

# CERTIFICATE OF ANALYSIS

ERM®-AE142

Pb in nitric acid (1 mol/L)			
Certified quantity	Unit	Certified value <sup>1)</sup>	Uncertainty <sup>2)</sup>
Isotope amount ratio $n(^{206}\text{Pb})/n(^{204}\text{Pb})$	mol/mol	21.114	0.017
Isotope amount ratio $n(^{207}\text{Pb})/n(^{204}\text{Pb})$	mol/mol	15.944	0.017
Isotope amount ratio $n(^{208}\text{Pb})/n(^{204}\text{Pb})$	mol/mol	39.850	0.044
Isotope amount ratio $n(^{208}\text{Pb})/n(^{206}\text{Pb})$	mol/mol	1.8874	0.0010
Isotope amount fraction $n(^{204}\text{Pb})/n(\text{Pb})$	mol/mol	0.012 8357	0.000 0083
Isotope amount fraction $n(^{206}\text{Pb})/n(\text{Pb})$	mol/mol	0.271 01	0.000 23
Isotope amount fraction $n(^{207}\text{Pb})/n(\text{Pb})$	mol/mol	0.204 65	0.000 21
Isotope amount fraction $n(^{208}\text{Pb})/n(\text{Pb})$	mol/mol	0.511 50	0.000 32
Molar mass of Pb in solution $M(\text{Pb})$	g/mol	207.177 83	0.000 53
<p>1) Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method each calibrated against SI-traceable calibrators. The certified values of this European Reference Material (ERM) are traceable to the International System of units (SI).</p> <p>2) The uncertainty of the certified value is the expanded uncertainty <math>U</math> with a coverage factor of <math>k = 2</math> corresponding to a 95 % confidence level estimated in accordance with international guidelines (JCGM 100:2008, EURACHEM/CITAC 2012).</p>			

This certificate is valid for 10 years after certification for units with unbroken seal stored under required conditions. This validity may be extended as further evidence of stability becomes available.

## NOTE

European Reference Material ERM®-AE142 was produced and certified under the responsibility of Bundesanstalt für Materialforschung und –prüfung (BAM) according to the principles laid down in the technical guidelines of the European Reference Materials® co-operation agreement between BAM-LGC-IRMM. Information on these guidelines is available on the Internet (<http://www.erm-crm.org>).

Accepted as an ERM®, Berlin, Germany, September 2016

BAM Department 1  
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## Indicative Values

Quantity	Unit	Indicative value <sup>1)</sup>	Uncertainty <sup>2)</sup>
Pb mass fraction	mg/kg	100.0	2.0

1) The indicative value of this European Reference Material (ERM) was obtained by gravimetric preparation and is traceable to the International System of units (SI), by calibrating all instruments against SI-traceable calibrators.

2) The uncertainty of the indicative value is the expanded uncertainty  $U$  with a coverage factor of  $k = 2$  corresponding to a 95 % confidence level estimated in accordance with international guidelines (JCGM 100:2008, EURACHEM/CITAC 2012). This uncertainty also accounts for small losses of solvent by evaporation through the container walls and the screw cap, when properly stored.

### DESCRIPTION OF THE SAMPLE

The isotopic reference material ERM-AE142 is a solution of natural Pb in nitric acid (1 mol/L) with a Pb mass fraction of 100 mg/kg. Approximately 20 mL of this solution each is filled in PFA bottles. This material is designed for verification and validation of all procedures (e.g. TIMS, ICPMS) being used for the determination of Pb isotope amount ratios.

### ANALYTICAL METHOD USED FOR CERTIFICATION

The certified values were determined by multi-collector ICPMS and multi collector TIMS. The mass fractionation or discrimination was corrected by using the certified isotopic reference material NIST SRM 981. More details can be found in the certification report, which can be requested from BAM.

### PARTICIPANTS

Federal Institute for Materials Research and Testing (BAM), Berlin, Germany

Korea Research Institute of Standards and Science, Daejeon, South Korea

Laboratory of the Government Chemist, Teddington, United Kingdom

National Institute of Metrology, Beijing, People's Republic of China

National Institute of Standards and Technology, Gaithersburg, Maryland USA

National Metrology Institute of Japan, Tsukuba, Japan

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### INSTRUCTIONS FOR USE

Once opened, the bottle lid should be left open as little as possible. The bottle weight might be monitored to track any evaporative losses during storage. These losses, however, will only affect the nominal Pb mass fraction in the solution and not the certified Pb isotope amount ratios.

The introduction of any contaminant to this solution may change the Pb isotope ratios, and will therefore render these certified values null and void.

The minimum amount of sample to be used is 100  $\mu$ L.

### SAFETY INFORMATION

The usual laboratory safety precautions apply.

ERM-AE142 is an acidic solution filled in PFA bottles, which contains 1 mol/L nitric acid. All appropriate safety precautions, including the use of gloves and safety glasses, should be taken.

### STORAGE

ERM-AE142 should be stored under normal laboratory conditions (between 5 °C and 25 °C).

BAM cannot be held responsible for changes that happen during storage of the material at the customer's premises, especially of opened samples.

## LEGAL NOTICE

Neither BAM, its contractors nor any person acting on their behalf:

- (a) make any warranty or representation, express or implied, that the use of any information, material, apparatus, method or process disclosed in this document does not infringe any privately owned intellectual property rights; or
- (b) assume any liability with respect to, or for damages resulting from, the use of any information, material, apparatus, method or process disclosed in this document save for loss or damage arising solely and directly from the negligence of BAM.

## NOTE

A detailed technical report describing the production, characterisation as well as the analytical procedures applied and the treatment of the analytical data used to certify ERM®-AE142 is available on request from BAM (<https://www.bam.de>).

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Supply of Reference Materials by: Bundesanstalt für Materialforschung und –prüfung (BAM)  
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**SAFETY DATA SHEET**

**FOR**

**“ERM-AE142”**

according to Regulation (EC) No 1907/2006

Version number 1

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**Section 1: Identification of the substance/mixture and of the company/undertaking**

**1.1. Product identifier**

Product name: ERM-AE142  
Product information: Lead aqueous solution in 6 % nitric acid (1 mol/L) with an approximate Pb mass fraction of 100 µg/g

**1.2. Relevant identified uses of the substance or mixture and uses advised against**

Reference sample to be used within the framework of CCQM-K98/P134 for the isotopic analysis of Pb.  
Any other use is discouraged.

**1.3. Details of the supplier of the safety data sheet**

Supplier / Producer: BAM Federal Institute for Materials Research and Testing  
Unter den Eichen 87, 12205 Berlin, Germany  
Contact person: Division 1.1, Dr. Jochen Vogl,  
Phone +49-30-8104-1144, Telefax +49-30-814-3527  
Issuing person: e-mail: [jochen.vogl@bam.de](mailto:jochen.vogl@bam.de)

**1.4. Emergency telephone number**

Emergency telephone: +49 30 8104 1144 (Mo – Fr, 09:00 – 15:00 MEZ)  
Outside the above given hours and in case of absence please contact your national poison control centre. For information see the world directory of poison control centres at the WHO homepage:  
[http://www.who.int/gho/phe/chemical\\_safety/poisons\\_centres/en/](http://www.who.int/gho/phe/chemical_safety/poisons_centres/en/)

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**2. Hazards identification**

**2.1. Classification of the substance or mixture**

*Classification (Regulation (EC) No 1272/2008)*

Skin irritation, Category 1B H314: Causes severe skin burns and eye damage

*Classification (67/548/EEC or 1999/45/EC)*

C R34: Causes burns

***Pb(NO<sub>3</sub>)<sub>2</sub> with c < 0.05% requires no classification. The classification therefore derives from nitric acid with c = 6 %.***

**2.2. Label elements**

Labelling according to Regulation (EC) No 1272/2008:

Hazard pictogram:



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*Signal word:*

Danger

*Hazard statements:*

H314 Causes severe skin burns and eye damage.

*Precautionary statements:*

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P363 Wash contaminated clothing before reuse

P321 Specific treatment (see ... on this label)

Restricted to professional users.

### Labelling according to Directive 67/548/EEC or 1999/45EC

Symbol(s):



C, corrosive

R-phrases: 34 Causes burns.

S-phrases: 23 - 26 - 36 - 45

For the full text of the H-Statements as well as S- and R-phrases mentioned in this Section, see Section 16.

## Section 3: Composition/information on ingredients

### 3.1. Substances

Chemical nature: Lead nitrate in nitric acid solution.

#### Hazardous components (Regulation (EC) No 1272/2008)

*Chemical Name (Concentration)*

CAS-No.	EC-No./Registration number	Index-No.	Classification
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*Nitric acid (>= 5% -<20 %)*

7697-37-2	231-714-2	007-004-00-1	Skin corrosion, Category 1A, H314 Oxidising liquid, Category 3, H272
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*Lead (II) nitrate (> 0.005% - < 0.05 %)*

10099-74-8	233-245-9	082-001-00-6	Acute toxicity, Category 4, H302, H332 Reprod. toxicity, Category 1A, H360Df Aquatic acute, Category 1, H400 Aquatic chronic, Category 1, H410 STOT RE, Category 1, H373
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### Hazardous components (1999/45/EC)

*Chemical Name (Concentration)*

CAS-No.	EC-No./Registration Number	Index-No.	Classification
<i>Nitric acid (&gt;= 5% -&lt;20 %)</i>			
7697-37-2	231-714-2	007-004-00-1	O; R8 C; R35
<i>Lead(II) nitrate (&gt; 0.005% - &lt; 0.05 %)</i>			
10099-74-8	233-245-9	082-009-00-2	Harmful Cat.4 R20/R22 Reprod. Cat.1, R61 Reprod. Cat.3, R62 Aquatic acute Cat.1 R50/53 R33

For the full text of the R-phrases mentioned in this Section, see Section 16.

### **3.2. Mixtures**

Does not apply. Product is prepared from substances under section 3.1. only.

## **Section 4: First aid measures**

### **4.1. Description of first aid measures**

After inhalation: fresh air.

After skin contact: wash off with plenty of water. Remove contaminated clothing.

After eye contact: rinse out with plenty of water. Call in ophthalmologist.

After swallowing: immediately make victim drink water (two glasses at the most). Consult a physician.

### **4.2. Most important symptoms and effects, both acute and delayed**

Irritant effect

### **4.3. Indication of any immediate medical attention and special treatment needed**

No information available

## **Section 5: Fire-fighting measures**

### **5.1. Extinguishing media**

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. For this substance / mixture no restrictions on extinguishing media are known.

### **5.2. Special hazards arising from the substance or mixture**

Not combustible.

Ambient fire may liberate hazardous vapours.

### **5.3. Advice for fire fighters**

Do not stay in dangerous zone without self-contained breathing apparatus. In order to avoid contact with skin, keep a safety distance and wear suitable protective clothing.

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### *Further information*

Prevent fire extinguishing water from contamination surface water or the ground water system.

## **Section 6: Accidental release measures**

### **6.1. Personal precautions, protective equipment and emergence procedures**

Do not breathe vapours, aerosols. Avoid substance contact. Ensure adequate ventilation.

Wear protective glasses and gloves. See section 8

### **6.2. Environmental precautions**

Do not empty into drains.

### **6.3. Methods and materials for containment and cleaning up**

Take up with liquid-absorbent and neutralizing material. Forward for disposal. Clean up affected area.

### **6.4. Reference to other sections**

Information on disposal see section 13.

## **Section 7: Handling and storage**

### **7.1. Precautions for safe handling**

Work under hood. Do not inhale substance. Avoid generation of vapours/aerosols. Observe label precautions. Wear protective equipment, see section 8

Keep general hygiene standards for laboratories.

### **7.2. Conditions for safe storage, including any incompatibilities**

Keep container tightly closed. Keep in a well-ventilated place.

### **7.3. Specific end use**

Not applicable

## **Section 8: Exposure controls/personal protection**

### **8.1. Control parameters**

Components with workplace parameters

#### *Components*

Basis	Value	Threshold limits	Remarks
<i>Inorganic lead and its compounds</i>			
Directive 98/24/EC	Occupational exposure limit value 8h	0.15 mg/m <sup>3</sup> inhalable aerosol	8 h average

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*Nitric acid (7697-37-2)*

Directive 2006/15/EC

Short Term Exposure  
Limit (STEL):

1 ppm  
2.6 mg/m<sup>3</sup>

15 minutes

### Recommended monitoring procedures

Methods for measurement of the workplace atmosphere have to correspond to the requirements of standards DIN EN 482 and DIN EN 689.

## 8.2. Exposure controls

### *Personal protective equipment*

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled. The resistance of the protective clothing to chemicals should be ascertained with the respective supplier.

### *Hand protection:*

Full contact:	Glove material:	Latex or polyvinylchloride
	Glove thickness:	0.5 mm
	Break through time:	> 8 h
Splash contact:	Glove material:	Latex or polyvinylchloride
	Glove thickness:	0.5 mm
	Break through time:	> 8 h

The protective gloves to be used must comply with the specifications of EC Directive 89/686/EEC and the resultant standard EN374.

This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves.

### *Eye protection:*

Safety glasses

### *Hygiene measures:*

Immediately change contaminated clothing. Apply skin-protective barrier cream. Wash hands and face after working with substance.

## Section 9: Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

Appearance	liquid
Colour	colourless
Odour	odourless
pH	< 1 at 20 °C, for the nitric acid component, literature data
Viscosity, dynamic	no data available
Boiling point	no data available
Ignition temperature	not combustible
Flash point	not required, inorganic substance
Flammability	not combustible
Danger of explosion	not explosive



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Vapour pressure	no data available
Relative vapour density	no data available
Density	ca. 1,035 g/cm <sup>3</sup> at 20 °C, based on tabulated data for dilute nitric acid
Solubility/qualitative	water soluble
Water solubility	100%
Partition coefficient:	
n-octanol/water	not required for inorganic solutions
Auto-flammability	not applicable
Corrosion	no data available
Evaporation rate	no data available
Oxidizing properties	not oxidizing

### **9.2. Other information**

No other information available.

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## **Section 10: Stability and reactivity**

### **10.1. Reactivity**

No dangerous reactions known.

### **10.2. Chemical stability**

Stable under normal storage conditions (0 – 40 °C)

### **10.3. Possibility of hazardous reactions**

No dangerous reactions known.

### **10.4. Conditions to avoid**

No information available

### **10.5. Incompatible materials**

*Increased reactivity with:*

oxidizable substances, organic solvent, Metals, metal alloys, Alkali metals, Alkaline earth metals, Ammonia, alkalines, acids

*Unsuitable working materials:*

Metals, metal alloys

### **10.6. Hazardous decomposition products**

no information available

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## **Section 11: Toxicological information**

### **11.1. Information on toxicological effects**

*Acute oral toxicity:*

Symptoms: Irritations of mucous membranes in the mouth, pharynx, oesophagus and gastrointestinal tract.

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*Skin irritation:*

Causes skin irritation.

*Eye irritation:*

Causes serious eye irritation.

*Sensitization:*

Sensitization possible in predisposed persons.

*CMR effects:*

Carcinogenicity:

May cause cancer by inhalation.

*Further information:*

Quantitative data on the toxicity of this product are not available.

Handle in accordance with good industrial hygiene and safety practice.

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**Section 12: Ecological information**

**12.1. Toxicity**

No information available.

**12.2. Persistence and degradability**

No information available.

**12.3. Bio accumulative potential**

No information available.

**12.4. Mobility in soil**

No information available.

**12.5. Results of PBT and vPvB assessment**

No information available.

**12.6. Other adverse effects**

No information available.

*Further information on ecology*

Do not allow to enter waters, waste water, or soil!

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**Section 13: Disposal considerations**

**13.1. Waste treatment methods**

*Product*

Chemicals must be disposed of in compliance with the respective national regulations.

*Packaging*

The product packaging must be disposed of in compliance with the country-specific regulations or must be passed to a packaging return system.

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### **Section 14: Transport information**

#### **Land transport (ADR/RID)**

14.1. UN number	2031
14.2. UN proper shipping name	NITRIC ACID
14.3. Transport hazard class(es)	8
14.4. Packing group	II
14.5. Environmental hazards	- -
14.6. Special precautions for users	yes
Tunnel restriction code	E

#### **Inland waterway transport (ADN)**

Not relevant

#### **Air transport (IATA/ICAO)**

14.1. UN number	2031
14.2. UN proper shipping name	NITRIC ACID
14.3. Transport hazard class(es)	8
14.4. Packing group	II
14.5. Environmental hazards	- -
14.6. Special precautions for users	no

#### **Sea transport (IMDG)**

14.1. UN number	2031
14.2. UN proper shipping name	NITRIC ACID
14.3. Transport hazard class(es)	8
14.4. Packing group	II
14.5. Environmental hazards	- -
14.6. Special precautions for users	yes
EmS	F-A S-B
14.7. Transport in bulk according to Annex II of Marpol 73/78 and the IBC code	
Not relevant	

The transport regulations are cited according to international regulations and in the form applicable in Germany. Possible national deviations in other countries are not considered.

### **Section 15: Regulatory information**

#### **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

##### *EU regulations*

Major Accident Hazard	96/82/EC
Legislation	Directive 96/82/EC does not apply
Occupational restrictions	Take note of Directive 94/33/EC on the protection of young people at work

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National legislation

Storage class (TRGS 510): 8B

### 15.2 Chemical safety assessment

For this product a chemical safety assessment is not required and therefore was not carried out.

## Section 16: Other information

Full text of H-Statements referred to under sections 2 and 3

H272	May intensify fire; oxidizer
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H332	Harmful if inhaled
H360Df	May damage fertility or the unborn child. Suspected of damaging fertility.
H373	May cause damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

Full text of R-phrases referred to under sections 2 and 3

R8	Contact with combustible material may cause fire.
R20/22	Harmful by inhalation and if swallowed
R33	Danger of cumulative effects
R34	Causes burns
R35	Causes severe burns.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R61	May cause harm to the unborn child
R62	Possible risk of impaired fertility

Full text of S-phrases referred to under sections 2 and 3

S23	Do not breathe gas/fumes/vapor/spray
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36	Wear suitable protective clothing
S45	In case of accident or if you feel unwell seek medical advice immediately.

Release management: Regulation (EC) No 453/2010

***The information contained herein is based on data considered to be accurate and on the present state of our knowledge. It characterizes the sample with regard to the appropriate safety precautions. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof.***