required GC-MS analysis.

4. The progress in drafting CEN standards for test methods is slow. This is caused, to some extend, by a slow progress in other related Groups such as TC155/WG2 and TC164/WG3 and by insufficient information on the effects of some proposed test conditions on test results.

5. It is important to set up and agree criteria for approval of products for use in contact with drinking water though no CEN Committee has so far been mandated to do this.

6. WORK PROPOSED AND TARGETS FOR THE FOLLOWING PERIOD

1. A short paper will be prepared for discussion in the TC 164/WG3/AHG4 on the benefits of using GC-MS to assess potential for leaching from materials into water supplies.

2. An interim report will be produced summerising the progress of the contract from the beginning (September 1990).

3. CEN involvement will continue to concentrate on providing advice on drafting migration test procedures and on the interpretation of test results in relation to conditions of approval.
4. Any experimental work would depend on the outcome of the next meeting of CEN TC164/WG3/AHG2 on 9 February 1993. This would most likely be related to testing cementitious products.
# Research Programme Bar Chart

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<tr>
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<th>91/92</th>
<th>92/93</th>
<th>93/94</th>
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<td>2. PRODUCE INTERIM REPORT</td>
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<td>3. ADVISE ON DRAFTING CEN STANDARDS ON MATERIAL TESTS</td>
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<td>4. AGREE CONDITIONS FOR CEN INTER-LABORATORY STUDY</td>
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<td>5. UNDERTAKE CEN INTER-LABORATORY STUDY</td>
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<td>6. VALIDATE METHODS FOR SITE-APPLIED PRODUCTS</td>
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<td>7. RECOMMEND TEST CONDITIONS FOR SITE-APPLIED PRODUCTS</td>
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<td>8. PRODUCE FINAL REPORT</td>
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<td>9. PRODUCE A REVIEW FOR TWO DRAFT CEN STANDARDS</td>
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<td>10. PRODUCE A PAPER ON THE USE OF GC-MS IN APPROVAL SCHEMES</td>
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<td>Form Nº 001</td>
<td>Epoxy resin coating</td>
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<td>/2: Test conditions</td>
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<tr>
<td>------------</td>
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<td>Grey PVC pipe - 75 mm diameter</td>
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<td>Grey PVC pipe - 32 mm diameter</td>
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<td>004</td>
<td>Glass-reinforced polyester pipes</td>
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<td>/2: Test conditions</td>
</tr>
<tr>
<td>005</td>
<td>EPDM Rubber</td>
<td>/1: Test samples</td>
<td>/2: Test conditions</td>
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</tbody>
</table>

* GC-MS chromatograms after the first and third stagnation periods contained a number of unknown compounds (extracts after the second period were not analysed) which could not be easily correlated for the replicate samples and the different periods. The defected compounds and their approximate concentrations are, therefore, listed separately and their migration values were not calculated.
LEACHING/MIGRATION TESTS

Test Samples Received

Received from: KIWA N.V, The Netherlands (Mr H Van Der Jagt)

Received at WRC (Date): 14/01/92

Manufactured/prepared (Date): Before 14/01/92

Dimensions: 150 x 200 mm

Sample Quantity: 4 plates

Sample appearance: White pigmented coating on metal plates

Manufacturers Ref No: None

Sample storage before test: In paper wrapping as supplied, in desk.

Tests to be carried out: In accordance with CEN/TC164/WG3/AHC2-N28 sixth draft, November 1991

Determinands to be measured: On leachate from each of three, 3-day (72 h) stagnation periods;
TOC
Secondary aliphatic amines
Alkyl benzenes
Bisphenol A/F Diglycidyl ethers (DGEBA, DGE BF)
GC-MS general scan
LEACHING/MIGRATION TESTS

Test Conditions

Test carried out in duplicate (A and B), two plates per test vessel.

Surface area for test: 1200 cm² (each plate 600 cm²)

Test Water
- Origin: Mains water deionized activated carbon filtered
- Conductivity: <12 μS cm⁻¹
- Chlorination: nil
- Volume during test: 1.850l
- Surface to volume ratio: 0.65 cm⁻¹
- Test Vessel Glass tank glass top, no headspace
- Temperature °C 24.0-25.0
LEACHING/MIGRATION TESTS

Analytical Results - Specific Determinands

<table>
<thead>
<tr>
<th>DETERMINAND/ SAMPLE CODE</th>
<th>Concentration found µg/l</th>
<th>First Stagnation 72h</th>
<th>Second Stagnation 72h</th>
<th>Third Stagnation 72h</th>
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<tbody>
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LEACHING/MIGRATION TESTS

Analytical Results - Specific Determinands

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LEACHING/HYDROLOGY TESTS

Concentrations of compounds detected by GC-MS

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<th>GC-MS Scan</th>
<th>Test Sample</th>
<th>Concentration (µg/l)</th>
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<td>Unknown m/z- 56,31,41,43</td>
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<tr>
<td>Benzaldehyde</td>
<td>662-663</td>
<td>A:</td>
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<td>Benzyl alcohol</td>
<td>790-980</td>
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* - GC-MS overload, approximate concentrations determined after 30 x dilution
### LEACHING/MIGRATION TESTS

#### Migration Values

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### LEACHING/MIGRATION TESTS

#### Migration Values

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# LEACHING/MIGRATION TESTS

Migration values for compounds detected by GC-MS

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<td>T2 6.7</td>
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<tr>
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<td>t-butyl-cyclohexane</td>
<td>1167-1186</td>
<td>A: 0.4</td>
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LEACHING/MIGRATION TESTS

Analytical Results - Control Determinands

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<th>Concentration found µg/l</th>
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<th>Second Stagnation T2</th>
<th>Third Stagnation T3</th>
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</tbody>
</table>
LEACHING/MIGRATION TESTS

Test Samples Received

Received from: Engler Bunte Institut

Received at WRC (Date): 03/04/92

Manufactured/prepared (Date): About 04/11/91

Dimensions: 75.1 mm O.D 67.25 mm I.D 1018 mm long

Sample Quantity: 2 pieces

Sample appearance: Grey plastic pipe

Manufacturers Ref No: OMNIPLAST DVGW K022 PVC n DN65 75 x 3.6
 PN 10 DIN 19532 04119130
 ONORM B5182 GEFUFT D5 972 NS S1S 1776

Sample storage before test: In the laboratory, in the original packing

Tests to be carried out: In accordance with CEN/TC164/WG3/AHG2-N28 sixth draft, November 1991

Determinands to be measured: On leachate from each of three, 3-day (72 h) stagnation periods;
TOC
Lead
GC-MS general scan
LEACHING/MIGRATION TESTS

Test Conditions

Test carried out in duplicate (A and B)

Surface area for test: 2150.75 dm²

Test Water

- Origin: Mains water deionized, activated carbon filtered
- Conductivity: <12 μS cm⁻¹
- Chlorination: nil
- Volume during test: 3.56 l
- Surface to volume ratio: 0.59 cm⁻¹
- Test Vessel: The pipe itself, held upright, bottom end closed with glass stopper. Top covered with aluminium foil.
- Temperature °C: 22.5-25.0
# LEACHING/MIGRATION TESTS

**Analytical Results - Specific Determinands**

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Concentration found ug/l</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Stagnation 72h</td>
<td>Second Stagnation 72h</td>
<td>Third Stagnation 72h</td>
</tr>
<tr>
<td><strong>TOC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>400</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td>PIPE B</td>
<td>&lt;200</td>
<td>290</td>
<td>&lt;200</td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td><strong>LEAD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>90</td>
<td>80</td>
<td>32</td>
</tr>
<tr>
<td>PIPE B</td>
<td>59</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
</tbody>
</table>
**LEACHING/MIGRATION TESTS**

**Analytical Results - GC/MS Analysis**

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Results</th>
<th>Conc. ug/l</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Third Stagnation 72 h</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>Scan No.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0196  2-Pentanol-2-methyl</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0229  3-Pentanol-3-methyl</td>
<td>1</td>
</tr>
<tr>
<td>PIPE B</td>
<td>0194  2-Pentanol-2-methyl</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0227  3-Pentanol-3-methyl</td>
<td>1</td>
</tr>
<tr>
<td><strong>Third Stagnation 72 h</strong></td>
<td>No compounds detected above 1 ug/l</td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1654  Unknown m/z 43, 179, 161, 59</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No other compounds detected above 1 ug/l</td>
<td></td>
</tr>
</tbody>
</table>
# LEACHING/MIGRATION TESTS

## Migration Values

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Migration values µg dm⁻² day⁻¹</th>
<th>First Stagnation 72h</th>
<th>Second Stagnation 72h</th>
<th>Third Stagnation 72h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>22</td>
<td>11</td>
<td>&lt;11</td>
<td></td>
</tr>
<tr>
<td>PIPE B</td>
<td>&lt;11</td>
<td>16</td>
<td>&lt;11</td>
<td>&lt;11</td>
</tr>
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<td>BLANK A</td>
<td>&lt;11</td>
<td>&lt;11</td>
<td>&lt;11</td>
<td>&lt;11</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;11</td>
<td>&lt;11</td>
<td>&lt;11</td>
<td>&lt;11</td>
</tr>
<tr>
<td><strong>LEAD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>5.0</td>
<td>4.5</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>PIPE B</td>
<td>3.3</td>
<td>6.5</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
</tr>
</tbody>
</table>
## LEACHING/MIGRATION TESTS

**Migration Values for compounds detected by GC-MS**

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>GC-MS Scan</th>
<th>Test Sample</th>
<th>Migration value ( M (\mu g \ dm^{-2} \ day^{-1}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>75 mm A: B:</td>
<td>Stagnation: T1, T2, T3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>All Values Below 0.1</td>
</tr>
</tbody>
</table>
LEACHING/MIGRATION TESTS

Test Samples Received

Received from: Engler Bunte Institut

Received at WRC (Date): 03/04/92

Manufactured/prepared (Date): About 5/12/91

Dimensions: 32.3 mm O.D 27.25 mm I.D 1018 mm long

Sample Quantity: 2 pieces

Sample appearance: Grey plastic pipe

Manufacturers Ref No: OMNIPLAST PVC b 32 x 18 PN10  DIN 8061/62 0512.91.22

Sample storage before test: In the laboratory, in the original packing

Tests to be carried out: In accordance with CEN/TC164/WG3/AHG2-N28 sixth draft, November 1991

Determinands to be measured: On leachate from each of three, 3-day (72 h) stagnation periods;
TOC
Lead
GC-MS general scan
LEACHING/MIGRATION TESTS

Test Conditions

Test carried out in duplicate (A and B)

Surface area for test: 871 cm²

Test Water
- Origin: Mains water deionized activated carbon filtered
- Conductivity: <12 μS cm⁻¹
- Chlorination: nil
- Volume during test: 0.591
- Surface to volume ratio: 1.47 cm⁻¹

- Test Vessel The pipe itself, held upright, bottom end closed with glass stopper. Top covered with aluminium foil.
- Temperature °C 22.5-25.0
**LEACHING/MIGRATION TESTS**

**Analytical Results - Specific Determinands**

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Concentration found ug/l</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Stagnation 72h</td>
<td>Second Stagnation 72h</td>
<td>Third Stagnation 72h</td>
</tr>
<tr>
<td><strong>TOC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td>PIPE B</td>
<td>350</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;200</td>
<td>&lt;200</td>
<td>&lt;200</td>
</tr>
<tr>
<td><strong>LEAD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td>170</td>
<td>139 / 140*</td>
<td>221 / 220*</td>
</tr>
<tr>
<td>PIPE B</td>
<td>140</td>
<td>112 / 130</td>
<td>493 / 460</td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
</tbody>
</table>

* Repeat analysis
## LEACHING/MIGRATION TESTS

### Analytical Results - GC/MS Analysis

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scan No.</td>
</tr>
<tr>
<td><strong>First</strong></td>
<td></td>
</tr>
<tr>
<td>Stagnation 72 h</td>
<td>1223</td>
</tr>
<tr>
<td>PIPE A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1245</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPE B</td>
<td></td>
</tr>
<tr>
<td><strong>Third</strong></td>
<td></td>
</tr>
<tr>
<td>Stagnation 72 h</td>
<td></td>
</tr>
<tr>
<td>PIPE A</td>
<td></td>
</tr>
<tr>
<td>PIPE B</td>
<td></td>
</tr>
</tbody>
</table>
LEACHING/MIGRATION TESTS

Migration Values

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Sample code</th>
<th>Migration values μgdm⁻² day⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>First Stagnation 72h</td>
</tr>
<tr>
<td>TOC</td>
<td>PIPE A</td>
<td>&lt;5</td>
</tr>
<tr>
<td></td>
<td>PIPE B</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>BLANK A</td>
<td>&lt;5</td>
</tr>
<tr>
<td></td>
<td>BLANK B</td>
<td>&lt;5</td>
</tr>
<tr>
<td>LEAD</td>
<td>PIPE A</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>PIPE B</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>BLANK A</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td></td>
<td>BLANK B</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>

* Repeat analysis
LEACHING/MIGRATION TESTS

Migration Values for compounds detected by GC-MS

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>GC-MS Scan</th>
<th>Test Sample</th>
<th>Migration value M ((\mu)g dm(^{-2}) day(^{-1}))</th>
<th>Stagnation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>32 mm A:</td>
<td>All Values Below 0.1</td>
<td>T1 T2 T3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Form No: 003/4b
Product: Grey PVC Pipe
(32mm diameter)
LEACHING/MIGRATION TESTS

Test Samples Received

Received from: KIWA NV

Received at WRC (Date): March 1992

Manufactured/prepared (Date): Not known to WRC

Dimensions: Surface exposed to water, 20 x 18.7 cms. Surfaces not to be exposed to water (ie the back and edges) were covered with a layer of SABA transparent silicone putty, 091212, and cured at ambient temperature for two days before commencement of test.

Sample Quantity: 2 pieces

Sample appearance: 1 piece - Glass reinforced polyester (GRP) on a section of grey composite pipe (Sample A)
1 piece - As above but coated with unknown clear resin (Sample B)

Manufacturers Ref No: None

Sample storage before test: In the laboratory, in the original packing

Tests to be carried out: In accordance with CEN/TC164/WG3/AHG2-N28 sixth draft, November 1991

Determinands to be measured: On leachate from each of three, 3-day stagnation periods;
TOC
Cobalt
Styrene
Dimethylphthalate
GC-MS general scan
LEACHING/MIGRATION TESTS

Test Conditions
Surface area for test: 374 cm²

Test Water
- Origin: Mains water deionized activated carbon filtered.
- Conductivity: <12 μS/cm⁻¹
- Chlorination: nil
- Volume during test: 3.39l
- Surface to volume ratio: 0.11 cm⁻¹
- Test Vessel: Glass tank, covered with glass sheet, no headspace
- Temperature °C 22.5 - 25.0

Blank
Glass plate coated with SABA transparent silicone putty, 091212, and cured at ambient temperature for two days before commencement of test.
## LEACHING/MIGRATION TESTS

### Analytical Results - Specific Determinands

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Concentration found µg/l</th>
<th>First Stagnation 72h</th>
<th>Second Stagnation 72h</th>
<th>Third Stagnation 72h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP A</td>
<td>5510</td>
<td>2160</td>
<td>1780</td>
<td></td>
</tr>
<tr>
<td>GRP B</td>
<td>9620</td>
<td>3500</td>
<td>2230</td>
<td></td>
</tr>
<tr>
<td>BLANK A</td>
<td>1000</td>
<td>400</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>BLANK B</td>
<td>740</td>
<td>300</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP A</td>
<td>6</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>GRP B</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Styrene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP A</td>
<td>&gt;15</td>
<td>22</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>GRP B</td>
<td>&gt;20</td>
<td>27</td>
<td>17</td>
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<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>DMP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP A</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>GRP B</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>BLANK A</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>BLANK B</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>
LEACHING/MIGRATION TESTS

Concentrations of compounds detected by GC-MS

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>GC-MS Scan</th>
<th>Test Sample</th>
<th>Concentration (µg/l)</th>
<th>Stagnation:</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown m/z-55,83,43,98</td>
<td>304-546</td>
<td>A:</td>
<td>20</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4-methyl-pent-3-ene-2-one?)</td>
<td></td>
<td>B:</td>
<td>10</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-hydroxy-4-methyl-2-pentanone</td>
<td>381-384</td>
<td>A:</td>
<td>31</td>
<td>ND</td>
<td>&lt;1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B:</td>
<td>15</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diacetone alcohol</td>
<td>625-628</td>
<td>A:</td>
<td>&lt;1</td>
<td>ND</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B:</td>
<td>&lt;1</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetophenone</td>
<td>783-1070</td>
<td>A:</td>
<td>22</td>
<td>ND</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B:</td>
<td>2</td>
<td>ND</td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Unknown m/z-82,54,143</td>
<td>1281-1580</td>
<td>A:</td>
<td>4</td>
<td>ND</td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B:</td>
<td>&lt;1</td>
<td>ND</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Dibutyl phthalate isomers</td>
<td>1786-2120</td>
<td>A:</td>
<td>9</td>
<td>ND</td>
<td></td>
<td></td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B:</td>
<td>147</td>
<td>ND</td>
<td></td>
<td></td>
<td>&lt;0.3</td>
</tr>
</tbody>
</table>

ND - not determined

(Outside and edges of both test samples A and B were covered with a layer of SABA silicone putty).
# LEACHING/MIGRATION TESTS

## Migration Values

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Migration values $\mu$g dm$^{-2}$ day$^{-1}$</th>
<th>First Stagnation 72h</th>
<th>Second Stagnation 72h</th>
<th>Third Stagnation 72h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP A</td>
<td>1665</td>
<td>650</td>
<td>534</td>
<td></td>
</tr>
<tr>
<td>GRP B</td>
<td>2907</td>
<td>1060</td>
<td>674</td>
<td></td>
</tr>
<tr>
<td>BLANK A</td>
<td>303</td>
<td>120</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>BLANK B</td>
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LEACHING/MIGRATION TESTS

Migration Values for compounds detected by GC-MS

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>GC-MS Scan</th>
<th>Test Sample</th>
<th>Migration value M (µg dm⁻² day⁻¹)</th>
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<tbody>
<tr>
<td></td>
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<td>T1</td>
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<td>Unknown m/z-55,83,43,98</td>
<td>304-546</td>
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<tr>
<td>(4-methyl-pent-3-ene-2-one?)</td>
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<td>4-hydroxy-4-methyl-2-pentanone</td>
<td>381-384</td>
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<td>B:</td>
<td>4.5</td>
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<td>Diacetone alcohol</td>
<td>625-628</td>
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<td>Acetophenone</td>
<td>783-1070</td>
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<td>1281-1580</td>
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<td>Dibutyl phthalate isomers</td>
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ND - not determined

(Outside and edges of both test samples A and B were covered with a layer of SABA silicone putty).
LEACHING/MIGRATION TESTS

Analytical Results - Control Determinands

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Concentration found µg/l</th>
<th>First Stagnation 72h</th>
<th>Second Stagnation 72h</th>
<th>Third Stagnation 72h</th>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Styrene (100µg/l)</td>
<td></td>
<td>31</td>
<td>28</td>
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<td></td>
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<td>32</td>
<td>23</td>
<td>-</td>
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<tr>
<td>Dimethyl phthalate (100µg/l)</td>
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<td>7</td>
<td>9.6</td>
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<td>7</td>
<td>8.2</td>
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</tbody>
</table>
LEACHING/MIGRATION TESTS

Test Samples Received

Received from: Engler-Bunte-Institut

Received at WRC (Date): 3 April 1992

Manufactured/prepared (Date): Not known to WRC

Dimensions: 20 x 20 x 0.2 cms

Sample Quantity: 5 pieces

Sample appearance: Squares of black rubber

Manufacturers Ref No: EPDM 149017

Sample storage before test: In the laboratory, at ambient. Samples had a very pronounced odour (ester-like?). The sheets were exposed laboratory air for one week, turning over after four days.

Tests to be carried out: In accordance with CEN/TC164/WG3/AHG2-N28 sixth draft, November 1991

Determinands to be measured: On leachate from each of three, 3-day (72h) stagnation periods;
TOC
Phenols
Primary aromatic amines
GC-MS general scan
LEACHING/MIGRATION TESTS

Test Conditions

In duplicate (A and B)

Surface area for test: 1632 cm² (two pieces each test)

Test Water

- Origin: Mains water deionized activated carbon filtered.
- Conductivity: <12 μS.cm⁻¹
- Chlorination: Nil
- Volume during test: 5.12l
- Surface to volume ratio: 0.32 cm⁻¹
- Test Vessel Glass tank
- Temperature °C 22.5 - 22.0
**LEACHING/MIGRATION TESTS**

**Analytical Results - Specific Determinands**

<table>
<thead>
<tr>
<th>DETERMINAND</th>
<th>Concentration found ug/l</th>
<th>First Stagnation 72h</th>
<th>Second Stagnation 72h</th>
<th>Third Stagnation 72h</th>
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</thead>
<tbody>
<tr>
<td><strong>TOC</strong></td>
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<tr>
<td>Test A</td>
<td>4450</td>
<td>3280</td>
<td>1910</td>
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<td>6090</td>
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<td>&lt;200</td>
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<td><strong>PHENOLS</strong></td>
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<td>Test A</td>
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<td><strong>PRIMARY</strong></td>
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<td><strong>amines</strong></td>
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LEACHING/MIGRATION TESTS

Analytical Results - GC/MS Analysis

First Stagnation 72 h

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<th>Sample Code</th>
<th>Scan No.</th>
<th>Compound</th>
<th>Concentration ug/l</th>
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<tbody>
<tr>
<td>TEST A</td>
<td>0038</td>
<td>2-Ethoxy-2-methyl propane</td>
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<td>Unknown m/z 41, 56, 68, 31, 112</td>
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<td>0192</td>
<td>2-Methyl pentan-2-ol</td>
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<td>0260</td>
<td>Tetrahydro 2,2,5,5-tetramethyl furan</td>
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<td>Unknown m/z 87, 43, 55, 101</td>
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<td>2-Methyl-2-Hexanol</td>
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<td>0440</td>
<td>1-Methoxyethoxy octane</td>
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<td>0638</td>
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<td>0652</td>
<td>2,5 dimethyl-2, 5-hexanediol + Unknown</td>
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<td>d8 Naphthalene</td>
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<td>1202</td>
<td>Methyl-tolyl-Carbonic acid ester + Unknown</td>
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# LEACHING/MIGRATION TESTS

Analytical Results - GC/MS Analysis

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Scan No.</th>
<th>Compound</th>
<th>Concn. µg/l</th>
</tr>
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<tbody>
<tr>
<td>TEST A</td>
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<td>Tetrahydro-2, 5-dimethyl-2H</td>
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<td>Pyranmethanol + Unknown</td>
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<td>1563</td>
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<td>Unknown m/z 60, 45, 92, 61, 210 Thiolane cpd isomer?</td>
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<td>Unknown m/z 149, 45, 91, 254</td>
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<td>Unknown m/z 60, 62, 45, 241, 300</td>
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**LEACHING/MIGRATION TESTS**

**Analytical Results - GC/MS Analysis**

**Third Stagnation 72 h**

<table>
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<th>Sample Code</th>
<th>Scan No.</th>
<th>Compound</th>
<th>Concn. ug/l</th>
</tr>
</thead>
<tbody>
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<td>TEST A</td>
<td>0050</td>
<td>1,2-Dichloroethylene</td>
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<tr>
<td></td>
<td>0087</td>
<td>Methyl ethyl ketone</td>
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<tr>
<td></td>
<td>0136</td>
<td>Ethyl acetate</td>
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<td></td>
<td>0142</td>
<td>Chloroform</td>
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<tr>
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<td>0165</td>
<td>Trimethyl oxirane</td>
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<td>0195</td>
<td>Unknown 59, 73, 55, 43</td>
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<td>0304</td>
<td>2-Methoxy-2-methylbutane</td>
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<td>0310</td>
<td>Unknown 57, 29, 75, 72</td>
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<td>0350</td>
<td>C8H18 isomer</td>
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<td>0369</td>
<td>C7H16 isomer</td>
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</tbody>
</table>
LEACHING/MIGRATION TESTS

Analytical Results - GC/MS Analysis

First Stagnation 72 h

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Scan No.</th>
<th>Compound</th>
<th>Conc. ug/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST B</td>
<td>0042</td>
<td>Propane-2-ethoxy-2-methyl</td>
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<td>0169</td>
<td>Propane-2-methyl-2-(1, methylethoxy)</td>
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<td>0190</td>
<td>3-Butan-1-ol-3-methyl</td>
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<td>0195</td>
<td>2-Pentanol-2-methyl</td>
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<td>0252</td>
<td>Peroxide, bis(1,1-dimethylethyl)</td>
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<td>0263</td>
<td>Furan tetrahydro 2, 2, 5, 5, tetramethyl</td>
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<td>Unknown m/z 59, 101, 45, C8</td>
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<td>Unknown m/z 59, 43, 57, 58</td>
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<td>C9 Alkene</td>
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<td>Propane 2, 2-methylene</td>
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<td>bis(oxy)bis-2-methyl?</td>
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LEACHING/MIGRATION TESTS

Analytical Results - GC/MS Analysis

First Stagnation 72 h

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LEACHING/MIGRATION TESTS

Analytical Results - GC/MS Analysis

Third Stagnation 72 h

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## Leaching/Migration Tests

### Migration Values

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## Analytical Results - Control Determinands

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