National Institute of Advanced Industrial Science and Technology
National Metrology Institute of Japan

Reference Material Certificate
NMII CRM 4004-a
No. +++
1,2-Dichloroethane

This certified reference material (CRM) was produced in accordance with the NMII’s management system and in compliance with ISO GUIDE 34:2000. This CRM is intended for use in calibration of analytical instruments, quality control of analytical instruments, and validation of analytical techniques and instruments.

Certified Value
The certified value is purity in the amount-of-substance fraction, given in the table below. The uncertainty of the certified value is the half-width of the expanded uncertainty interval calculated using a coverage factor (k) of 2, which gives a level of confidence of approximately 95%.

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS No.</th>
<th>Certified value, Amount-of-substance fraction (mol/mol)</th>
<th>Expanded uncertainty Amount-of-substance fraction (mol/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichloroethane</td>
<td>107-06-2</td>
<td>0.9997</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

Analysis
The certified value was determined by the freezing point depression method with a differential scanning calorimeter (DSC) by using the stepwise scan method. The combined standard uncertainty of the certified value was estimated by combing standard uncertainties derived from purity determination, homogeneity test and stability test.

Metrological Traceability
The certified value is determined by the primary method of measurement, the freezing point depression method with a DSC. Scale of temperature of the DSC is calibrated with NIST SRM 1745 (indium) and NIST SRM 2225 (mercury), and scale of enthalpy of the DSC is calibrated with NIST SRM 2225 (mercury). And the scales are traceable to the International System of Units (SI). The certified value, therefore, is traceable to the SI.

Indicative Value
The purity in the mass fraction is given in the table below. The purity in the mass fraction was obtained by converting the purity in the amount-of-substance fraction using the average molecular weight of impurities. The uncertainty of this indicative value is the half-width of the expanded uncertainty interval calculated using a coverage factor (k) of 2, which gives a level of confidence of approximately 95%.

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS No.</th>
<th>Indicative value, Mass fraction (kg/kg)</th>
<th>Expanded uncertainty Mass fraction (kg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichloroethane</td>
<td>107-06-2</td>
<td>0.9998</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

Mutual Recognition Arrangement under Meter Convention
This certificate is consistent with the calibration and measurement capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other’s calibration and measurement certificates for the
quantities, ranges and measurement uncertainties specified in Appendix C (as for Appendix C of MRA, see http://kcdb.bipm.org/AppendixC/default.asp).

**Expiration of Certification**
This certificate is valid for one year from the date of shipment, provided that the material remains unopened and is stored in accordance with the instructions given in this certificate.

**Sample Form**
This CRM is in the form of a colorless and clear liquid at room temperature. This CRM of ca. 15 mL in net volume is kept in an amber glass ampule with argon gas.

**Homogeneity**
Ten ampules were sampled from the total of 500 subdivided ampules with almost the same intervals in order of subdivision for homogeneity tests by the gas chromatography. Another set of ten ampules were sampled in the same way for the homogeneity tests by the Karl-Fischer titrimetry. Area percentages of 1,2-dichloroethane were measured by the gas chromatography while water content was measured by the Karl-Fischer titrimetry. The evaluated variation of purity among the ampules due to inhomogeneity has been incorporated into the uncertainty of the certified value. It is concluded, therefore, that this CRM is homogeneous within the range of the uncertainty of the certified value.

**Instructions for Storage**
This CRM should be stored in a cold place (around -20 °C) and shielded from light.

**Instructions for Use**
This CRM is for laboratory use only. The bottles of this CRM should be allowed to warm to room temperature before opening and then they should be shaken well. The bottles of this CRM, after being warmed to room temperature, are recommended to be opened in as a low humidity condition as possible since this CRM was purified by the dehydration.

**Precautions for Handling**
Keep away from heat and ignition sources. Wear personal protective equipment such as safety glasses, safety mask and safety gloves when handling. Refer to the safety data sheet (SDS) on this CRM before use.

**Preparation**
This CRM was prepared by KANTO CHEMICAL CO., INC. The raw material of this CRM was purified through drying and distillation processes. Amber glass ampules were filled with the purified 1,2-dichloroethane in the argon gas atmosphere.

**NMIJ Analysts**
The technical manager for this CRM is A. Nomura. The production manager is T. Ihara and analysts are Y. Ohte, S. Otsuka, X. Bao, Y. Kitamaki, E. Yoshimura, and N. Fujiki.

**Collaborator**
Before 2005, impurity analysis and stability monitoring were performed by National Institute of Technology and Evaluation.

**Information**
If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customer. Customer registration on the NMIJ Website (given below) will facilitate notification. Technical reports regarding this CRM can be obtained from the contact details given below.

**Reproduction of Certificate**
In reproducing this certificate, it should be clearly indicated that the document is a copy.
Date of Shipment: Xxxxx XX, 20XX

April 1, 2015

Ryoji Chubachi
President
National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:
National Institute of Advanced Industrial Science and Technology,
National Metrology Institute of Japan,
Center for Quality Management of Metrology, Reference Materials Office,
1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan
Phone: +81-29-861-4059; Fax: +81-29-861-4009, https://www.nmij.jp/english/service/C/

Revision history

March 17, 2005: This CRM is changed to “NMIJ CRM” from “NIMC CRM” and the description on Expiration of Certification was added.

March 24, 2009: The expiration of this certificate was extended from “March 31, 2009.” to “March 31, 2018.”
The descriptions in Certified Value, Analysis and NMIJ Analysts were revised.
The descriptions on Metrological traceability and Mutual Recognition Arrangement under Meter Convention were added.
The description on Organizations of Sample Preparation and Characterization was deleted

March 13, 2012: The description on Mutual Recognition Arrangement under Meter Convention was deleted.

April 1, 2015: “Metrology Management Center” was renamed to “Center for Quality Management of Metrology.”

February 21, 2017: The descriptions in Certified Value, Analysis and Indicative Value were revised.
The description in Expiration of Certification was changed to “one year from the date of shipment.”
The descriptions on Mutual Recognition Arrangement under Meter Convention and Collaborator were added.